ONTARIO NORTHLAND

TRANSPORTATION COMMISSION

Request for Proposals No. RFP 2025 083

For

Grit Blast Upgrade
Location – North Bay, ON

REPLY BY DATE:

2:00:00 p.m. Friday, October 17, 2025

Primary Contact:

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PART 1

REQUEST FOR PROPOSALS

SECTION 1 - INTRODUCTION

1.1 General

(1) Ontario Northland Transportation Commission ("ONTC") is issuing this Request for Proposals ("**RFP**") to obtain proposals from a vendor/service provider(s) for the provision of the goods and/or services described in the RFP Specifications (the "**Goods and/or Services**").

(2) In this RFP:

"Applicable Laws" means the statutes, regulations, orders, by-laws and other laws of Ontario, Quebec, Manitoba, Canada and any municipal government relevant to the RFP and the subject matter of the RFP;

"Addendum" means the written supplementary information provided to potential Respondents prior to the Submission Deadline, which information becomes part of the RFP Documents;

"Business Day" means any day except Saturday, Sunday or a statutory holiday;

"Final Agreement" means the agreement for the supply of the Goods and/or Services entered into by ONTC and the Successful Respondent;

"Material" means a document or information that must be included in the Proposal including without limitation the information requested in the RFP Data Sheet, and is essential to allow ONTC to evaluate a Proposal and that if not included will result in the disqualification of the Proposal;

"Non-compliant" means the Proposal or the Respondent does not meet a requirement of the RFP Documents;

"Proposal" means the response to the RFP submitted by a Respondent to ONTC;

"Respondent(s)" means the entity submitting a Proposal and includes prospective respondents, whether or not that entity submits a Proposal. If the context requires it, "Respondent" includes any of the Respondent's respective shareholders, owners, officers, agents, consultants, partners, contractors, subcontractors, advisors, employees, or representatives;

"RFP Data Sheet" means the information and requirements contained in Schedule 2-A of Part 2;

"RFP Documents" means the documents listed in RFP Section 2.1 (1) and any additional documents issued through Addenda;

"Short-listed Respondent" means a Respondent selected to proceed to the next step in the evaluation process pursuant to section 6.2 (2) of the RFP;

"Substantially Compliant" means Proposal does not meet the requirements of the RFP Documents; however, the Proposal includes all of the Material items, as identified in the RFP Data Sheet;

"Successful Respondent" means the Respondent selected by ONTC to enter into the Final Agreement.

(3) The process to select the Short-listed Respondents for the supply of the Goods and/or Services (the "**RFP Process**") will commence with the issuance of these RFP Documents and will terminate at the earlier of:

(a) when ONTC and the Successful Respondent execute the Final Agreement; or,
(b) upon the termination of the RFP Process in accordance with the terms and conditions of this RFP.

1.2 Ontario Northland Transportation Commission

ONTC is an agency of the Province of Ontario that provides reliable and efficient transportation services to northern and rural communities. For over 120 years, the company has provided integrated and impactful transportation services including rail freight, passenger rail, motor coach transportation, rail repair, and remanufacturing services.

ONTC's rail services are vital in maintaining a reliable supply chain in Northern Ontario by connecting freight customers to global economies. The forestry industry, mining operations, farming communities, and manufacturers count on ONTC's services to deliver large volumes across vast distances. The company's 675 miles of mainline track span throughout northeastern Ontario and northwestern Quebec.

ONTC motor coaches connect rural Ontario to major centres providing access to education, medical appointments, shopping, and seamless connections to other transportation providers. The Polar Bear Express passenger train connects Moosonee and Cochrane, Ontario, providing an all-season land link for Indigenous communities on the James Bay Coast.

Improving and repairing transportation equipment is also part of ONTC's service offering. ONTC's unique mechanical skillset attracts new business and secures skilled trades jobs in Northern Ontario by remanufacturing and repairing locomotives, passenger rail cars, freight cars, and more.

ONTC makes provincial dollars reach further by creating innovative solutions that help drive economic growth sustainably, responsibly, and with future generations in mind. Throughout the agency, modernization is underway with many exciting projects that will improve how we operate. ONTC employs over 1000 people including Locomotive Engineers, Motor Coach Operators, skilled tradespeople, and business professionals. Employees work together to improve and deliver services that provide value to the regions served.

SECTION 2 - THE RFP DOCUMENTS

2.1 Request for Proposals Documents

(1) The Request for Proposals documents consist of:

Part 1 – Request for Proposals

Part 2 – Requests for Proposals Summary of Requirements
(a) Schedule 2-A – RFP Data Sheet
(b) Schedule 2-B – Participation Registration Form

Part 3 – RFP Specifications
(a) Schedule 3-A-1 – Scope of Work
(b) Schedule 3-A-2 – Technical Specifications
(c) Schedule 3-A-3 – Issue for Tender Drawings
(d) Schedule 3-A-4 – Reference Reports
(e) Schedule 3-A-5 - Policies and Procedures

Part 4 – Form of Proposal
(a) Proposal Form 1 – Proposal Submission Form
(b) Proposal Form 1-A – Schedule of Prices
(c) Proposal Form 2 – Respondent's General Information
(d) Proposal Form 3 – Acknowledgment to Comply with Part 3 – Request for Proposals Specifications
(e) Proposal Form 4 – References
(f) Proposal Form 5 – Compliance with Contract Documents
(g) Proposal Form 6 – Respondents' Site Visit Registration Form
(h) Proposal Form 7 – Health, Safety and Environment
(i) Proposal Form 8 - Schedule of Materials
(j) Proposal Form 9 – List of Equipment
(k) Proposal Form 10 – Schedule and Proposed Approach
(l) Proposal Form 11 – Schedule of Progress Payments
(m) Proposal Form 12 – List of Personnel and Resumes
(n) Proposal Form 13 – Current Labour Agreements
(o) Proposal Form 14 – Contractor's Qualification Statement
(p) Proposal Form 15 – Claims

Part 5 – CCDC 2 – 2020 - Supplementary Conditions

(2) The RFP Documents shall be read as a whole. The Schedules and Addenda, if any, constitute an integral part of this RFP and are incorporated by reference.

(3) Each Respondent shall verify the RFP Documents for completeness upon receipt and shall inform the Contact Person (identified in RFP Section 3.2(7)), immediately:

(a) should any documents be missing or incomplete; or,

(b) upon finding any discrepancies or omissions.

(4) Complete sets of the RFP Documents are available at our company website at www.ontarionorthland.ca and MERX.

(5) The RFP Documents are made available only for the purpose of Respondents submitting Proposals. Availability and/or use of the RFP Documents do not confer a license or grant for any other purpose.

2.2 Priority of Documents

(1) If there are any inconsistencies between the terms, conditions or other provisions of the RFP Documents, the order of priority of RFP Documents, from highest to lowest, shall be:

(a) Any Addenda modifying the RFP Documents issued during the RFP Process;
(b) The RFP Data Sheet;
(c) Part 1 –- Request for Proposals;
(d) Part 3 –- Specifications; and,
(e) Any other RFP Documents.

2.3 Distribution of Documents – Electronic Distribution

(1) ONTC will use an online electronic distribution system to distribute all RFP Documents.

(2) Each Respondent is solely responsible for making appropriate arrangements to receive and access the RFP Documents through that electronic distribution system.

2.4 Information Provided by ONTC

(1) Each Respondent is solely responsible for conducting its own independent research, due diligence, and any other work or investigations and seeking any other independent advice necessary for the preparation of its Proposal, negotiation or finalization of the Final Agreement and the subsequent delivery of all the Goods and/or Services to be provided by the Successful Respondent. Nothing in the RFP Documents is intended to relieve the Respondents from forming their own opinions and conclusions with respect to the matters addressed in this RFP.

(2) No guarantee, representation or warranty, express or implied, is made and no responsibility of any kind is accepted by ONTC or its representatives for the completeness or accuracy of any information presented in the RFP Documents, if any, during the RFP Process or during the term of the Final Agreement. By submitting a Proposal, each Respondent agrees that ONTC and its representatives shall not be liable to any person or entity as a result of the use of any information contained in the RFP Documents or

otherwise provided by ONTC or its representatives during the RFP Process or during the term of the Final Agreement.

SECTION 3 – THE RFP PROCESS

3.1 RFP Process

(1) The deadline for the submission of Proposals (the "**Submission Deadline**") is set out in the RFP Data Sheet.

(2) ONTC may amend, extend or shorten any of the dates and/or times prescribed in this RFP, at any time, at its sole discretion, including without limitation the Submission Deadline. If ONTC extends the Submission Deadline, all requirements applicable to Respondents will thereafter be subject to the new, extended Submission Deadline.

3.2 Questions and Communications Related to the RFP Documents

(1) Respondents shall submit all questions, requests for clarifications, and other communications regarding the RFP Documents and the RFP Process by email to the Contact Person set out in section 3.2(7) no later than four (4) full Business Days before the Submission Deadline.

(2) ONTC will endeavor to provide the Respondents with written responses to questions that are submitted in accordance with this RFP Section 3.2, by no later than two (2) full Business Days before the Submission Deadline. Responses to any questions or requests for clarifications, will be collected and distributed with answers to be delivered to all Respondents who have submitted the Participation Registration Form by way of emailed addenda from ONTC in accordance with the timeline set out in this Section 3.2(2).

(3) The responses to questions form part of the RFP Documents.

(4) ONTC may, in its sole discretion:

(a) answer questions that ONTC deems to be similar from various Respondents only once;

(b) edit any question(s) for the purpose of clarity;

(c) respond to questions submitted after the deadline for submission of questions if ONTC believes that such responses would be of assistance to the Respondents generally; and,

(d) exclude any questions that, in the sole opinion of ONTC, are ambiguous, incomprehensible, or are deemed by ONTC to be immaterial to the RFP Process, the RFP Documents, or the Goods and/or Services.

(5) If Respondents find discrepancies, omissions, errors, departures from laws, by-laws, codes or good practice, or information considered to be ambiguous or conflicting, they shall bring them to the attention of the Contact Person in writing, and not less than four (4) full Business Days before the Submission Deadline, so that ONTC may, if ONTC deems it necessary, issue instructions, clarifications or amendments by addendum to all Respondents prior to the Submission Deadline. ONTC will endeavor to, but is not required to, issue such Addenda at least two (2) full Business Days prior to the Submission Deadline. It is each Respondent's responsibility to seek clarification from ONTC of any matter it considers to be unclear in the RFP Documents or the description of the Goods and/or Services and the Respondent may seek clarification in accordance with this Section 3.2. Neither ONTC nor the Government of Ontario shall be responsible for any misunderstanding by a Respondent of the RFP Documents, the RFP Process or the Goods and/or Services.

(6) If ONTC gives oral answers to questions at any meeting (Section 3.4), these answers will not be considered final, and may not be relied upon by any of the Respondents, unless and until such answers are provided by way of an addendum in accordance with this Section 3.2.

(7) The Contact Person designated by ONTC for this RFP is ***Brinda Ranpura, Procurement Contract Specialist, 555 Oak Street East, North Bay, Ontario P1B 8L3 (705) 472-4500 ext. 548, brinda.ranpura@ontarionorthland.ca*** (the "Contact Person"). The above Contact Person is the sole contact for this RFP. A Respondent may be disqualified where contact is made with any person other than the Contact Person.

(8) ONTC will not be responsible for statements, instructions, clarifications, notices or amendments communicated orally by ONTC to one or more of the Respondents. Statements, instructions, clarifications, notices or amendments by ONTC, which affect the RFP Documents, may only be made by addendum.

3.3 Addenda/Changes to the RFP Documents

(1) ONTC may, in its sole discretion, amend, supplement, or change the RFP Documents prior to the Submission Deadline. ONTC shall issue amendments, supplements, or changes to the RFP Documents by Addendum only. No other statement or response(s) to questions, whether oral or written, made by ONTC or any ONTC advisors, employees or representatives, including, for clarity, the Contact Person, or any other person, shall amend, supplement or change the RFP Documents. Addenda will be distributed in the same manner as the RFP and shall become part of the RFP Documents.

(2) Each Respondent is solely responsible for ensuring that it has received all Addenda issued by ONTC. Respondents may, in writing by email to the Contact Person, seek confirmation of the number of Addenda, issued under this RFP.

3.4 Respondents' Meeting

(1) To assist Respondents in understanding the RFP Documents, and the RFP Process, ONTC may conduct an information meeting (the "**Respondents' Meeting**") for all Respondents. Whether or not ONTC will conduct a Respondents' Meeting is set out in the RFP Data Sheet. If ONTC is conducting a Respondents' Meeting, the meeting will be held on the date and at the time and location set out in the RFP Data Sheet.

(2) Attendance by Respondents at a Respondents' Meeting may not be mandatory but, if one is held, Respondents are strongly encouraged to attend. Whether or not the Respondents' Meeting is mandatory will be identified on the RFP Data Sheet. When a Respondents' meeting is mandatory, all attending persons or entities will be required to sign the "Site Meeting Log" to confirm their attendance and provide a valid email address for the purpose of receiving information.

(3) If ONTC gives oral answers to questions at the Respondents' Meeting, these answers will not be considered final, and may not be relied upon by any of the Respondents, unless and until such answers are provided by way of an Addendum in accordance with Section 3.2.

(4) If pre-registration for the Respondents' Meeting is necessary, the deadline for registration will be set out in the RFP Data Sheet and details regarding the registration process will be set out in the RFP Data Sheet.

3.5 Prohibited Contacts

(1) Respondents and their respective advisors, employees and representatives are prohibited from engaging in any form of political or other lobbying, of any kind whatsoever, to influence the outcome of the RFP Process.

(2) Without limiting the generality of Section 3.5(1) above, neither Respondents nor any of their respective advisors, employees or representatives shall contact or attempt to contact, either directly or indirectly, at any time during the RFP Process, any of the following persons or organizations on matters related to the RFP Process, the RFP Documents, or their Proposals:

(a) any member of the Evaluation Team (as defined in Section 6.1), except the Contact Person;

(b) any advisor to ONTC or the Evaluation Team, except the Contact Person; or,

(c) any directors, officers, employees, agents, representatives or consultants of:

(i) ONTC, except the Contact Person;
(ii) Ontario Ministry of Transportation;
(iii) The Premier of Ontario's office or the Ontario Cabinet office;
(iv) A Member of Provincial Parliament (including the Premier); or,
(v) Any other person or entity listed in the RFP Data Sheet.

(3) If a Respondent or any of their respective shareholders, owners, officers, agents, consultants, partners, contractors, subcontractors, advisors, employees, representatives, or other third parties acting on behalf or with the knowledge of the Respondent; in the opinion of ONTC, contravenes RFP Section 3.5(1) or 3.5(2), ONTC may, but is not obliged to, in its sole discretion:

(a) take any action in accordance with RFP Section 7.2; or

(b) impose conditions on the Respondent's continued participation in the RFP Process that ONTC considers, in its sole discretion, to be appropriate.

3.6 Media Releases, Public Disclosures, Public Announcements and Copyright

(1) A Respondent shall not, and shall ensure that its shareholders, owners, officers, agents, consultants, partners, contractors, subcontractors, advisors, employees, representatives, or other third parties acting on behalf or with the knowledge of the Respondent do not, issue or disseminate any media release, social media or Internet post, public announcement or public disclosure (whether for publication in the press, on the radio, television, internet or any other medium) that relates to the RFP Process, the RFP Documents or the Goods and/or Services or any matters related thereto, without the prior written consent of ONTC.

(2) Neither the Respondents or any of their respective shareholders, owners, officers, agents, consultants, partners, contractors, subcontractors, advisors, employees, representatives, or other third parties acting on behalf or with the knowledge of the Respondent shall make any public comment, respond to questions in a public forum, or carry out any activities to either criticize another Respondent or Proposal or to publicly promote or advertise their own qualifications, interest in or participation in the RFP Process without ONTC's prior written consent, which consent may be withheld, conditioned or delayed in ONTC's sole discretion. Respondents, and their respective advisors, employees and representatives are permitted to state publicly that they are participating in the RFP Process but shall not publicly identify other Respondents without the prior written consent of ONTC.

(3) Respondents shall not use the name of ONTC or any of ONTC's logos, designs, colours or registered trademarks and names used, owned or registered by ONTC, during the RFP Process, if selected as the Successful Respondent, or at any time prior to, during, or following the supply of the Goods and/or Services, except with the prior written consent of ONTC.

3.7 Confidentiality and Disclosure Issues – Respondent Information

(1) Respondents are advised that ONTC may be required to disclose the RFP Documents, any other documentation related to the RFP Process and a part or parts of any Proposal pursuant to the *Freedom of Information and Protection of Privacy Act* (Ontario) ("FIPPA"). Respondents are also advised that FIPPA does provide protection for confidential and

proprietary business information. Respondents are strongly advised to consult their own legal advisors as to the appropriate way in which confidential or proprietary business information should be marked as such in their Proposals. Subject to the provisions of FIPPA, ONTC will use reasonable commercial efforts to safeguard the confidentiality of any information identified by the Respondent as confidential but shall not be liable in any way whatsoever to any Respondent if such information is disclosed based on an order or decision of the Information and Privacy Commissioner or otherwise as required under the Applicable Laws.

(2) The Respondent agrees that ONTC may disclose Proposals, and all information submitted in or related to the Proposals, to the Government of Ontario.

(3) ONTC may provide the Proposals to any person involved in the review and/or evaluation of the Proposals on behalf of ONTC and ONTC may:

(a) make copies of the Proposal; and/or,

(b) retain the Proposal.

(4) ONTC may disclose any information with respect to the Respondents, the Proposals and the RFP Process as required by the Applicable Laws.

(5) The Respondent shall not require ONTC or any of its representatives to sign a non-disclosure agreement in respect of any step taken or information provided as part of this RFP Process, provided that if the nature of the subject matter of the RFP is such that, in the opinion of ONTC, it would be appropriate to enter into a non-disclosure agreement with a Respondent or Respondents, ONTC and/or the Respondent shall enter into such agreement in a form and with the content satisfactory to ONTC.

3.8 Confidential Information

(1) In this RFP, "**RFP Information**" shall mean all material, data, information or any item in any form, whether oral or written, including in electronic or hard-copy format, supplied by, obtained from or otherwise procured in any way, whether before or after the RFP Process, from ONTC or any Ministry or Agency of the Government of Ontario, in connection with the RFP Documents or the Goods and/or Services excluding any item which:

(a) is or becomes generally available to the public other than as a result of a disclosure resulting from a breach of this RFP Section 3.8;

(b) becomes available to the Respondent on a non-confidential basis from a source other than ONTC, so long as that source is not bound by a non-disclosure agreement with respect to the information or otherwise prohibited from transmitting the information to the Respondent by a contractual, legal or fiduciary obligation; or,

(c) The Respondent is able to demonstrate it was known to it on a non-confidential basis before it was disclosed to the Respondent by ONTC.

(2) RFP Information:

(a) shall remain the sole property of ONTC or the Government of Ontario, as applicable, and the Respondent shall maintain the confidentiality of such information except as required by law;

(b) shall not be used by the Respondent for any other purpose other than submitting a Proposal or performing obligations under any subsequent agreement with ONTC relating to the Goods and/or Services;

(c) shall not be disclosed by the Respondent to any person who is not involved in the Respondent's preparation of its Proposal or in the performance of any subsequent agreement relating to ONTC, or the Government of Ontario, as applicable, without prior written authorization from ONTC;

(d) shall not be used in any way detrimental to ONTC or the Government of Ontario; and,

(e) if requested by ONTC, it shall be returned to the Contact Person or destroyed by the Respondent no later than ten (10) calendar days after such request is received in writing by the Respondent.

(3) Each Respondent shall be responsible for any breach of the provisions of this RFP Section 3.8 by any person to whom it discloses the RFP Information.

(4) Each Respondent or Short-listed Respondent acknowledges and agrees that a breach of the provisions of this RFP Section 3.8 would cause ONTC, the Government of Ontario and/or their related entities to suffer loss which could not be adequately compensated by damages, and that ONTC, the Government of Ontario and/or any related entity may, in addition to any other remedy or relief, enforce any of the provisions of this RFP Section 3.8 upon application to a court of competent jurisdiction without proof of actual damage to ONTC, the Government of Ontario or any related entity.

(5) Notwithstanding RFP Section 9.3, the provisions of this RFP Section 3.8 shall be binding and shall survive any cancellation or termination of this RFP and the conclusion of the RFP Process.

(6) ONTC may, in its sole discretion, require that Respondents execute a legally binding non-disclosure agreement in a form and substance satisfactory to ONTC prior to receiving the RFP Information.

3.9 Governing Laws and Attornment

(1) This RFP Process and the Final Agreement entered into pursuant to this RFP Process shall be governed and construed in accordance with the laws of Ontario, the laws of Quebec, the laws of Manitoba, if relevant to the subject matter of this RFP, and the applicable laws of Canada, excluding any conflict of laws principles.

(2) Each Respondent agrees that the courts of the Province of Ontario shall have exclusive jurisdiction to entertain any action or proceeding based on, relating to or arising from this RFP process.

3.10 Licenses and Permits

(1) If a Respondent is required by the Applicable Laws to hold or obtain a license, permit, consent or authorization to carry on an activity contemplated in its Proposal, neither acceptance of the Proposal nor execution of the Final Agreement shall be considered to be approval by ONTC of carrying on such activity without the requisite license, permit, consent or authorization.

3.11 Respondents' Costs

(1) The Respondent shall bear all costs and expenses incurred by the Respondent relating to any aspect of its participation in this RFP Process, including, without limitation, all costs and expenses related to the Respondent's involvement in:

(a) the preparation, presentation and submission of its Proposal;

(b) due diligence and information gathering processes;

(c) attendance at any Respondents' Meeting(s) or presentations;

(d) preparation of responses to questions or requests for clarification from ONTC;

(e) preparation of the Respondent's own questions during the clarification process;

(f) preparation of prototypes, proof of concept and/or demonstrations; and,

(g) any discussions or negotiations with ONTC regarding the Final Agreement.

(2) Without limiting the generality of Section 9.1(2) of this RFP, in no event shall ONTC or the Government of Ontario be liable to pay any costs or expenses or to reimburse or compensate a Respondent under any circumstances for the costs or expenses set out in Section 3.11(1), regardless of the conduct or outcome of the RFP Process.

3.12 Delay and Costs of Delay

(1) By submitting a Proposal, the Respondent waives all claims against ONTC and the Government of Ontario including any claims arising from any error or omission in any part

of the RFP Documents or RFP Information or any delay, or costs associated with delays, in the RFP Process.

3.13 Clarification and Verification of Respondent's Proposal

(1) Following submission of a Proposal, ONTC may:

(a) request a Respondent to clarify or verify the contents of its Proposal, including by submitting supplementary documents; and/or,

(b) request a Respondent to confirm an ONTC interpretation of the Respondent's Proposal.

(2) Any information received by ONTC from a Respondent pursuant to a request for clarification or verification from ONTC as part of the RFP Process may, in ONTC's discretion, be considered as an integral part of the Proposal even if such information should have been submitted as part of the Respondent's Proposal and may, in ONTC's discretion, be considered in the evaluation of the Respondent's Proposal.

(3) ONTC may, in its sole discretion, verify or clarify any statement or claim contained in any Proposal or made subsequently in any interview, presentation, or discussion. That verification or clarification may be made by whatever means that ONTC deems appropriate which may include contacting the persons identified in the contact information provided by the Respondent and contacting persons or entities other than those identified by any Respondent.

(4) By submitting a Proposal, the Respondent is deemed to consent to ONTC verifying or clarifying any information and requesting additional information from third parties regarding the Respondent) and its directors, officers, shareholders or owners and any other person associated with the Respondent as ONTC may determine is appropriate.

(5) ONTC is not obliged to seek clarification or verification of any aspect of a Proposal, or any statement or claim made by a Respondent.

(6) Requests for clarifications shall not be construed as acceptance by ONTC of a Proposal.

3.14 Two-Envelope Process

(1) ONTC may elect to complete a Two-Envelope Process. Whether Respondents will be required to submit their Proposals using a Two-Envelope Process will be identified on the RFP Data Sheet.

(2) If ONTC elects to complete a Two-Envelope Process, the Proposal shall be broken down into two components: a technical submission and a financial submission.

(3) If ONTC elects to complete a Two-Envelope Process, ONTC will identify a minimum score that must be attained on the technical submission on the RFP Data Sheet. Proposals that

do not meet the minimum score for the technical submission following evaluation of the technical submission, will not proceed further in the evaluation process, provided that ONTC may, in its sole discretion, based on the overall scores of all the technical submissions, revise the minimum score required to proceed further in the evaluation process. Financial submissions will only be opened and evaluated for the Proposals that meet the minimum score for the technical submission.

SECTION 4 - PROPOSAL CONTENT AND FORMAT

4.1 Format and Content of Proposal

(1) Respondents shall submit their Proposal in one envelope or, if submitting electronically, one electronic folder. Where required by the RFP Data Sheet to follow the two-envelope process, Respondents shall submit the technical submission and the financial submission in two separate envelopes or, if submitting electronically, two separate electronic folders.

(2) Unless otherwise specified in the RFP Data Sheet, Respondents shall not submit pre-printed literature with their Proposals. Any unsolicited pre-printed literature submitted as part of a Proposal will not be reviewed by the Evaluation Team.

(3) Each Respondent will:

(a) in a clear, concise and legible manner, complete and submit all documentation and information required by Part 2, Part 3, and Part 4 to the RFP;

(b) for a hard copy submission, complete any handwritten portions of the proposal forms in ink;

(c) provide all information requested and ensure that an authorized person or persons sign all forms where indicated. Failure to provide all requested information on the proposal forms and failure to fill in all blank spaces may result in a Proposal being determined to be non-compliant; and,

(d) use only the proposal forms issued as part of the RFP documents unless otherwise indicated.

(4) Information provided by Respondents on hard copy proposal forms may be amended prior to the Proposal submission, provided the amendments are initialed by an authorized representative of the Respondent. Un-initialed pre-submission amendments may result in the Proposal being declared non-compliant.

(5) Proposals that are not originals (if hard copy), are unsigned, improperly signed, incomplete, conditional or illegible, may be declared non-compliant.

(6) The Harmonized Sales Tax (HST) shall not be included in the price. Any taxes or increases to taxes announced prior to the date of the issuance of the RFP Documents

and scheduled to come into effect subsequent to it shall be taken into consideration at time of invoicing.

(7) Price:

(a) Price shall be an all-inclusive lump sum price (excluding HST), unless otherwise indicated in the RFP Documents; and,

(b) Where the RFP requires the Respondent to provide a breakdown of the price in Proposal Form 1-A, the price as stated in Proposal Form 1 shall govern in the case of conflict or ambiguity between the price and the sum of the breakdown of the price.

(8) Listing of Subcontractors

Each Respondent shall complete the "Subcontractors" section of Proposal Form 2 – Respondent's General Information, naming the Subcontractors which the Respondent will employ to perform an item of the work called for by the RFP Documents. Failure of the Respondent to list Subcontractors where required, may result in the Proposal being declared non-compliant.

4.2 Proposal Submission Form

(1) Each Respondent will complete and submit the forms included in Part 4 – Form of Proposal. Failure of the Respondent to complete and submit one or more of the forms included in Part 4 – Form of Proposal, may result in the Proposal being declared non-compliant.

(2) Respondents shall execute the Proposal Submission Form as follows:

(a) in the case of a sole proprietorship, the sole proprietor will sign the Proposal Submission Form and have the signature witnessed;

(b) in the case of a corporation, an authorized signing officer will sign the Proposal Submission Form; or,

(c) in the case of a partnership, a partner or partners authorized to bind the partnership will sign the Proposal Submission Form and have their signatures witnessed.

4.3 Bid Performance Security

(1) The Respondent shall provide with its Proposal, Bid Performance Security in one of the following forms:

(a) Irrevocable stand-by Letter of Credit ("**LOC**"); or,

(b) Bid bond

(the "**Bid Performance Security**").

The Bid Performance Security shall be:

(a) in the Respondent's own name;

(b) if a bid bond, issued by a surety licensed to conduct surety and insurance business in Ontario;

(c) in a form satisfactory to ONTC;

(d) for a term of at least ninety (90) calendar days after the Submission Deadline; and,

(e) in the amount of ten percent (10%) of the total bid price excluding HST.

The Bid Performance Security is for the benefit of ONTC and will be retained by ONTC to compensate ONTC for the damages it will suffer if the Successful Respondent fails to provide the Contract Securities (defined in Section 4.3(2), below) and evidence of insurance and other documents required by this RFP or by the Final Agreement, or fails to execute the Final Agreement within the time required by the RFP Documents.

The Bid Performance Security of the Successful Respondent will be returned after the Successful Respondent delivers to ONTC compliant Contract Securities and evidence of insurance and other documents required by this RFP or by the Final Agreement and the Successful Respondent has executed the Final Agreement, all within the time required by the RFP Documents.

The Bid Performance Security of all other Respondents shall be returned to the Respondents upon the occurrence of the earlier of:

(a) execution by both parties of the Final Agreement between ONTC and the Successful Respondent;

(b) the expiry of the 90-day period following the Submission Deadline;

(c) the cancelation of the RFP process without an award of the contract; or,

(d) the disqualification of all Proposals.

(2) Agreement to Bond

The Respondent shall provide with its Proposal an agreement to bond issued by a surety company undertaking to provide a fifty percent (50%) Performance Bond and a fifty percent (50%) Labour and Material Bond (the "**Contract Securities**") in the form prescribed by the *Construction Act*, both to be provided to ONTC by the Successful Respondent following award of the contract.

(3) Proposals not accompanied by the required Bid Performance Security and the required agreement to bond will be declared non-compliant.

The Respondent shall include the actual cost of all bonds, with no mark-up, in the Proposal price.

4.4 References and Past Performance Issues

(1) If specified in the RFP Data Sheet, Respondents shall provide reference information. Unless otherwise set out in the RFP Data Sheet, all references shall be, where possible, with respect to similar goods and/or services, as applicable, during the five (5) years immediately prior to the Submission Deadline. Unless otherwise set out in the RFP Data Sheet, the Respondent shall provide a minimum of three (3) references.

(2) ONTC may, in its sole discretion, confirm the Respondent's experience and ability to provide the Goods and/or Services by contacting the Respondent's references. However, ONTC is under no obligation to contact references submitted by any Respondent. References and information received from references, if contacted, will be taken into account in the evaluation process as identified in the RFP Data Sheet.

(3) ONTC may take into account in the evaluation process reliable information received from the Government of Ontario or its Agencies regarding past performance of a Respondent, provided information evidencing past poor performance by a Respondent is provided to the Respondent (subject to any restrictions or disclosure imposed by applicable law) and the Respondent is afforded an opportunity to respond to the information.

(4) If ONTC receives information from referees of a Respondent's past poor performance, ONTC shall advise the Respondent (subject to any restrictions on disclosure imposed by applicable law) and afford the Respondent an opportunity to respond to the information prior to considering this information as part of the evaluation process.

4.5 Conflict of Interest

(1) For the purposes of this Section 4.5, the term "**Conflict of Interest**" includes, but is not limited to, any situation or circumstance where the interests, conduct, other commitments or relationships of a Respondent, a Respondent's family member or an officer, director or employee of the Respondent could or could be perceived to, directly or indirectly, compromise, impair or be in conflict with the integrity of the RFP Process, the subject matter of the RFP or ONTC.

(2) Each Respondent shall promptly disclose any potential, perceived or actual Conflict of Interest of the Respondent to the Contact Person in writing. If ONTC discovers a Respondent's failure to disclose a Conflict of Interest, ONTC may, in its sole and absolute discretion disqualify the Respondent or terminate the Final Agreement if such Respondent is the Successful Respondent.

(3) ONTC may, in its sole discretion, and in addition to any other remedy available at law or in equity:

(a) waive any Conflict of Interest;

(b) impose conditions on a Respondent that require the management, mitigation and/or minimization of the Conflict of Interest; or,

(c) disqualify the Respondent from the RFP Process if, in the sole and absolute opinion of ONTC, the Conflict of Interest cannot be managed, mitigated or minimized.

SECTION 5 - PROPOSAL SUBMISSION, WITHDRAWAL, MODIFICATION

5.1 Submission of Proposals and Late Proposals

(1) Each Respondent shall submit their proposal in the format prescribed in the RFP Data Sheet. ONTC will not accept any proposal submission that is not submitted in the format prescribed in the RFP Data Sheet.

ONTC may elect to accept Electronic Bid Submissions, Physical Bid Submissions or a combination of both.

(a) If ONTC elects to use Electronic Bid Submissions, submissions shall be submitted on, and in accordance with, forms supplied by ONTC. **All responses are to be submitted to ONTC through the use of MERX Electronic Bid Submission (EBS).** Respondents shall be solely responsible for the delivery of their Proposals in the manner and time prescribed in the RFP Data Sheet.

Questions concerning submitting through MERX should be addressed to:

- MERX Customer Support
- Phone 1-800-964-6379
- Email merx@merx.com

Any Proposal from a Respondent whose name does not appear on the official MERX document request list (i.e., who has not downloaded the documents themselves) will be declared invalid, and the Proposal will not be considered.

MERX EBS does not allow submissions to be uploaded after the bid submission deadline; therefore, the Respondent should ensure they allow plenty of time to upload the documents.

Where required by the RFP Data Sheet to use a two-envelope process, Respondents shall include two separate and clearly identifiable attachments: 1) Technical and, 2) Financial. The file names for the technical and financial attachments should be sufficiently distinguishable such that ONTC does not need to open the attachments to differentiate between them.

(b) If ONTC elects to use Physical Bid Submissions, Respondents shall submit one original and the number of copies of its Proposal (in hard copy) specified in the RFP Data Sheet and the number of electronic copies of its Proposal (on a properly labelled CD or USB key in PDF format) specified in the RFP Data Sheet, at the correct location for submission and on or before the Submission Deadline. If there is any difference whatsoever between the electronic copy of the Proposal and the original hard copy, the original hard copy of the Proposal, as submitted, will govern. The electronic copy of the Proposal is solely for the convenience of ONTC.

Respondents shall submit their Proposals to the attention of the Manager, Public Procurement by prepaid courier or personal delivery at the following address:

Ashley Commanda
Manager, Public Procurement
Ontario Northland Transportation Commission
555 Oak Street East
North Bay, Ontario P1B 8E3

The Respondent shall place their Proposal Submission in a sealed envelope or package with the Respondent's full legal name and return address, the RFP Number, the Submission Deadline and the label "Proposal Submission" clearly displayed on the outside of the envelope.

Where required by the RFP Data Sheet to use a two-envelope process, Respondents shall have one sealed envelope as prescribed above that contains two individual sealed envelopes inside that are clearly marked "Technical Submission" and "Financial Submission".

(c) For the convenience of the Respondents, and only when identified in the RFP Data Sheet, ONTC may allow either an Electronic Bid Submission through MERX or Physical Bid Submission. The Respondent shall only use one method and follow the same procedure prescribed above.

(2) Proposals must be received before the time noted in the RFP Data Sheet.

(3) Proposals will be date and time stamped at the place receiving the Proposals. Late Proposals will be returned unopened.

(4) Proposals which are submitted by facsimile transmission, email, or by electronic means other than MERX will NOT be considered.

(5) Respondents are solely responsible for the method and timing of delivery of their Proposals.

(6) ONTC reserves the right to make copies of the Respondent's Proposals as it may be required for the purpose of conducting a full evaluation of the Proposal submitted.

(7) The Respondent should identify and mark any trade secret or proprietary intellectual property in its Proposal.

5.2 Late Proposals

(1) ONTC will reject Proposals that are received after the Submission Deadline.

5.3 Withdrawal of Proposals

(1) When submitting a Physical Bid Submission, a Respondent may withdraw its Proposal at any time before the Submission Deadline by notifying the Contact Person in writing. ONTC shall return, unopened, a Proposal that has been withdrawn.

(2) When submitting an Electronic Bid Submission, MERX will allow withdrawal of Proposals up to the Submission Deadline.

5.4 Amendment of Proposals

(1) When submitting a Physical Bid Submission, Respondents may amend their Proposals after submission but only if the original Proposal is withdrawn and the amended Proposal is submitted before the Submission Deadline.

(2) Electronic Bid Submissions through MERX will allow amendments up to the closing date and time; however, **Respondents are responsible for ensuring they allow sufficient time to upload the amended documents**.

(3) If more than one Proposal is received from the same Respondent before the Submission Deadline, only the last Proposal received before the Submission Deadline will be considered.

5.5 Proposal Irrevocability

(1) Subject to the Respondent's right to withdraw or amend the Proposal before the Submission Deadline, the Respondent's Proposal is irrevocable and shall remain in effect and open for acceptance for ninety (90) days after the Submission Deadline.

5.6 One Proposal per Person or Entity

(1) Except as set out in the RFP Data Sheet or with ONTC's approval:

(a) a person or entity shall submit or participate in only one Proposal either individually or as a Respondent team member; and,

(b) a person or entity shall not be a subcontractor of a Respondent and also submit a Proposal individually or as a Respondent team member in the same RFP Process.

(2) If a person or entity submits or participates in more than one Proposal in contravention of RFP Section 5.6(1), ONTC may, in its sole discretion, disqualify any or all of the Proposals submitted by that person or entity or in which that person or entity is a participant.

SECTION 6 - PROPOSAL EVALUATION

6.1 Evaluation Team

(1) ONTC will establish an evaluation team for the purpose of evaluating Proposals (the "**Evaluation Team**").

(2) The Evaluation Team may, in its sole discretion, delegate certain administrative functions related to the evaluation of Proposals to a separate team of individuals who are not members of the Evaluation Team, who will be supervised by the Evaluation Team. Without limiting the generality of the foregoing, but for greater particularity, the Evaluation Team may seek the advice and assistance of third-party consultants and the Government of Ontario. Each Respondent acknowledges that the RFP documents may have been prepared with the assistance of a third-party consultant and that the consultant may participate in the evaluation of the Proposals.

6.2 Evaluation of Proposals

(1) The Respondents' Proposals will be reviewed and evaluated by the Evaluation Team on the basis of the evaluation criteria set out in the RFP Data Sheet (the "**Evaluation Criteria**").

(2) After selection of the Short-listed Respondent(s), ONTC may, in its sole discretion, negotiate changes, amendments or modifications to the Short-listed Respondent's Proposal or the Final Agreement.

(3) If ONTC is of the opinion that any of the following apply, then ONTC may, in ONTC's sole discretion, decline to select that Respondent to be a Short-listed Respondent:

(a) a Respondent has submitted a price that is clearly insufficient to perform the supply of Goods and/or Services;

(b) a Respondent has previously provided poor performance to ONTC or a subsidiary of ONTC;

(c) a Respondent is disqualified from participating in the RFP Process per RFP Section 7.2 (1)(i);

(d) ONTC cannot, to ONTC's satisfaction, prior to the conclusion of the RFP Process, verify independently or through a third party or parties any and/or all information, statements, representations and/or warranties contained in the Proposal;

(e) a Respondent or any subcontractor of the Respondent is not financially sound, or ONTC is unable to obtain from the Respondent or third-party sources reasonable assurances of the financial position of the Respondent or any of its subcontractors;

(f) the overall cost to ONTC would be significantly increased with that Respondent;

(g) the Respondent failed to meet the mandatory requirements specified in the RFP Data Sheet; or,

(h) the Respondent failed to attain the minimum score required for the Technical Submission, where the RFP Data Sheet called for a two-envelope process.

6.3 Short-Listing

(1) The Evaluation Team will establish the list of Short-listed Respondents based on the Evaluation Criteria.

(2) The number of Respondents short-listed is in the sole discretion of ONTC.

6.4 Interviews, Site Visits, Demonstrations and Presentations

(1) ONTC may, in its sole discretion, conduct interviews, demonstrations, site visits or presentations as part of the evaluation process if set out in the RFP Data Sheet.

(2) The evaluation of any interviews, demonstrations, site visits or presentations will be conducted in accordance with the process set out in the RFP Data Sheet.

(3) ONTC may conduct interviews, demonstrations, site visits or presentations with some or all Respondents, or may restrict participation to only the Short-listed Respondent(s).

SECTION 7 - GENERAL EVALUATION AND DISQUALIFICATION PROVISIONS

7.1 ONTC's Discretion

(1) ONTC may determine, in its sole discretion:

(a) the membership of the Evaluation Team;

(b) if a Proposal is compliant with the RFP Documents;

(c) if a failure to comply is material;

(d) if a Proposal or a Respondent is disqualified;

(e) the evaluation results and ranking for each Respondent; and,

(f) which Respondent, if any, and how many Respondents, based on the evaluation process, will be Short-listed Respondents.

7.2 Disqualification

(1) ONTC may, in its sole discretion, disqualify a Respondent or a Respondent's Proposal or cancel its decision to identify a Respondent as a Short-listed Respondent or a Successful Respondent, at any time prior to the execution of the Final Agreement by ONTC, if:

(a) The Respondent fails to cooperate in any attempt by ONTC to clarify or verify any information provided by the Respondent in its Proposal;

(b) The Respondent contravenes RFP Section 3.5, RFP Section 3.6 or RFP Section 5.6(2);

(c) The Respondent fails to comply with the Applicable Laws;

(d) The Proposal contains false or misleading information, or the Respondent provides false or misleading information in any part of the RFP Process;

(e) The Proposal, in the sole discretion of ONTC, reveals a Conflict of Interest that cannot be managed, mitigated or minimized;

(f) There is evidence that the Respondent colluded with one or more other Respondents in the preparation or submission of Proposals;

(g) The Respondent has previously breached or been in default of compliance with any term of any agreement with ONTC and such breach or default has not been waived by ONTC or the Respondent has not cured the default;

(h) The Respondent has been convicted of an offence in connection with any services rendered by the Respondent to ONTC, or to any Ministry, Agency, Board or Commission of the Government of Ontario or the Government of Canada;

(i) The Respondent, at the time of issuance of this RFP or any time during the RFP Process, has an outstanding claim or is engaged in an ongoing legal dispute with ONTC, other than an adjudication under the Construction Act;

(j) The Proposal is not Substantially Compliant;

(k) The Respondent has failed to notify ONTC of, or ONTC has not approved, a post-submission change in the control of the Respondent or in the circumstances of the Respondent that may materially negatively impact the Respondent's ability to perform its obligations if selected as the Successful Respondent; or,

(l) The Respondent has received a Vendor Performance Evaluation as part of ONTC's Vendor Performance Policy, and received a total rating on the Final Performance Form that disqualifies the Respondent from participating in the RFP Process.

(2) Notwithstanding Section 7.2 (1), ONTC shall retain the right to select as the Successful Respondent, any Respondent(s) which, in ONTC's sole and absolute discretion, has submitted a substantially compliant Proposal(s).

7.3 General Rights of ONTC

(1) ONTC may, in its sole discretion and at any time during the RFP process:

(a) reject any or all of the Proposals;

(b) accept any Proposal or any portions of any Proposals for any reason whatsoever;

(c) reject any Proposals or any portions of Proposals for any reason whatsoever;

(d) if only one Proposal is received, elect to either accept it, reject it, or enter into negotiations with the applicable Respondent;

(e) elect not to proceed with, cancel, or terminate the RFP;

(f) alter the Submission Deadline or any other deadlines associated with the RFP Process;

(g) change the RFP Process or any other aspect of the RFP Documents; or,

(h) cancel this RFP Process and subsequently conduct another competitive process for the same Goods and/or Services that are the subject matter of this RFP or subsequently enter into negotiations with any person or persons with respect to the Goods and/or Services that are the subject matter of this RFP.

(2) If ONTC, in its sole discretion, is of the opinion that all of Proposals submitted are not substantially compliant, ONTC may:

(a) take any action in accordance with Section 7.3. (1);

(b) carry out a process whereby all Respondents are directed to correct the deficiencies in their Proposals for re-submission; or,

(c) negotiate an agreement for the whole or any part of the Goods and/or Services with a Respondent which has submitted a Non-compliant Proposal.

SECTION 8 – AGREEMENT FINALIZATION AND DEBRIEFING AND SUCCESSFUL RESPONDENT

8.1 Finalization of the Agreement

(1) ONTC may, in its sole discretion, retain more than one Respondent to provide the Goods and/or Services.

(2) ONTC reserves the right in its sole discretion to sub-divide and/or bundle the Goods and/or Services which are the subject of this RFP and award one or any number of separate contracts for the Goods and/or Services.

(3) ONTC may, in its sole discretion, enter into negotiations with one or more Respondent(s) for the purpose of selecting a Successful Respondent(s) and finalizing an agreement.

(4) Either ONTC or a Respondent may withdraw from negotiations at any time prior to the Successful Respondent(s) being identified.

(5) The Successful Respondent is expected to enter into the relevant CCDC form of agreement which shall include the Supplementary Conditions in Part 5. Proposal Form 5 – Compliance with Contract Documents allows a Respondent to submit suggested changes to the Supplementary Conditions. ONTC does not have any obligation to accept any proposed changes to the Supplementary Conditions and will do so in its sole discretion. ONTC may, in ONTC's sole discretion; (i) consider only a minimal number of changes to the Supplementary Conditions; (ii) consider significant material proposed changes to negatively impact the evaluation of the Respondent's proposal; or (ii) disqualify any Respondent where the changes or the number of changes made by the Respondent to the Supplementary Conditions would be, in ONTC's sole discretion, too onerous to successfully negotiate within the timeframe set out in Section 8.1 (6) below or are unacceptable to ONTC.

In any event, ONTC will not accept any material changes to the clauses in the Supplementary Conditions relating to Confidentiality, Personal Information, Intellectual Property ownership and infringement, Indemnification, Limitation of Liability or rights of ONTC on termination. ONTC, as an Ontario Crown corporation, is unable to provide indemnities pursuant to s.28 of the *Financial Administration Act* (Ontario).

If a Respondent does not submit any proposed amendments in Proposal Form 5, it will be deemed to have accepted and will be required to execute the Final Agreement in the form attached to this RFP. If a Respondent has submitted proposed amendments to the Final Agreement, negotiations respecting those amendments shall be conducted within the timeframe set out in Section 8.1(6).

(6) If a Successful Respondent fails or refuses to enter into and execute the Final Agreement within ten (10) Business Days of being notified they are the Successful Respondent

(ONTC may extend such period of time in ONTC's sole discretion), or a Successful Respondent fails or refuses to provide the documentation in accordance with Section 8.1(7), ONTC may, in its sole discretion, take any one of the following actions:

(a) terminate all negotiations and cancel its identification of that Respondent as a Successful Respondent;

(b) select another Respondent or Short-Listed Respondent as the Successful Respondent;

(c) retain the bid security described in Section 4.3 to compensate for any damages suffered by ONTC as a result of the Successful Respondent's failure or refusal to enter into the Final Agreement

(d) take any other action in accordance with Section 7.3; or,

(e) pursue any other remedy available to ONTC at law.

(7) Prior to supplying any Goods and/or Services pursuant to the Contract, the Successful Respondent shall deliver to ONTC:

(a) The performance bond and the labour and material bond described in the RFP Documents. The form of such bonds shall comply with the requirements prescribed in the *Construction Act.* Refer to the link below for the appropriate form (Form 31 and 32).

http://ontariocourtforms.on.ca/en/construction-lien-act-forms/

(b) Certificates of insurance as specified in the Supplementary Conditions;

(c) Executed Contractors Health and Safety Responsibility Agreement;

(d) Respondent's Health and Safety, and Environmental Policies; and,

(e) A current Clearance Certificate issued by the Workplace Safety and Insurance Board, if applicable.

8.2 Notification If Successful or Not

(1) The Successful Respondent and unsuccessful Respondents will be notified by ONTC in writing regarding their success or failure in the RFP Process.

8.3 Debriefing

(1) Respondents may request a debriefing after receipt of a notification pursuant to RFP Section 8.2. All Respondent requests should be in writing to the Contact Person no later

than 60 calendar days after receipt of the notification. ONTC will conduct debriefings in the format prescribed by the OPS Procurement Directive.

SECTION 9 - LEGAL MATTERS AND RIGHTS OF ONTC

9.1 Limit on Liability

(1) The total liability of the Respondent to ONTC for loss and damage arising from the Respondent who is selected as the Successful Respondent but then fails to deliver the Contract Security, evidence of insurance or other documents required under Section 8.1(7) within the time period specified in Section 8.1(6) or fails to execute the Final Agreement shall be limited to the value of the Bid Performance Security provided by the Respondent pursuant to Section 4.3. The liability of the Respondents for any other loss or damage suffered by ONTC as part of this RFP Process shall be without limit.

(2) By submitting a Proposal,

(a) each Respondent acknowledges ONTC's rights as stated herein and absolutely waives any right of action against ONTC for ONTC's failure to accept the Respondent's Proposal whether such right of action arises in contract, negligence, bad faith, or any other cause of action;

(b) each Respondent covenants and agrees that, under no circumstances, shall ONTC, or any of its employees, officers, representatives, agents or advisors, be liable to any Respondent, whether in contract, tort, restitution, or pursuant to any other legal theory, for any claim, action, loss, damage, cost, expense or liability whatsoever and howsoever arising from this RFP Process, a Respondent's Proposal in response to this RFP Process, or due to the acceptance or non-acceptance of any Proposal, or as a result of any act or omission by ONTC and/or its employees, officers, representatives, agents or advisors, including any information or advice or any errors or omissions that may be contained in the RFP Documents, or any other documents or information provided to a Respondent, or arising with respect to the rejection or evaluation of any or all of the Proposals, any negotiations with any of the Respondents, or the selection of any Respondent as a Short-listed Respondent or the Successful Respondent; and,

(c) each Respondent shall indemnify and hold harmless ONTC, its employees, officers, representatives, agents and advisors, from and against any and all claims, demands, actions or proceedings brought by third parties, including but not limited to the Respondent's subcontractors or suppliers, in relation to this RFP Process.

9.2 Power of Legislative Assembly

(1) No provision of the RFP Documents (including a provision stating the intention of ONTC) is intended to operate, nor shall any such provision have the effect of operating, in any

way, that would interfere with or otherwise fetter the discretion of the Legislative Assembly of Ontario in the exercise of its legislative powers.

9.3 RFP Not a "Bidding Contract" or a Tender

(1) Notwithstanding any other provision of this RFP, this RFP is not a tender call, ONTC does not intend to create any contractual relations or obligations with any of the Respondents by virtue of issuing this RFP, and this RFP is not an offer to enter into a contract (often referred to as "Contract A"). Except as provided in RFP Section 3.8, 4.3 and 9.1, neither this RFP nor the submission of a Proposal by a Respondent shall create any legal or contractual rights or obligations whatsoever on any of the Respondent, ONTC, the Government of Ontario or any Ministry of the Government of Ontario.

SECTION 10 – VENDOR PERFORMANCE

10.1 General

(1) ONTC has established a Vendor Performance Policy, which provides a framework for ONTC to maximize the value for money of its Vendors by:

(a) proactively managing the performance of Vendors in accordance with ONTC's Purchasing Policy; and,

(b) creating a record of past performance for use by ONTC when selecting Vendors for the supply of goods and services.

10.2 Vendor Performance Evaluation

(1) Successful Respondents who enter into a Final Agreement with ONTC may be required to participate in the Vendor Performance Evaluation process.

10.3 Vendor Ratings for Proposal Evaluation Purposes

(1) ONTC may access a Respondent's Vendor Performance Evaluations for previous contracts as part of the Evaluation Process. The manner in which the Respondent's ratings will be used will be identified in the Evaluation Criteria of the RFP Data Sheet.

SECTION 11 – TRANSPARENCY AND FAIRNESS

11.1 General

(1) ONTC is committed to procuring goods and services through a process that is conducted in a fair and transparent manner, providing equal opportunity to vendors.

(2) ONTC endeavors to provide specifications that meet the requirements of the procurement without naming specific brands. However, there may be instances where a third-party consultant prepares a specification on behalf of ONTC, and a specific brand is named. In these instances, alternate materials or products may be used if ONTC determines the proposed materials or products are equivalent to the materials or products in the

specifications. Respondents shall submit proposed alternate materials or products with their Proposal submission to be considered.

SECTION 12 – INTERPRETATION

12.1 General

(1) In this RFP, the singular shall include the plural and the plural shall include the singular, except where the context otherwise requires.

(2) All references in this RFP to “discretion” or “sole discretion” means in the sole and absolute discretion of the party exercising the discretion.

(3) For clarity, where the expression “Government of Ontario” is used in this RFP, it includes all Ministries and Agencies of the Government of Ontario.

PART 2

REQUEST FOR PROPOSALS

SUMMARY OF REQUIREMENTS

PART 2 – REQUEST FOR PROPOSALS
SUMMARY OF REQUIREMENTS
SCHEDULE 2-A
RFP DATA SHEET

RFP 2025 083 **Grit Blast Upgrade**	
Contact Details	
Contact Person	Brinda Ranpura Procurement Contracts Specialist
Contact Information	555 Oak Street East North Bay, Ontario, P1B 8L3 brinda.ranpura@ontarionorthland.ca (705) 472-4500 ext. 548
Proposal Detail	
Site Visit	A mandatory Respondents' Meeting will be carried out on Wednesday, September 24, 2025 at 10:00 a.m. at **916 McIntyre St, North Bay, ON**. Respondents must complete the Respondents' Meeting Registration Form, together with the Release of Liability, and return it via email by Tuesday, September 23, 2025 to Brinda Ranpura at brinda.ranpura@ontarionorthland.ca.
Validity of Proposals	90 days following the Submission Deadline
Format of Submission	Respondents shall submit their Proposal through MERX Electronic Bid Submissions (EBS). Refer to Part 1, Request for Proposals, Section 5.1 (1) (a). **MERX EBS does not allow Proposals to be uploaded after the Submission Deadline; therefore, Respondents shall ensure they allow sufficient time to upload the documents.** Proposals which are submitted by facsimile transmission, by email or by electronic means other than MERX will NOT be considered.
French Language Services	This Request for Proposal Document will be available in French Language upon request.
Two-Envelope Process	This procurement **will** be a two-envelope process. Please submit Proposal Form 1, Proposal Form 1-A and Proposal Form 11 – Schedule of Progress Payments in Envelope 2 - Price Proposal. The balance of the Proposal should be contained in Envelope 1 - Technical Proposal. Please do not include any pricing information in Envelope 1 - Technical Proposal.
Distribution Method	The RFP Documents will be posted on the ONTC website and MERX. Any addenda to the RFP will be shared to these locations.

PART 2 – REQUEST FOR PROPOSALS
SUMMARY OF REQUIREMENTS
SCHEDULE 2-A
RFP DATA SHEET *continued*

RFP 2025 083
Grit Blast Upgrade

Proposal Detail *continued*

Submission Requirements

Respondents are required to submit **all** of the material documents listed below as part of their Proposal. Respondents shall confirm they have included the documents listed below with their Proposal by placing a checkmark in the column "Included in Proposal". If the Respondent fails to include a document listed below as being "Material", the respondent may be disqualified in accordance with section 6.2 (3) of the RFP.

Item	Included in Proposal (indicate with x)	Item is classified as Material
This checklist		
Proposal Form 1 - Proposal Submission Form		Material
Proposal Form 1-A – Schedule of Prices		Material
Proposal Form 2 - Respondent's General Information		Material
Proposal Form 3 - Acknowledgment to Comply with Part 3 – Request for Proposals Specifications		Material
Proposal Form 4 - References		Material
Proposal Form 5 - Compliance with Contract Documents		
Proposal Form 7 - Health, Safety and Environment		Material
Proposal Form 8 - Schedule of Materials		
Proposal Form 9 - List of Equipment		
Proposal Form 10 - Schedule and Proposed Approach		Material
Proposal Form 11 - Schedule of Progress Payments		Material
Proposal Form 12 - List of Key Personnel		Material
Proposal Form 13 - Current Labour Agreements		
Proposal Form 14 - Contractor's Qualification Statement		Material
Proposal Form 15 – Claims		
Bid Performance Security and Agreement to Bond (Scanned Copy Acceptable)		Material

PART 2 – REQUEST FOR PROPOSALS
SUMMARY OF REQUIREMENTS
SCHEDULE 2-A *continued*
RFP DATA SHEET

RFP 2025 083 **Grit Blast Upgrade**			
Important Dates			
Publication Date	Friday, September 12, 2025		
Participation Registration Form	Complete and submit to the Contact Person as soon as possible		
Deadline for Additional Information Request	Four (4) full Business Days prior to the Submission Deadline		
Submission Deadline Date and Time	Friday, October 17, 2025 at 2:00:00 p.m. (EDT)		
Ready-for-Takeover Date	November 03, 2025 – February 01, 2027		
Notes Pertaining to Final Agreement			
Liquidated Damages	The per diem rate calculated in relation to Section 10.4 of the Supplementary Conditions is $500 for each calendar day of delay beyond the prescribed date for Substantial Performance of the Work until Substantial Performance of the Work is achieved and certified, pursuant to the terms of the Contract.		
Procedure of Selection			
Mandatory Requirements	Respondents must satisfy all of the Mandatory Requirements listed below. Respondents will receive a pass/fail for each Mandatory Requirement. Respondents who fail any of the Mandatory Requirements will be disqualified from the RFP Process.		
	Mandatory Requirement	**Pass**	**Fail**
	Respondent has participated in the Mandatory Respondents' Meeting		
	Proposals must be submitted in English		
	Bid Performance Security and Agreement to Bond as prescribed in Part 1, Request for Proposals, Section 4.3 (Scanned copy acceptable with Proposal)		

PART 2 – REQUEST FOR PROPOSALS
SUMMARY OF REQUIREMENTS
SCHEDULE 2-A *continued*
RFP DATA SHEET

RFP 2025 083
Grit Blast Upgrade

Procedure of Selection *continued*		
Evaluation General Procedure	Respondents must score a <u>minimum of 50%</u> in Experience and Qualifications and score a <u>minimum of 50% in</u> Schedule and Proposed Approach to qualify for shortlist consideration. Respondents who fail to score a minimum of 50% in each of these categories may be disqualified from the RFP Process.	
Evaluation Criteria	**Description**	**Weight**
	Price ONTC will use the following to calculate the initial score for price: Lowest price of all Proposals / price of Respondent x 40 = Score [ONTC may deduct up to a total of three (3) points for incomplete forms i.e. missing details, specifics, line items etc] *<u>This information shall be provided under Proposal Form 1–A Schedule of Prices</u>* *ONTC reserves the right in its sole discretion to consider the best overall value when evaluating price and adjust the score accordingly. If ONTC, in its sole discretion, is of the opinion that the Respondent has submitted a price that is too low to adequately complete the scope of work, then ONTC reserves the right not to use that price as the "Lowers price of all Proposals".*	40
	Experience and Qualifications ONTC will assess Respondents' experience and qualifications using the information supplied in Part 4 of this RFP. The following sub-weights will apply: Resumes of Key Personnel (Including Subcontractor(s) if any): • Project Manager – **2 Points**; • Site Supervisor – **2 Points**; • Quality Coordinator – **2 Points**; • Health & Safety Coordinator – **1 Point;** and • All Other Resumes – **3 Points** *<u>This information must be provided under Proposal Form 12 List of Key Personnel</u>* Company Profile (Including Subcontractor(s) if any) – **2 points** Project Profile 1 to 3, inclusive – **12 points (4 Points Each)**	30

PART 2 – REQUEST FOR PROPOSALS
SUMMARY OF REQUIREMENTS
SCHEDULE 2-A *continued*
RFP DATA SHEET

RFP 2025 083 **Grit Blast Upgrade**		
Procedure of Selection *continued*		
	Description	**Weight**
Evaluation Criteria	**Experience and Qualifications** *cont'd* Local Benefit: Respondents must confirm that their organization is utilizing Ontario's local workforce, vendors, manufacturers, contractors, and/or apprentices/trainees in achieving the project goals and providing the requested services. Respondents who select 'Yes' will be awarded full points. Respondents who select 'No' but provide supporting details will be awarded 2.5 points.– **5 points** *This information shall be provided under Proposal Form 14 Contractor's Qualification Statement* *ONTC may or may not contact references as part of the evaluation and may use this information as part of this score.*	
	Schedule and Proposed Approach ONTC will assess the Respondent's Schedule and Proposed Approach based on the following: Is the Schedule in the format requested and are the milestone dates aligned with the completion dates for each phases of the Project? **- 4 points** Has the critical path been identified? Respondents are required to identify the critical path in their schedule and describe it in their proposed approach - **2 points** Is the schedule and proposed approach logical and do they have sufficient detail, including durations for each task? Provide a detailed written narrative covering Proposed Approach including major milestones such as Contract Award, Pre-Construction activities-(Submittals, Shop Drawings), Construction (Mobilization, critical construction milestone, deliveries, commissioning), Post Construction Activities (Site Cleanup), Training, Closeout - **10 points** Describe how you will provide an uninterrupted supply of the required goods and/or services to avoid any adverse impact between phases on the project schedule. Respondents must identify any anticipated product delays and build this into the schedule. – **4 points**	20

PART 2 – REQUEST FOR PROPOSALS
SUMMARY OF REQUIREMENTS
SCHEDULE 2-A *continued*
RFP DATA SHEET

RFP 2025 083 **Grit Blast Upgrade**		
Procedure of Selection *continued*		
	Description	**Weight**
Evaluation Criteria	**Schedule and Proposed Approach** *cont'd* *This information must be provided under Proposal Form 10 – Schedule and Proposed Approach*	
	Health, Environment and Safety Provide evidence of compliance with Ontario's health, safety and environmental requirements by submitting copies of your Health, Safety, and Environmental Protection Policies. Including any documentation/policies for working around active rail. Provide evidence of compliance with the Occupational Health and Safety Act (OHSA), Construction Projects Regulation (O. Reg. 213/91), Environmental Protection Act (EPA), and ONTC's Technical Specifications. Respondents are required to include the following – a) Health and Safety Compliance Documentation – **4 points**; b) Environmental Protection and Sustainability Measures – **4 Points**; and c) Policies/Procedures for Working around Active Rail – **2 Points** *This information must be provided under Proposal Form 7 – Health, Environment and Safety*	10
	Total	**100**

PART 2 – REQUEST FOR PROPOSALS
SUMMARY OF REQUIREMENTS
SCHEDULE 2-B
PARTICIPATION REGISTRATION FORM

Required in order to register and receive any communications in relation to the requirement referenced below.

Date:	
Reference Number:	RFP 2025 083
Description of Requirement:	Grit Blast Upgrade

I, the undersigned, am registering to participate in the above referenced requirement and will be the primary contact for any communications in relation to this process and project until further advised.

Company Name:	
Address:	
Name of person registering to represent company referenced above (please print):	
Email Address:	
Phone Number: (Main Office Number)	
Cell Number:	
Signature of Primary Contact:	

Return form to the Contact Person as referenced below via email as an attachment:

Thank you.

Brinda Ranpura
Procurement Contracts Specialist
Ontario Northland Transportation Commission
Phone: 705-472-4500 Ext. 548
Email: brinda.ranpura@ontarionorthland.ca
Website: www.ontarionorthland.ca

PART 3

REQUEST FOR PROPOSALS

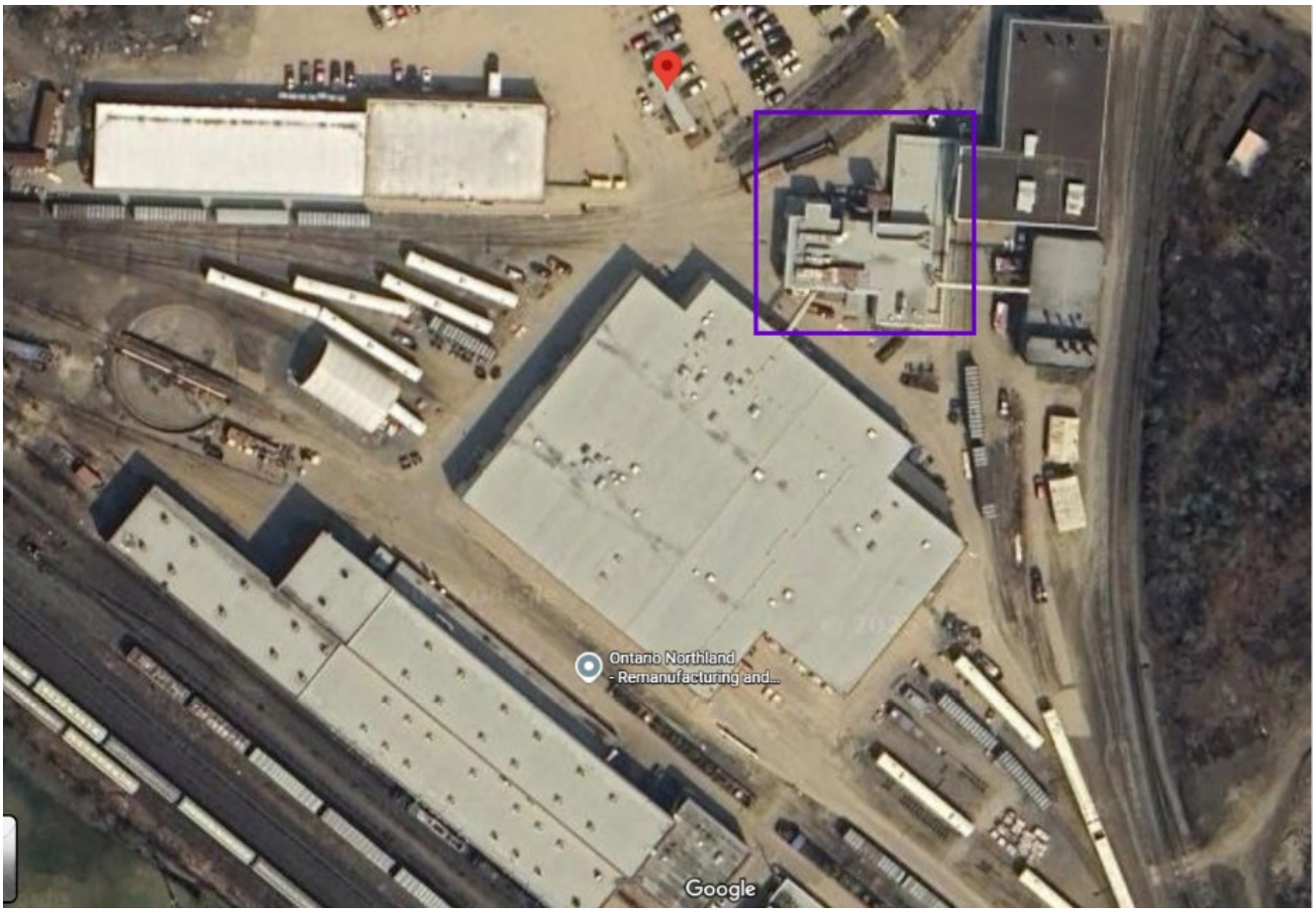
SPECIFICATIONS

PART 3 – RFP SPECIFICATIONS
SCHEDULE 3-A-1
SCOPE OF WORK

OVERVIEW

Ontario Northland Transportation Commission (ONTC) is undertaking a project in the Paint Shop titled Upgrade Grit Blast. The project is critical to ensure safe, efficient, and compliant maintenance of Paint Shop. The design phase, completed by AECOM, identified various improvements, replacements, and new installations necessary to meet operational and safety standards. This Scope of Work outlines **but is not limited to** the construction requirements for implementing the detailed design.

The project location is: **916 McIntyre St, North Bay, ON** and is a part of the ONTC's Remanufacturing and Repair Center's facility - Paint shop which is indicated in a purple rectangle below.



The following is a General Description of the work to be completed by **February 01, 2027.**

The work to be completed is detailed in the drawings and attached to this RFP.

The entire project is to be completed in two Fiscal Years (2026-2027)

Project Timeline: November 03, 2025 – February 01, 2027

PROJECT SCOPE AND GENERAL REQUIREMENT

Note: The following list of items is to be used as a guideline only and may not include all the tasks to complete the work.

The entire scope of work, as outlined in the project drawings, will be strategically carried out over the course of 2025, 2026 & 2027 Calendar Year. The final completion and ready to take over by February 01, 2027.

The project involves demolition, temporary Blast Booth Setup, rebuilding, Equipment Supply & Install. The work includes architectural modifications, structural reinforcements, electrical & mechanical systems installation, HVAC upgrades, fire protection, plumbing, and integration of new blasting and Dust Collector equipment.

Scope of Work

1. Construction will begin after building a temporary blast booth for continuing operation, account for the transition to the permanent booth when construction is completed. (Successful Contractors Responsible for building the Temporary Blast Booth with necessary arrangement in a cost-effective way). *ONTC will show the temporary location during respondent meeting*.

Figure: Snippet of Google map showing approximate location of the Temporary Blast Booth beside Butler building

Figure: Picture, approximately where the Blast Booth will be built temporarily

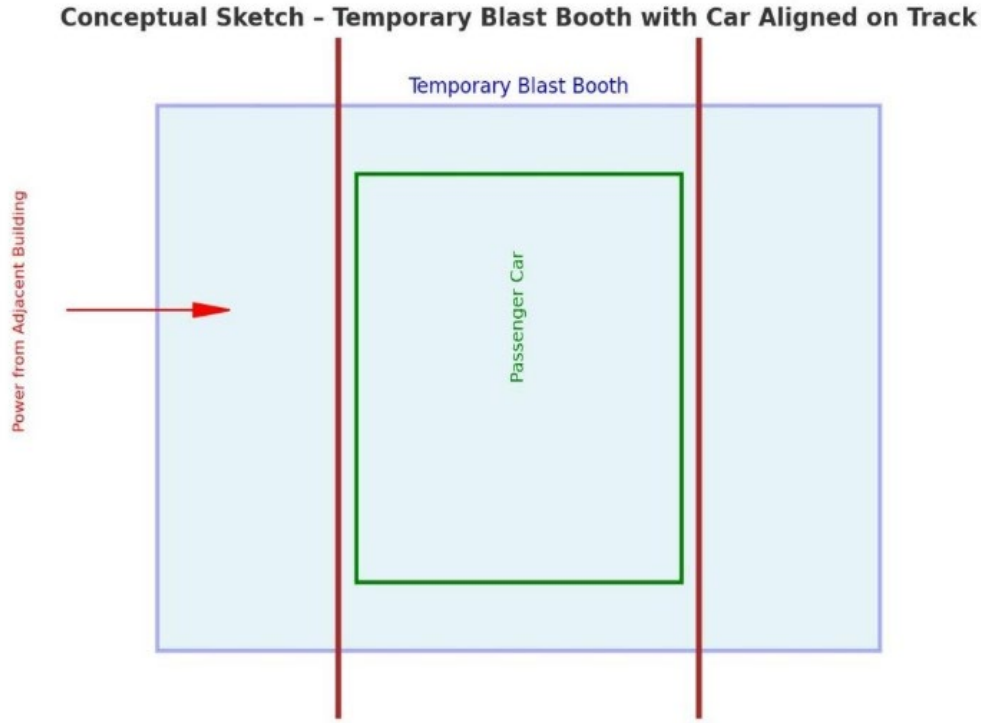


Figure - 02: Conceptual Sketch of temporary Blast Booth

Figure - 03: Conceptual Picture of temporary Blast Booth

ONTC requires the construction of a temporary blast booth over the existing track shown in the site area. The booth will be used for blasting **Rail Cars**, and its dimensions must accommodate the full car length, width, and height with safe working clearances.

The Successful Contractor shall supply, install, and facilitate all work necessary to design, deliver, assemble and commission the temporary facility.

Dimensions

- Ensure temporary blast booth structure suitable for outdoor installation over the existing track and the dimension is suitable for two persons blasting from each side
- Ensure booth dimensions accommodate Rail Cars (approx. 50 ft length × 12 ft width × 15 ft height). .

Power & Utilities

- Contractor will provide Temporary Power Panel with breakers that will be fed from the Adjacent Building or Standalone Generator.
- Supply all cabling and distribution as required.
- Ensure temporary connections comply with ESA (Electrical Safety Authority) requirements.
- Carry the above-mentioned work under Cash Allowance Specified in Cost Breakdown Structure form-01 of RFP Data sheet

- ONTC will cover heating costs if required for the Temporary Blast Booth

Site Preparation

- Provide leveling, anchoring, or temporary foundations as needed for booth stability.
- Protect existing infrastructure during construction and operations.

Supply & Installation

- Supply and install temporary blast booth, including:
- Structural enclosure
- Lighting and electrical systems
- Access doors including Man Door beside the garage door
- Ensure booth have access from both way of the track to get in from one direction and exit the other way
- Ensure booth is sealed to prevent dust escape.
- Supply & Install Temporary/Portable Washroom
- Supply & Install Temporary/Portable Eye Wash Station

Commissioning & Testing

- Conduct system testing and demonstrate functionality.
- Verify safety systems and power supply
- Provide training for Owner's personnel in operation and safety as required

Health, Safety, and Environment (HSE)

- Complete the work following ONTC's H& S Policy and Procedure.

Contractor Responsibilities

- Provide all equipment, materials, labor, and supervision to construct the temporary Blast Booth.
- Coordinate with Owner's representative for site access and utility tie-ins.

2. Respondents may propose and price the BlastOne System (Blast Booth, Dust Collector System) as an optional system following the BlastOne Specification.
3. Once the temporary setup is completed and the blasting operation can be relocated, construction can begin at Blast Bay following the Engineering Drawing and spec
4. Contractor is expected to initiate parallel activities (Equipment purchase, shop drawing review, lead time and schedule coordination, utility service inspections- Locates, MEP investigations etc.) from the beginning of the project
5. Follow the removal drawings to remove/demolish the existing systems (Particularly the existing Dust Collector System) and coordinate with ONTC Project Manager. Contractor is responsible for disposal of existing systems & demolished materials
6. Refer to the DSS report for any asbestos presence in the existing system and follow procedures while removing (submit a plan with the proposal)
7. Paint Shop and office area will be occupied during the construction and contractor is responsible for facilitating safety measures, traffic control, ensure minimal operational interruption and efficient scheduling while working at the ONTC Property

8. Upgrade the Blast Bay Floor following the drawing details and embedded rail track details as mentioned. Note that the Rail Jacks will be installed by the same contractor in order to jack the rails during blasting operation. Refer to the drawing package for details
9. Contractor will be responsible for levelling the Rail tracks after Installation.
10. Contractor is responsible for locating the MEP utilities in the entire construction zone, treating the lines as instructions, cap off where indicated, adjusting as required with approval and remove & dispose of any abandoned lines with proper consultation and approval
11. A new Mechanical building is proposed on the side of the Blast Bay, follow M/E room details to ensure interior upgrade details and dirty room. Coordinate with ONTC management regarding any efficient utilization of the storage space inside the building
12. Construction of the Mud room at the dead end of the Blast Bay, corridor and upgrade the locker rooms as instructed
13. Contractor is responsible for Supply and Installation of the new Dust Collector System. All the duct work needs to be performed as indicated and any opening must be sealed appropriately once completed
14. Ensure all the Structural and Architectural requirements are met accordingly to support the new structures
15. There will be multiple pieces of equipment going on the roof (MUA, ERV System, Duct Work, Exhaust fans, condenser units, etc.). Contractor is responsible for completing all the work and when placing the equipment through the Crane, it is necessary to follow the procedure laid down by ONTC.
16. Release Schedule of Near Track Operation upfront (5-7) Business days
    - Duration of Work
    - Ensure Flag Support team is present during operation
    - Car Shop operation/production can be delayed due to incapability of switching: the communication needs to be properly channeled to ensure zero or minimum interruption
    - *** Follow the Track Foul rules/policy and make sure to always abide by them
17. Contractor is responsible for ensuring temporary safety measures- caution tape, temporary guard rails, traffic & construction signs.
18. Follow the Electrical Drawings for necessary electrical arrangements including Lighting, Power Distribution, Control System, Junction boxes, Panel Upgrade etc.
19. Accommodate necessary plumbing and drainage systems as instructed. This includes- water supply as indicated, sanitary & storm drainage- New buried storm drains, roof drain chases, and sanitary connections etc.
20. Contractors must follow the engineering inspection schedule and coordinate accordingly to ensure all the technical requirements have been met as instructed and provide the reports to the stakeholders with due diligence.
21. After the project is awarded, provide an updated construction schedule may include the Inspection dates by sequences with marked points on the schedule.
22. Follow ONTC's Safe Handling of Hazardous Substances & Hot Work Policies particularly and validate the requirements when applicable
23. Contractor must propose a site use plan dividing the entire project into multiple phases strategically aligning with the schedule and ONTC's Maintenance/Operation to ensure zero or minimal interruptions
24. Contractor is responsible for hiring 3rd party testing agencies for Integrated testing and commissioning of all systems and cover all associated costs.
25. Contractor is responsible for any temporary equipment rental/facilitation and cover the expenses as required to accommodate construction activities

26. ONTC will utilize ACC- Auto Desk Construction Cloud platform for documentation and communication management. Successful contractor team will be given access to the system
27. Upon the Project award, contractor must submit- Environmental Protection Plan (EPP- following Div-01, specifically regarding the excess soil management & ground water management), Traffic flow directions and site-specific H&S plans
28. Contractors will be responsible for contacting and arranging any external safety authorities such as (TSSA, ESA, Fire safety, etc.)
29. After Project completion, contractor will make sure ONTC Operator receives training on new systems and equipment and demonstrates a mock-up run
30. It is contractor's responsibility to keep the construction area organized, clean and safe throughout the project tenure
31. After completion, contractor must take the sign-off from the consultants and owner, finish the touch-ups, hand over the temporary access keys and adjust as required.

GENERAL REQUIREMENTS

1. Please note any deviation(s) must be first agreed to and approved by ONTC.
2. Follow the instructions to demolish the existing systems and site preparation
3. Follow all the site regulations and act accordingly to ensure Environmental and H&S protocols.
4. Conduct regular inspections throughout the project to verify that protection measures remain effective.
5. Verify existing utilities per SUE investigations
6. Review the Geotechnical Investigation Report before proceeding with construction
7. Submit site-specific safety plan along with an environmental protection plan
8. Implement detailed quality control plan, provide QA/QC reports
9. Address any identified issues prior to project completion.
10. Remove all temporary protections and construction materials from the site.
11. Facilitate any temporary safety measures required during construction to protect the employees and construction zone
12. Restore any areas impacted by the construction process to their original condition.
13. Relocate Mechanical and Electrical Services as shown in the contract documents and drawings.
14. The contractor is expected to deliver construction turnkey activities for this project resulting in a finished, fully functional, usable facility that satisfies all project requirements and contract terms.
15. A building permit will not be required; any other required permits will be the Contractor's responsibility.

DELIVERABLES

1. Pre-Construction Survey Report – Document existing site conditions, utilities, and MEP systems.
2. Detailed Project Schedule – Provide a comprehensive timeline with key project milestones. Two Week Look ahead as well to be provided by the contractor.
3. Bi-Weekly Progress Reports – Submit updates on project progress, challenges, and mitigation measures.
4. Completed Construction as per approved design
5. Commissioning and functional testing
6. As-built drawings (CAD&PDF), Operations and maintenance manuals

7. Close-out Phase: Final Inspection and Acceptance Report – Provide documentation confirming the work meets all ONTC standards and requirements, training, Commissioning, any notable changes.

SCHEDULE OF SERVICES

Although ONTC has established a two-year timeline for the overall completion of the Project, the contractor is expected to execute the construction work in a single, continuous phase. To minimize disruption to ONTC's ongoing operations, it is strongly recommended that all procurement activities be finalized prior to the commencement of on-site construction/mobilization (However, suitable parallel activities are encouraged to be performed to manage the schedule)

This approach ensures that mobilization only begins once the necessary equipment has been delivered, a temporary Blast Booth has been installed, and the contractor is fully prepared to carry out the remaining construction tasks without delays or interruptions continuously.

Note: the phases mentioned below are only to divide ONTC's Fiscal Years

- Phase-01: Services shall start on November 03, 2025 and continue till March 31, 2026

- Phase-02: Services shall start in Early April 2026 and continue till February 01, 2027.

PRICING

- **Blast Booth & Dust Collector System**

The contractor has the option to price the Dust Collector and the Blast Booth System as per AECOM's Design or Propose a Turnkey System equivalent to BlastOne System (See Technical Specifications BlastOne Specs); If the contractor chooses to propose a Turnkey System, their price should include any additional work, design and adjustment required. **All other items should be priced as per drawings**.

Contractor shall use the lowest price (option 1 or option 2) as their base price.

Option 1: AECOM Designed Blast Booth & Dust Collector System

Option 2: BlastOne or Equivalent Turnkey System for Blast Booth & Dust Collector

PART 3 – RFP SPECIFICATIONS
SCHEDULE 3-A-2
TECHNICAL SPECIFICATIONS

Refer to the Technical Specifications, as outlined below, and which are attached to this Schedule 3-A-2.

SECTION	TITLE
Division 00 – Procurement and Contracting Requirements	
00 31 00	Available Project Information
Division 01 – General Requirements	
01 11 00	Summary of Work
01 14 00	Work Restrictions
01 31 19	Project Meetings
01 32 00	Construction Progress Documentation
01 32 16.16	Construction Progress Schedule – Critical Path Method (CPM)
01 32 33	Photographic Documentation
01 33 00	Submittal Procedures
01 35 29.06	Health and Safety Requirements
01 35 35	Fire Safety Requirements
01 35 43	Environmental Procedure
01 41 00	Regulatory Requirements
01 43 00	Quality Assurance
01 45 00	Quality Control
01 51 00	Temporary Utilities
01 52 00	Construction Facilities
01 55 26	Traffic Controls
01 56 00	Temporary Barriers and Enclosures
01 57 00	Temporary Controls
01 61 00	Common Products Requirements
01 71 00	Examination and Preparation
01 73 00	Execution
01 74 00	Cleaning
01 74 19	Waste Management and Disposal
01 77 00	Closeout Procedures
01 78 00	Closeout Submittals
01 79 00	Demonstration and Training
01 91 13	General Commissioning Requirements
01 91 13.13	Commissioning Plan
01 91 13.16	Commissioning Forms
Advanced Blast Booth Systems with Integrated Recovery, Airwash, and Handling Tech.	

1 GENERAL

1.01 REFERENCE STANDARDS

.1 Canadian Construction Documents Committee (CCDC)

.1 CCDC 2-2020, Stipulated Price Contract.

1.02 DEFINITIONS

.1 Available Project Information: information identified in this section, of any type, and in any form, and identified as Reference Documents. Available Project Information, or any part thereof, does not form part of the Contract Documents unless specifically incorporated into Contract Documents by means of copying, transcribing, or referencing, or is listed in the Agreement as a Contract Document.

.2 Contractor: synonymous with Respondent

1.03 USE AND RELIANCE UPON AVAILABLE PROJECT INFORMATION

.1 Available Project Information is made available to Respondents for the purpose of disclosing information that is available to the Consultant and Owner.

.2 Per CCDC, Available Project information is made available to Respondents to fulfill the Owner's duty to disclose all relevant Project information to Respondents.

.3 Do not consider the Available Project Information as a representation or warranty that the information is necessarily accurate, complete, or appropriate.

.4 Respondents are responsible for interpreting and forming their own conclusions about the Available Project Information, including consideration of the time the document was created. Respondents are encouraged to obtain specialist advice if necessary. The Owner and Consultant assume no responsibility for interpretations or conclusions made.

.5 In the event there is a conflict between the Contract Documents and the recommendations contained in the Available Project Information, the Contract Documents shall govern.

1.04 AVAILABLE PROJECT INFORMATION

.1 The following Available Project Information is not incorporated into the Contract Documents, but is made available to Respondents:

.1 Attachment 1: Issued for Tender Drawing Packages

.1 Attachment 2: Geotechnical Report

.1 Attachment 3: DSS Report

.2 The following Available Project Information is incorporated into the Contract Documents:

. .1 HSP-007 – Blue Signals Flags Procedure

.2 ONTC Electrical Safety Policy and Programs

.3 ONTC Municipal Permitting Environmental Permitting and Dtc Policy 2024 05 21

.4 ONTC Hot-work Program

.5 ONTC- Policy Contractor Subcontractor

.6 ONTC- Health and Safety Authorities, responsibilities and accountability

.7 ONTC- Hearing Protection Program

.8 ONTC- Vendor Performance evaluation policy

.3 Contractors working on ONTC property near Railway Tracks

1.05 RELATED INSTRUCTIONS

.1 Report any irregularities or changed surface conditions at the Place of the Work to the Owner a minimum of 7 days before RFP close.

2 PRODUCTS

2.01 NOT USED

.1 Not Used.

3 EXECUTION

3.01 NOT USED

.1 Not Used.

END OF SECTION

1 GENERAL

1.01 REFERENCE STANDARDS

1. Canadian Construction Documents Committee (CCDC)

   .1 CCDC 2-2020, Stipulated Price Contract.

1.02 RELATED REQUIREMENTS

.1 Refer to Specification Index for Sections applicable to this work.

1.03 WORK COVERED BY CONTRACT DOCUMENTS

.1 Work of this Contract includes the following:

   .1 Completion of Upgrade Grit Blast Project according to the IFT Drawings

.2 The Summary of Work provided above is for reference only:

   .1 The contractor shall undertake the Work during the Mid-October 2025 with all Work to be completed by March 31, 2027.

1.04 SUBMITTALS

.1 Submit for review and Acceptance in accordance with Section 01 33 00 - Submittal Procedures.

.2 In addition to Submittals identified throughout the Specifications, submit the following:

   .1 Submit Project Construction Schedule in accordance with Section 01 32 16.16 - Construction Progress Schedule.

   .2 Submit Construction Waste Management Plan highlighting recycling and salvage requirements in accordance with Section 01 74 19 - Waste Management and Disposal.

   .3 Submit site-specific Health and Safety Plan in accordance with Section 01 35 29.06 - Health and Safety Requirements.

   .4 Submit a Construction Project Management Plan, including communication, risk, and Quality Management Plans.

1.05 WORK BY OTHERS

.1 The Work under this Contract shall be performed by the Contractor.

.2 Contractor shall co-operate with other contractors retained by the Owner in carrying out their respective works and carry out instructions from the Owner and the Consultant. Refer to Contract Documents for additional requirements.

1.06 WORK SEQUENCE

.1 Construct Work in a manner that accommodates Owner's and public continued and/or intermittent use of premises during construction. Refer to Section 01 14 00 - Work Restrictions.

.2 Co-ordinate Construction Schedule and Owners use of premises during construction.

.3 Do not close off Owner or public usage of premises until use of one stage of Work will provide alternate usage.

.4 Maintain fire access/control.

.5 Protect workers and public safety.

.6 Work near rail tracks shall be preapproved by the Owner and completed as per Owner's procedures and policies.

1.07 CONTRACTOR USE OF PREMISES

.1 Contractor shall establish a Construction Area where the Contractor assumes the role of Constructor and will be responsible for the Construction Area until Ready for Takeover. The Contractor will be required to secure the Construction Area for the duration of the Project. The Contractor will be responsible for all activities inside the Construction Area, including health and safety. The Contractor shall coordinate the Work with the Owner to ensure that work being done by the Owner in the areas outside of the Construction Area is not interrupted. Access by the Contractor shall be restricted to the Construction Area only.

.2 In some circumstances, Contractor shall coordinate and limit its access to Construction Area to allow:

.1 Owner occupancy.

.2 Partial owner occupancy.

.3 Work by other contractors or utilities providers.

.4 Public usage.

.5 Third Party Property Owner occupancy and use.

.3 Co-ordinate use of premises under the direction of the Owner.

.4 Refer to Section 01 51 00 - Temporary Utilities, Section 01 52 00 - Construction Facilities and Section 01 56 00 - Temporary Barriers and Enclosures, for temporary facilities, access roads and parking areas, traffic regulations, and utilities.

1.08 OWNER OCCUPANCY

.1 Owner may occupy premises (adjacent buildings, railway tracks) during the entire construction period for execution of normal operations.

.2 Co-operate with the Owner in scheduling of the Work to minimize conflict and to facilitate Owner

occupancy and usage of the premises.

1.09 Products Supplied by Others

.1 Contractor is responsible for receiving, unloading, if required, and handling Products Supplied by Others at the project site; setting or installing the Products in place; making any required connections to the mechanical, plumbing, electrical systems, and any other systems; and disposal of shipping or packing materials. Owner and/or Consultant and Contractor shall jointly inspect the Products for damage upon delivery to the Place of the Work. If this inspection determines that the furnished Products are damaged or defective, the Owner will arrange for the necessary replacement or repairs. Contractor is responsible for protecting the Products Supplied by Others from damage during storage and handling and is responsible for damage caused to those Products during storage and handling.

.2 Contractor to install all Products Supplied by Others in accordance with the manufacturer's installation instructions and the design Drawings, Specifications and Contract Documents.

.3 Contractor to review manufacturer's installation instructions and advise the Consultant of any discrepancies or issues in a timely manner to avoid any potential delays.

.4 Contractor to obtain manufacturer and Consultant approval before making any modification to Products Supplied by Others.

.5 Upon completion of the installation of the Products Supplied by Others, the Contractor, the Consultant and/or the Owner will inspect the Work. Manufacturers and or Suppliers may participate in the inspection as required by their contract obligations. Upon Acceptance, the Contractor will provide a workmanship warranty in accordance with the Contract Documents.

1.10 ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING BUILDING AND STRUCTURES

.1 Execute Work with least possible interference or disturbance to premises, site, Owner operations, occupants, public and normal use of premises. Arrange with the Consultant and Owner to facilitate execution of Work.

.2 Use only elevators existing in the building for moving workers and material.

1. Investigate the status of existing elevators in building(s) to determine if they are functional and safe for moving workers and materials before the Work starts.

2. Provide the required protection for passenger elevators walls and obtain the Owner approval before using these elevators.

3. Accept liability for damage, safety of equipment and overloading of existing equipment.

1.11 EXISTING SERVICES

.1 Notify the Owner, the Consultant, Third Party Property Owners when applicable, and utility companies of intended interruption of existing services and obtain required permissions when applicable.

.2 Where Work involves breaking into or connecting to existing services, provide the Owner at least five (5) Working Days' notice of necessary interruptions of mechanical or electrical service during the Work. Minimize the duration of interruptions. Carry out Work at times as directed by Authorities Having Jurisdiction and the Owner to ensure minimum disturbance to pedestrian and vehicular traffic and the Owner operations.

.3 Provide alternative safe and protected routes for personnel, pedestrian and vehicular traffic.

.4 Establish location and extent of service lines in the Place of the Work before starting Work. Notify the Consultant of findings.

.5 Submit schedule for Acceptance by the Consultant ten (10) Working Days before any scheduled work for any shut-down or closure of active service or facility including power and communications services. Adhere to Accepted schedule and provide notice to affected parties. Refer to Section 01 14 00 - Work Restrictions.

.6 Provide temporary services when directed by the Owner to maintain critical operations, building and tenant services. Refer to Section 01 14 00 - Work Restrictions.

.7 Provide adequate bridging over trenches which cross sidewalks or roads to permit normal traffic.

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

.9 Protect, relocate or maintain existing active services. When inactive services are encountered, cap off in a manner approved by Authorities Having Jurisdiction and the Consultant.

.10 Record locations of maintained re-routed and abandoned service lines.

.11 Construct barriers, as required, in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

.12 Locate and trace existing underground services before any excavation.

.13 Any damage to existing services during the Work will be the responsibility of the Contractor.

1.12 DOCUMENTS REQUIRED

.1 Maintain at the Place of the Work, one copy of each document as follows:

.1 Contract Documents.

.2 Contract Drawings.

.3 Technical Specifications.

.4 Accepted Shop Drawings, Product data and samples.

.5 List of Outstanding Shop Drawings.

.6 Change Orders.

.7 Other Contract Amendments.

.8 Field Test Reports.

.9 Copy of Accepted Construction Schedule.

.10 Health and Safety Plan and Other safety related documents.

.11 As-Built Drawings.

.12 Other documents as specified.

2 EXECUTIONS

2.01 General Requirements:

.1 Contractor will be required to complete the Work in accordance with applicable federal, provincial, and municipal laws.

.2 The Contractor shall designate a Project Manager with overall responsibility for the Work. The Contractor will also designate a site supervisor who will be responsible for managing the Work at each site and be responsible for on-site safety, including all Sub-contractors and Suppliers. The site supervisor will be the single point of contact at each site. This site supervisor will be required to communicate with the Consultant and Owner as required to ensure the Work is completed safely with no impact on Owner operations.

.3 The Contractor will be required to coordinate their hours of work with the Owner.

.4 The Contractor’s employees, Subcontractors, and Suppliers will be required to sign in and sign out every time they enter or leave the Place of the Work using a sign-in/sign-out log book which will be held by the site supervisor in charge of that site.

.5 Contractor shall supply all necessary tools, machinery, and equipment to perform the Work including, but not limited to, forklifts, mobile cranes, hoisting equipment, scaffolding, ladders, man lifts, temporary lighting, heating, welding machines, ventilation, consumables, and any other material or equipment required to complete the Work. The Contractor shall provide all necessary vehicles and qualified personnel to transport people and materials.

END OF SECTION

1 GENERAL

1.01 REFERENCE STANDARDS

1. Canadian Construction Documents Committee (CCDC)

    .1 CCDC 2-2020, Stipulated Price Contract.

1.02 RELATED REQUIREMENTS

.1 Canadian Rail Operating Rules.

.2 ONTC Contractor/Subcontractor Policy.

.3 Contractors Working on ONTC Property Near Railway Tracks.

.4 Railway Flagging Protection Policy

.5 Section 01 73 00 - Execution

1.03 ACCESS AND EGRESS

.1 Design, construct and maintain temporary “access to” and “egress from” Construction Areas, including stairs, runways, ramps or ladders and scaffolding, independent of finished surfaces and in accordance with the applicable laws of Authorities Having Jurisdiction.

1.04 USE OF SITE AND FACILITIES

.1 Execute Work with least possible interference or disturbance to normal use of premises. Make arrangements with the Owner to facilitate Work as stated.

.2 Where premises are not owned by the Owner or are leased to Third Party Property Owners, provide written notification of access and planned Work to the Consultant (10) Working Days prior to the Work commencing.

.3 Maintain existing services to building and provide for safe and protected access for people and vehicles.

.4 Where security is reduced by the Work provide temporary means to maintain security.

.5 Closures: protect the Place of the Work temporarily until permanent enclosures are completed.

.6 Carry out Work Monday to Friday during hours of 7:00 am to 5:00 pm. Work outside of these hours, including on weekends, shall be pre-approved. Submit a request to the Consultant for review and approval to work outside these hours a minimum of five (5) Working Days prior to the work commencing.

1.05 SPECIAL REQUIREMENTS

.1 Protect rail infrastructure as directed by the Owner and obtain approval before working near live tracks. Submit a request to the Consultant in accordance with the Contractors Working On ONTC Property Near Railway Tracks and Railway Flagging Policies for any scheduled work near rail tracks. Requests should be submitted seven (7) Working Days prior to the Work commencing. Include in the request the scope of Work, proposed schedule (duration) and names of workers who will perform the Work. Follow the ONTC policies while working near tracks. Work near tracks will be supervised by the Owner. The Owner will provide a qualified person for flagging protection. Upon completion of the Work, clean the area and return the area and affected adjacent areas to their original or better conditions. Adhere to direction of the person providing flagging protection to ensure the site is safe and ready to resume rail operations.

.2 Ensure Contractor's personnel on site are familiar with and obey the policies and safety, fire, traffic and security regulations and have completed the ONTC site orientation training.

.3 Keep within limits of Work and avenues of ingress and egress.

.4 Contractor may apply for Line Closures if required. Line Closures will not be granted within the times outlined in Section 1.09 Train Timetable for Station Work Near Mainline Track. Submit a request to the Consultant for review and approval a minimum of five (5) Working Days prior to the work commencing for any planned Line Closures.

.5 **Additional requirements**:

.2 Construct Work in stages and in a manner that accommodates the Owner's continued and/or intermittent use of premises during construction.

.3 ONTC operations shall not be interrupted. Coordinate with Consultant to facilitate the execution of the work with minimal disruption.

.4 Arrange and obtain Consultant approval for any temporary utility outages a minimum of seven (7) Working Days prior to the commencement date of the Work, including details about the Work to be completed and the schedule for the Work. Provide temporary power services to ensure no outages to maintain critical operations, building and tenant services.

.5 Limit access to the Construction Area.

.6 Employ just-in-time delivery methods to minimize required storage and laydown space.

.7 Arrange and obtain Owner approval to access ONTC building to complete Work under this Contract. Submit a request to Owner and the Consultant a minimum of seven (7) Working Days prior to the proposed commencement date for the Work, including details about the Work to be completed, the schedule for the Work and a list of Contractor employees and Subcontractors and Suppliers involved in the Work.

.8 Do not move Products and Construction Equipment through the building, unless authorized by the Owner.

.9 Park vehicles in locations approved by Owner.

.10 Where the excavation, cutting and/or patching is required closely or immediately adjacent to,

and/or drilling into, the existing building foundation assess impact and provide for Acceptance a site plan which demonstrates structure is not affected and specifies reinstatement prior to undertaking the Work.

.11 Contractor shall not access Third Party leased land without prior approval by the Owner. Submit a request to Owner and the Consultant a minimum of seven (7) Working Days prior to the proposed commencement date for the Work, including details about the Work to be completed, the schedule for the Work and a list of Contractor employees and Subcontractors and Suppliers involved in the Work.

.12 Park vehicles in locations approved by the Owner.

.13 Where the excavation, cutting and/or patching is required closely or immediately adjacent to, and/or drilling into, the existing building foundation assess impact and provide for Acceptance a site plan which demonstrates structure is not affected and specifies reinstatement prior to undertaking the Work.

.14 Inform Owner and the Consultant of large deliveries and arrange the delivery in a manner that will not affect ONTC operations or the safety of public.

.15 Obey site traffic rules and speed limits.

1.06 SMOKING ENVIRONMENT

.1 Comply with smoking and vaping restrictions. Smoking and vaping are not permitted.

1.07 VIDEO SURVEILLANCE:

.1 Video surveillance cameras are installed on Ontario Northland-owned and leased property to ensure the safety and security of passengers, employees, visitors, assets, infrastructure and the public. In accordance with the Freedom of Information and Protection of Privacy Act (FIPPA), the use of video surveillance cameras is carried out in a manner that respects and minimizes privacy intrusion. Recorded video footage only is protected, used or disclosed for investigative purposes related to a health and safety matter, a railway occurrence or for an incident of suspected crime, property damage, motor vehicle damage or personal injury.

1.08 COMMUNICATION PROHIBITION:

.1 Owner will lead and make any announcements relating to the Work. The Contractor shall not make any announcement of any kind, including press releases, social media posts, public declarations, or any form of publication or announcement, in relation to the Work unless prior written consent is given by Owner. If the Contractor is contacted by any media outlet or other person or entity wishing to make any form of publication or announcement or seeking any information in relation to the Work, the Contractor shall not provide any information and shall refer the person to Owner and immediately notify Owner.

END OF SECTION

1 GENERAL

1.01 REFERENCE STANDARDS

.1 Canadian Construction Documents Committee (CCDC)

.1 CCDC 2-2020, Stipulated Price Contract.

1.02 RELATED REQUIREMENTS

.1 Section 01 33 00 – Submittal Procedures.

1.03 ADMINISTRATIVE

.1 Schedule and administer project meetings throughout the progress of the Work in accordance with the Specifications and at the call of the Owner or the Consultant.

.2 Prepare agenda for meetings.

.3 Unless otherwise specified in Specification sections, distribute written notice of each meeting five (05) Working Days in advance of meeting date to the Owner, the Consultant and any other meeting participants.

.4 Provide physical space at one of the Places of Work and make arrangements for meetings.

.5 The Owner will chair the meetings.

.6 Record the meeting minutes. Include significant proceedings and decisions. Identify actions by parties.

.7 Reproduce and distribute copies of minutes within three (03) Working Days after meetings and transmit to meeting participants and, affected parties not in attendance, the Owner and the Consultant.

.8 Representatives of the Contractor, Subcontractor and suppliers attending meetings shall be qualified and authorized to act on behalf of the party each represents.

1.04 PRECONSTRUCTION MEETING

.1 Within (10) Working Days after award of Contract and before Contractor mobilization to the Place of the Work, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities related to the Work.

.2 The Owner, Consultant, Contractor, major Subcontractors, field inspectors and supervisors and other parties, as applicable and at their discretion, will be in attendance.

.3 Arrange with the Owner the time and location of meeting and notify parties concerned minimum five (5) Working Days before meeting.

.4 Agenda to include, but not limited to:

.1 Appointment of official representative of participants in the Work.

.2 Construction Schedule: in accordance with Section 01 32 00 – Construction Progress Documentation.

.3 Schedule of submission of Shop Drawings, samples, colour chips. Submit Submittals in accordance with Section 01 33 00 - Submittal Procedures.

.4 Requirements for temporary facilities, site signage, offices, storage sheds, utilities, site set-up/Utility connections, laydown areas, fences in accordance with Section 01 52 00 - Construction Facilities.

.5 Delivery schedule of specified equipment in accordance with Specifications.

.6 Site security in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

.7 Proposed changes, Change Orders, procedures, Acceptance required, approvals required, mark-up percentages permitted, time extensions, overtime, and administrative requirements.

.8 Products Supplied by Others

.9 Record As-Built Drawings in accordance with Section 01 33 00 - Submittal Procedures.

.10 Operations and Maintenance manuals in accordance with Section 1 78 00 - Closeout Submittals.

.11 Take-over procedures, Acceptance, and warranties in accordance with Section 01 78 00 - Closeout Submittals.

.12 Monthly progress, claims, administrative procedures, photographs, holdbacks, commissioning, and training.

.13 Appointment of inspection and testing agencies or firms.

.14 Insurances, transcript of policies.

.15 Site Safety and Fire protection in accordance with section 01 35 29.06 Health and Safety Requirements.

.16 Existing conditions and ONTC site use/operations.

.17 Cleaning and Waste Management

.18 Invoicing and payment procedures

.19 Lines of Communication, use of social media and distribution List.

1.05 PROGRESS MEETINGS

.1 During course of Work and up to the completion date, schedule regular monthly progress meetings.

.2 Contractor, major Subcontractors involved in Work, the Owner, and the Consultant are to be in attendance. Other parties may attend subject to the agreement of the Owner.

.3 Agenda to include, but not limited to, the following:

.1 Review, approval of minutes of previous meeting.

.2 Review of Work progress since previous meeting.

.3 Field observations, problems, conflicts.

.4 Problems which impede Construction Schedule.

.5 Review of off-site fabrication delivery schedules.

.6 Corrective measures and procedures to regain baselined Construction Schedule.

.7 Proposed revisions to Construction Schedule.

.8 Progress against Construction Schedule, during succeeding work period.

.9 Review Submittal schedules: expedite as required.

.10 Maintenance of quality standards.

.11 Review proposed changes for effect on Construction Schedule and on completion date.

.12 Safety concerns and issues.

.13 Open items, Request for Information (RFI) and Supplemental Instructions (SI).

.14 Other business.

1.06 COMMISSIONING MEETINGS

.1 Arrange pre-commissioning meetings for the commissioning of equipment and systems in accordance with 01 91 13 – General Commissioning Requirements. The Owner, the Consultant and Contractor commissioning team shall be in attendance.

.2 The meeting's intent is to ensure all parties are fully aware of the Commissioning expectations and requirements.

.3 Meeting Agenda to include, but not limited to:

.1 Review Commissioning plan, Specification, and process.

.2 Review Commissioning documentation.

.3 Review all factory testing that will be required.

.4 Review training requirement/schedule.

.5 Discuss future Commissioning meetings.

.6 Issues/risks.

1.07 SUBSTANTIAL COMPLETION MEETINGS:

.1 Arrange pre-Substantial Completion meetings. The Contractor, the Owner and the Consultant shall be in attendance.

1.08 OTHER MEETINGS:

.1 The Contractor shall, as directed by the Owner, attend Project coordination meetings, which may be required in addition to the specific meetings listed herein. Meetings may include topics related to site and railway safety, orientation and training, design compliance, Work progress and issues, installation of Products Supplied by Others, coordination of Subcontractors, quality, delivery and Acceptance activities, warranty, dispute resolution, and environmental issues.

.2 Arrange meetings with the Owner to coordinate large deliveries and in advance of complex installation.

END OF SECTION

1 GENERAL

1.01 SUMMARY

.1 This Section specifies Contractor's responsibilities for the preparation and submission of Construction Schedule updates, progress reports and other documentation related to tracking progress of the Work.

.2 The purpose of submitting construction progress documentation is to:

.1 Inform the Owner of actual progress versus planned progress, and.

.2 Provide assurance that scheduling issues are being proactively identified and addressed in a timely manner, and that planned progress is being maintained as closely as possible.

1.02 REFERENCE STANDARDS

.1 Canadian Construction Documents Committee (CCDC)

.1 CCDC 2-2020, Stipulated Price Contract.

1.03 RELATED SECTIONS

.1 Section 01 31 19 - Project Meetings.

.2 Section 01 33 00 - Submittal Procedures.

.3 Section 01 77 00 - Closeout Procedures.

.4 Section 01 32 00.16 - Construction Progress Schedule – Critical Path Method (CPM).

1.04 SUBMISSION

.1 Submit, for review and Acceptance a Construction Schedule within ten (10) Working Days from Contract award. The Construction Schedule shall be based on the Contractor's initial schedule submitted at the RFP phase. Notify the Owner of any major changes from the initial schedule.

.2 Submit schedules in PDF and Excel files. Submit via email unless otherwise requested.

.3 Owner will review the Construction Schedule and return review copy within ten (10) Working Days after receipt.

.4 If changes are required, resubmit, the Construction Schedule for Acceptance within five (5) Working Days after return of review copy.

.5 The Accepted Construction Schedule shall be baselined, and all progress updates shall be made against this version. The baselined Accepted Construction Schedule shall not be changed without the agreement of the Owner and shall be subject to review and Acceptance prior to becoming the new baselined Construction Schedule.

.6 Submit updated progress schedule with each monthly construction report in accordance with clause 2.2 of this section.

.7 Distribute copies of revised schedule to:

.1 Job site offices.

.2 Subcontractors.

.3 Other concerned parties.

.8 Instruct recipients to report to Contractor within five (5) Working Days any problems anticipated by timetable shown in the schedule.

1.05 CONSTRUCTION SCHEDULE UPDATES

.1 Show projected percentage of completion of each item as of the last date of the month.

.2 Indicate progress of each activity to date of submission schedule.

.3 Show changes occurring since previous submission of Construction Schedule:

.1 Major changes in scope.

.2 Activities modified since previous submission.

.3 Revised projections of progress and completion.

.4 Other identifiable changes.

.4 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.

.5 Schedules shall be continuous, and logic driven without using hard constraints, Lags and Leads.

2 PRODUCTS:

2.01 DAILY CONSTRUCTION REPORTS:

.1 Prepare a daily construction report recording the following information concerning events at Project Site and include progress photos as applicable:

.1 List of subcontractors at Project Site.

.2 Approximate count of personnel at Project Site.

.3 Equipment at Project Site.

.4 Material Deliveries.

.5 Accidents/Incidents/Near Misses.

.6 Meetings and Significant Decisions.

.7 Unusual and emergency Events.

.8 Stoppages, Delays, Shortages, and Losses.

.9 Orders and requests of Authorities Having Jurisdiction.

.10 Change Orders received and implemented.

.11 Construction Work Change Directives received and implemented.

.12 Services Connected and Disconnected.

.13 Equipment or System Tests and Startups.

.14 Partial Completions and Occupancies.

.15 Substantial Completions Authorized.

.16 Progress made in Work that day

.2 Submit daily reports at the end of each shift to ONTC and the Owner.

.3 A report shall be submitted for each Work site.

2.02 MONTHLY CONSTRUCTION REPORTS:

.1 Monthly progress reports shall be prepared by the Contractor and submitted to the Owner in the form of an electronic copy of the relevant Construction Schedule files to demonstrate how the Work is progressing and the planned and detailed sequencing of the Work at the time of the report. The cut-off date for the monthly progress report shall be the last date of the month and the report shall be submitted no later than ten (10) Working Days after the cut-off date.

.2 Each monthly progress report shall be in a format acceptable to the Owner, and shall be arranged according to the following headings and sub-headings:

.1 Executive Summary.

1. Activity to (date).
2. Forecast activity to (date).

.2 Project Cost Information:

1. Budget Summary.
2. Cash Allowance Log.
3. Change Order Log.

.3 Project Data:

1. Project Schedule.
2. Shop Drawing Log.
3. Site Inspection Log.
4. Site Testing Log.

.4 Risk and Critical Issues Log.

.5 Site Photos.

.3 Each monthly progress report shall include:

.1 An updated schedule showing progress against the baselined Accepted Construction Schedule, comparing actual and target progress for all milestones and activities. Sort activities by activity identification number and accompany with descriptions. List early and late start and finish dates together with durations, codes and float.

.2 Criticality report listing activities and milestones with up to five (5) days of total float used as first sort for ready identification of near critical paths through entire project. List early and late starts and finishes dates, together with durations, codes and float for critical activities.

.3 Progress report in early start sequence, listing for each trade, activities due to start, to be underway, or finished within two months from monthly update date. List activity identification number, description and duration. Provide columns for entry of actual start and finish dates, duration remaining and remarks concerning action required.

.4 A schedule narrative, including:

1. Detailed descriptions of progress, including each stage of procurement, fabrication, delivery to site, construction, installation, and testing.
2. Discussion of the basis for any work sequencing, logic, interdependencies or original activity duration revisions incorporated into an updated progress schedule; and
3. Comparisons of actual and planned progress, with a brief commentary on any actual or forecast delays or problems that might have an impact on the completion. date of the Work, and a discussion of the measures being (or to be) adopted to overcome these.
4. Charts showing the status of Submittals, permits and approvals, utility relocations, purchase orders, manufacturing/fabrication and construction.
5. For each fabricated item, the name and location of the fabricator, percentage progress, and the actual or expected dates of commencement of fabrication, Contractor's inspections, tests and delivery.
6. Progress photographs taken, prepared, and submitted in formats specified, all in accordance with Section 01 32 33 - Photographic Documentation.
7. Request For Information (RFI) log.

.5 Timely submission of updates is of significant and crucial importance to the management of this project. Lack of or late receipt of updates diminishes their value to the Owner and the Owner. Therefore, if the Contractor fails to submit any progress schedule or required revision to a progress schedule within the prescribed time period, the Owner, in its sole discretion, may hold back subsequent progress payments until the updated schedule is submitted or the revision is accepted.

.6 The monthly progress reports and progress schedules will be used by the Owner and the Owner to monitor the Contractor’s performance against the baselined Accepted Construction Schedule.

2.03 RECORDING ACTUAL SITE CONDITIONS ON AS-BUILT DRAWINGS

.1 Obtain from Owner an electronic copy of the construction Drawings for the purpose of creating As-built drawings.

.2 Record information on a set of black line opaque drawings.

.3 Use marking pens, maintaining separate colours for each major system, for recording information.

.4 Clearly label each As-Built Drawing as “AS-BUILT DRAWING”. Record information concurrently with construction progress. Do not conceal Work until required information is recorded.

.5 Record actual construction including:

.1 Measured depths of elements of foundation in relation to finish first floor datum.

.2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.

.3 Measured locations of pipes, ducts, conduits, outlets, fixtures, access panels, and appurtenances, referenced to visible and accessible features of construction.

.4 Field changes of dimension and detail.

.5 Changes made by Change Orders and Supplemental Instructions.

.6 References to Shop Drawings, where Shop Drawings show more detail.

.7 Referenced Standards to related Shop Drawings and modifications.

.8 Details not on original Contract drawings.

.6 Do not use As-Built Drawings for construction purposes.

.7 Following construction, Contractor shall prepare As-Built Record Drawings in accordance with Section 01 78 00 Closeout Submittals.

2.04 MATERIAL LOCATION REPORTS:

.1 At bi-weekly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Place of the Work. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site.

.2 Indicate the following categories for stored materials:

.1 Material stored prior to previous report and remaining in storage.

.2 Material stored prior to previous report and since removed from storage and installed.

.3 Material stored following previous report and remaining in storage.

3 EXECUTION

3.01 CONTRACTOR'S CONSTRUCTION SCHEDULE

.1 Contractor's Construction Schedule Updating: At weekly intervals, update schedule to reflect actual construction progress and activities.

.2 Distribution: Distribute copies of Accepted Construction Schedule to the Owner, Owner, Subcontractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

.1 Post copies in Project meeting rooms and temporary field offices.

.2 When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION

1 GENERAL

1.01 REFERENCE STANDARDS

.1 Project Management Institute (PMI Standards)

.1 A Guide to the Project Management Body of Knowledge (PMBOK Guide) - [Fifth Edition].

.2 Practice Standard for Scheduling - [2011].

.2 AACE International Recommended Practice 37R-06 entitled, “Schedule Levels of Detail – As Applied in Engineering, Procurement and Construction”.

.3 Canadian Construction Documents Committee (CCDC)

.1 CCDC 2-2020, Stipulated Price Contract.

1.02 RELATED REQUIREMENTS

.1 Section 01 32 00 – Construction Progress Documentation

1.03 DEFINITIONS

.1 Activity: Distinct, scheduled portion of work performed during course of a project.

.2 Activity Duration: time in calendar units between start and finish of a scheduled activity. See also Duration.

.3 Assumption: factor in planning process that is considered true, real, or certain without proof or demonstration.

.4 Bar Chart (Gantt Chart): graphic display of schedule-related information.

.1 In typical bar chart, schedule activities or work breakdown structure components are listed down left side of chart, dates are shown across the top, and activity durations are shown as date-placed horizontal bars.

.5 Baseline: approved version of a work product that can be changed only through formal change control procedures and is used as a basis for comparison.

.6 Budget: approved estimate for a project or work breakdown structure component or schedule activity.

.7 Cash Flow: projection of progress payment requests based on cash loaded construction schedule.

.8 Change Control: process whereby modifications to documents, deliverables, or baselines associated with a project are identified, documented, approved, or rejected.

.9 Completion Milestones: they are firstly [Interim Certificate] [Substantial Completion] and secondly Final Certificate.

.10 Constraint: scheduled limiting factor that effects execution of a project, program, portfolio, or process.

.11 Contract: mutually binding agreement that obligates a seller to provide a specified product or service or result and obligates a buyer to pay for it.

.12 Control: comparing actual performance with planned performance, analyzing variance, assessing trends, to effect process improvements, evaluating possible alternatives, and recommending appropriate corrective action as needed.

.13 Corrective Action: intentional activity that realigns performance of project work with project management plan.

.14 Critical Path: sequence of activities that represents longest path through a project, which determines shortest possible duration.

.15 Critical Path Activity: activity on critical path in a project schedule.

.16 Critical Path Method (CPM): method used to estimate minimum project duration and determine amount of scheduling flexibility on logical network of paths within schedule model.

.17 Data Date: point in time when the status of the project is recorded.

.18 Decomposition: technique used for dividing and subdividing project scope and project deliverables into smaller, more manageable parts.

.19 Deliverable: unique and verifiable product, result, or capability to perform a service that is required to be produced to complete a process, phase, or project.

.20 Duration: total number of work periods (not including holidays or other non-working periods) required to complete a schedule activity or work breakdown structure component.

.1 Usually expressed as workdays or work weeks.

.21 Early Finish Date (EF): in Critical Path Method, earliest possible point in time when uncompleted portions of schedule activity can finish based on schedule network logic, data date, and schedule constraints.

.1 Early finish dates can change as Project progresses and changes are made to Project plan.

.22 Early Start Date (ES): in Critical Path Method, earliest possible point in time when uncompleted portions of a schedule activity can start based on schedule network logic, data date, and schedule constraints.

.1 Early start dates can change as Project progresses and changes are made to Project Plan.

.23 Execute: directing, managing, performing, and accomplishing project work; providing deliverables, and providing work performance information.

.24 Finish Date: point in time associated with a schedule activity's completion.

.1 Usually qualified by one of following: actual, planned, estimated, scheduled, early, late, baseline, target, or current.

.25 Float: (also known as slack) amount of time a schedule activity can be delayed without delaying early start date of a successor or violating a schedule constraint.

.1 This resource is available to both [PWGSC] and Contractor.

.26 Forecast: estimate or prediction of conditions and events in project future based on information and knowledge available at time of forecast.

.1 Information is based on projects past performance and expected future performance, and includes information that could impact project in future, such as estimate at completion and estimate to complete.

.27 Gantt Chart: see Bar Chart.

.28 Impact Analysis: schedule analysis technique that adds a modeled delay to an accepted construction schedule to determined possible outcome of that delay on project completion.

.29 Imposed Date: a fixed date imposed on a schedule activity or schedule milestone, usually in form of a “start no earlier than” and “finish no later than” date.

.30 Lag: amount of time whereby a successor activity is required to be delayed with respect to a predecessor activity.

.31 Late Finish Date (LF): in critical path method, latest possible point in time when uncompleted portions of a schedule activity can finish based on schedule network logic, project completion date, and schedule constraints.

.32 Late Start Date (LS): in critical path method, latest possible point in time when uncompleted portions of a schedule activity can start based on schedule network logic, project completion date, and schedule constraints.

.33 Lead: amount of time whereby a successor activity can be advanced with respect to a predecessor activity.

.34 Logic Diagram: see Project network diagram.

.35 Logical Relationship: dependency between two activities or between an activity and a milestone.

.36 Master Schedule: summary-level schedule that identifies major deliverable; work breakdowns structure components, and key schedule milestones.

.37 Milestone: significant point or event in a project, program, or portfolio.

.38 Monitor: collect project performance data with respect to a plan, procedure performance measures, and report and disseminate performance.

.39 Network: see Project Schedule Network Diagram.

.40 Non-Critical Activities: activities which when delayed, do not affect specified Contract duration.

.41 Project Control System: fully computerized system utilizing commercially available software packages.

.42 Project Management: application of knowledge, skills, tools, and techniques, to project activities to meet project requirements.

.43 Project Management Plan: approved document that describes how project will be executed, monitored, and controlled.

.1 Primary uses of Project Management Plan are to document planning assumptions and decisions, facilitate communication among stakeholders, and document approved scope,

cost, and schedule baselines.

.2 Project Management Plan may be summary or detailed.

.44 Project Management Planning: development and maintenance of Project Management Plan.

.45 Project Management Planning, Monitoring and Control System: overall system operated to enable monitoring of Project Work in relation to established milestones.

.46 Project Schedule: planned dates for performing activities and planned dates for meeting milestones.

.47 Project Schedule Network Diagram: graphical representation of logical relationships among project schedule activities.

.1 Always drawn from left to right to reflect Project chronology.

.48 Project Scope: work performed to deliver a product, service, or result with specified features and functions.

.49 Quantified days duration: Working Days based on 5 day work week, discounting statutory holidays.

.50 Risk: uncertain event or condition that, if it occurs, has positive or negative effect on one or more project objectives.

.51 Schedule: see Project Schedule.

.52 Schedule Data: collection of information for describing and controlling schedule.

.53 Scope: see Project Scope.

.54 Start Date: point in time associated with activity's start, usually qualified by one of following: actual, planned, estimated, scheduled, early, late, target, baseline, or current.

.55 Work Breakdown Structure (WBS): hierarchical decomposition of total scope of work to be carried out by project team to accomplish project objectives and create the required deliverables.

1.04 ADMINISTRATIVE REQUIREMENTS

.1 Scheduling:

.1 Ensure that planning process is iterative and results in generally top-down processing with more detail being developed as planning progresses, and decisions concerning options and alternatives are made.

.2 Ensure Construction Schedule efficiencies through monitoring of Project in detail to ensure integrity of Critical Path, by comparing actual completions of individual activities with their scheduled completions, and review progress of activities that has started but are not yet completed.

.3 Monitor sufficiently often so that causes of delays can immediately be identified and mitigated.

.2 Project monitoring and reporting:

.1 Keep team aware of changes to schedule, and potential consequences as Project progresses.

.2 Use narrative reports to provide advice on seriousness of challenges and measures to overcome them.

.3 Begin narrative reporting with statement on general status of Project followed by summarization of delays, potential problems, corrective measures and Project status criticality.

.3 Critical Path Method (CPM) Requirements:

.1 Ensure Construction Schedule is practical and remains within specified Contract duration.

.2 Submit Construction Schedule for Acceptant. If rejected, as schedule is deemed impractical by Owner, revise and resubmit, until Acceptance is achieved.

.3 Change to Contract Duration:

.1 .1 Acceptance of Construction Schedule showing scheduled Contract duration shorter than specified Contract duration does not constitute a change to Contract.

.2 .2 Duration of Contract may only be changed through bilateral Agreement.

.4 Consider the Construction Schedule deemed practical by the Owner, showing Work completed in less than specified Contract duration, to have float.

.5 First Milestone on Construction Schedule will identify start Milestone with an Early Start, “ES”, constraint date equal to Award of Contract date.

.6 Calculate dates for completion of milestones from plan and Schedule using specified time periods for Contract.

.7 Calculations on updates such that if early finish of Ready for Takeover falls later than specified Contract duration then float calculation to reflect negative float.

.8 Delays to non-critical activities with float may not be basis for time extension.

.9 Do not use float suppression techniques such as software constraints, preferential sequencing, special lead/lag logic restraints, extended activity times or imposed dates other than required by Contract Documents.

.10 Allow for adverse weather conditions normally anticipated and show in Construction Schedule.

.1 Specified Contract duration has been predicated assuming normal amount of adverse weather conditions appropriate for the location of the Work.

.11 Provide necessary crews and manpower to meet schedule requirements for performing Work within specified Contract duration.

.1 Simultaneous use of multiple crews on multiple fronts on multiple critical paths may be required.

.12 Arrange participation on and off site of Subcontractors and suppliers, as required by the Owner, for purpose of network planning, scheduling, updating and progress monitoring.

.1 Acceptance by the Owner of original networks and revisions do not relieve Contractor from duties and responsibilities required by Contract Documents.

1.05 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit impact analysis of schedule for changes that result in extension of contract duration.

.1 Include draft Construction Schedule update and report as outlined in article “PROGRESS MONITORING AND REPORTING”.

1.06 QUALITY ASSURANCE

.1 Use experienced personnel, fully qualified in planning and scheduling to provide services from start of construction to Ready for Takeover, including Commissioning.

1.07 WORK BREAKDOWN STRUCTURE (WBS)

.1 Prepare construction Work Breakdown Structure (WBS) within five (5) Working Days of contract award.

.1 Develop WBS through at least five levels: project, stage, element, sub-element and work package.

1.08 PROJECT MILESTONES

.1 Contractor shall include appropriate Milestones in accordance with the scope contained in the Contract Documents. At minimum, Milestones should be included, by station, for Shop Drawing start and end, construction start and end, testing and commissioning start and end, Substantial Performance of the Work and Ready for Takeover.

1.9 DETAILED CONSTRUCTION SCHEDULE

.1 Provide detailed project Construction Schedule (CPM logic driven) within ten (10) Working Days of Contract award date showing activity sequencing, interdependencies and duration estimates. In addition to the Milestones listed in 1.09.1, include listed activities as follows:

.1 Sequence for Shop Drawings.

.2 Samples.

.3 Submittals and Owner review period.

.4 Procurement.

.5 Construction.

.1 Site clearing.

.2 Site utilities.

.3 Foundation Work.

.4 Special Subcontractor Work.

.5 Equipment delivery and Installations.

.6 Finishes.

.6 Installation.

.7 Site works.

.8 Testing.

.9 Commissioning and Acceptance.

.10 Line Closures and flagging

.11 Any required permits

.12 Installation of Protection of Finishings – Owner review prior to installation

.2 Schedule should be Level 3, in form of a horizontal bar chart. “Level 3” means the level of detail required for a Project Control Schedule as set out in the AACE International Recommended Practice 37R-06 entitled, “Schedule Levels of Detail – As Applied in Engineering, Procurement and Construction”.

.3 Detail CPM schedule to cover the activities in detail from Contract award date to Substantial Performance of the Work and Ready for Takeover.

.4 Clearly show sequence and interdependence of construction activities and indicate:

.1 Start and completion of all items of Work, their major components, and interim milestone completion dates.

.2 Activities for procurement, delivery, installation and completion of each major piece of equipment, materials and other supplies, including:

.1 Time for Submittals, resubmittals and review.

.2 Time for fabrication and delivery of manufactured Products for Work.

.3 Delivery of Products Supplied by Others

.4 Interdependence of procurement and construction activities.

.3 Include sufficient detail to assure adequate planning and execution of Work. Activities duration should be less than ten (10) Working Days.

.6 Provide level of detail for Project activities such that sequence and interdependency of Contract Document tasks are demonstrated and allow co-ordination and control of Project activities. Show continuous flow from left to right.

.7 Ensure activities with no float are calculated and clearly indicated on logical CPM construction network system as being, whenever possible, continuous series of activities throughout length of Project to form “Critical Path”. Increased number of critical activities is seen as indication of increased risk.

.8 Insert Change Orders in appropriate and logical location of Construction Schedule. After analysis, clearly state and report to Owner for review effects created by insertion of new Change Order.

1.10 REVIEW OF CONSTRUCTION DETAIL SCHEDULE

.1 Submit Construction Schedule in accordance with 01 32 00 Construction Progress Documentation.

.2 Submittal of Construction Schedule indicates that it meets Contract Document requirements and will be executed generally in sequence.

1.11 COMPLIANCE WITH DETAIL SCHEDULE

.1 Comply with Accepted Construction Schedule.

.2 Proceed with significant changes and deviations from scheduled sequence of activities that cause delay, only after written receipt of Acceptance by Owner.

.3 Identify activities that are behind schedule and causing delay. Provide measures to regain slippage.

.1 Corrective measures may include:

.1 Increase of personnel with more experience/qualifications on site for effected activities or work package.

.2 Increase in materials and equipment.

.3 Overtime work and additional work shifts.

.4 Submit to Owner, justification, Construction Schedule data and supporting evidence for approval of extension to Contract completion date or interim milestone date when required. As part of supporting evidence, include:

.1 Written submission of proof of delay based on revised activity logic, duration and costs, showing time impact analysis illustrating influence of each change or delay relative to approved Construction Schedule.

.2 Prepared schedule indicating how change will be incorporated into overall logic diagram. Demonstrate perceived impact based on date of occurrence of change and include status of construction at that time.

.3 Other supporting evidence requested by Owner and Owner.

.4 Do not assume approval of Contract extension prior to receipt of written Acceptance from Owner.

.5 In event of Contract extension, display in Construction Schedule that scheduled float time available for Work involved has been used in full without jeopardizing earned float.

.1 Owner will determine and advise Contractor number of allowable days for extension of Contract based on Construction Schedule updates for period in question, and other factual information.

.2 Construction delays affecting Construction Schedule will not constitute justification for extension of the Ready for Takeover date.

1.12 PROGRESS AND REPORTING

.1 On an ongoing basis, the Contractor shall keep the Construction Schedule on job site to show “Progress to Date”. Arrange participation on and off site of Subcontractors and suppliers, as, and when necessary, for purpose of network planning, scheduling, updating and progress monitoring. Inspect Work with Owner at least once monthly to establish progress on each current activity shown on applicable networks.

.2 Update and reissue project Work Breakdown Structure and relevant coding structures as project develops and changes.

.3 Perform Construction Schedule update monthly with status dated (Data Date) on last date of month. Update to reflect activities completed to date, activities in progress, logic and duration changes.

.4 Do not automatically update actual start and finish dates by using default mechanisms found in project management software.

.5 Submit to Owner copies of updated Construction Schedule.

.6 Requirements for monthly progress monitoring and reporting are basis for progress payment request.

.7 As part of the monthly progress report, in accordance with 01 32 00 – Construction Progress Documentation, include a written report based on the updated Construction Schedule, showing Work performed to date, comparing Work progress to planned, and presenting current forecasts. Report summarize progress, defining problem areas and anticipated delays with respect to Work schedule, and critical paths. Explain alternatives for possible schedule recovery to mitigate potential delay. Include in report:

.1 Description of progress made.

.2 Pending items and status of: permits, Shop Drawings, Change Orders, possible time extensions.

.3 Status of Contract Ready for Takeover and Milestones.

.4 Current and anticipated problem areas, potential delays and corrective measures.

.5 Review of progress and status of Critical Path activities.

END OF SECTION

1 GENERAL

1.01 REFERENCE STANDARDS

.1 Canadian Construction Documents Committee (CCDC)

.1 CCDC 2-2020, Stipulated Price Contract.

1.02 MEASUREMENT AND PAYMENT

.2 Separate measurement or payment will not be made for Work required under this section. All costs in connection with the Work specified herein will be considered to be included with the related item of Work or incidental to the Work.

1.03 FREQUENCY OF PHOTOGRAPHIC DOCUMENTATION

.1 The Contractor shall take photographs as indicated in Specification sections, at all construction milestones as identified in the Accepted Construction Schedule, and at each of the following stages of construction:

.1 Before commencement of clearing and demolition;
.2 Upon completion of clearing and demolition;
.3 Upon completion of excavation
.4 Upon completion of foundation and concrete work.
.5 Delivery and installation of Structural steel.
.6 Building Envelope Construction (roof, walls, doors, windows, etc.)
.7 Upon completion of any remedial Work.
.8 Upon completion of the Work.
.9 Anytime a problem arises that may result in a potential claim and the problem can be illustrated by photographs.

.2 Furnish at least three different views or vantage points of each milestone and stage of construction. Furnish an average of 20 photographs each month until completion of the Work. Location of views shall be as agreed with the Owner.
.3 Contractor shall take photos at each shift and include photos in the daily report in accordance with section 01 32 00-Construction Progress Documentation.
.4 Submit photos to the Owner with the monthly progress reports in accordance with section 01 32 00-Construction Progress Documentation and other reports in accordance with Specification sections and Contract Documents.
.5 Transfer photos to the Owner at the end of the Project.

1.04 QUALITY AND QUANTITY OF PHOTOGRAPHS

.1 All photographs shall be digital photographs in pdf, jpg or png format with the following requirements:

.1 Minimum resolution: 1024 x 768 pixels.

.2 Colors: 24 Bits per Pixel.
.3 Maximum File size of 3MB.

.2 Digital photographs provided shall use the following file naming convention:

PYYMMDDLOCATIONSEQ.EXT

P =	Photograph
YYMMDD =	Date in Year, Month, Day format
LOCATION =	(8 Characters maximum) Location taken, either by BART 3-character alpha numeric + 5, or Milepost by line designation. (e.g. M90, C40-west, A1MP32-1, etc.)
SEQ =	Sequential number from 001 to 999.
EXT =	File extension (e.g. pdf, jpg, or png).

.3 If flash drives are used to store photos they shall be labeled to include the Contract number and the date the photographs were taken.

1.05 IDENTIFICATION OF PHOTOGRAPHS

.1 The following information shall be furnished for each digital photograph in a manner approved by the Owner.

.1 Title of Contract and Contract Number;
.2 Site location.
.3 Identification of subject shown;
.4 Station point of camera and direction of view;
.5 Time and date taken.

1.06 VIDEO RECORDINGS

.1 The Contractor shall provide video recordings to supplement Contract photographs of certain construction milestones as identified in the Accepted Construction Schedule, and events as indicated herein:

.1 Start of construction, including clearing and demolition operations, as applicable;
.2 Highlights of all formal inspections; and
.3 Highlights of the final inspection and acceptance by the Owner and Authority having jurisdiction.
.4 Video recordings shall be at minimum standard definition (480p).

.2 Video recordings shall include an unobtrusive time and date indicator on the film, accurately depicting the time and date when the photography was performed.
.3 If flash drives are used to store videos they shall be labeled to include the Contract number and the date the video was taken.
.4 Individual digital video files shall use the file naming convention indicated above, paragraph 1.03.2, however the filename shall be modified such that the first character shall be “V” for video instead of “P”.

END OF SECTION

1 GENERAL

1.01 REFERENCE STANDARDS

.1 Canadian Construction Documents Committee (CCDC)

.1 CCDC 2-2020, Stipulated Price Contract.

1.02 RELATED REQUIREMENTS

.1 Section 01 32 33 – Photographic Documentation

.2 Section 01 43 00 - Quality Assurance.

1.03 ADMINISTRATIVE REQUIREMENTS

.1 Submit to the Owner Submittals listed in Specifications for review and Acceptance. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.

.2 Do not proceed with Work affected by Submittal until review is complete and Acceptance has been provided.

.3 Present Shop Drawings, Product data, samples and mock-ups in SI Metric units.

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

.5 Review Submittals before submission to the Owner. Stamp Submittals as “Approved by Contractor” prior to submitting to the Owner. This review represents that necessary requirements have been determined and verified, or will be, and that each Submittal has been checked and coordinated with requirements of Work and Contract Documents and Contractors own quality procedures. Submittals not stamped, signed, dated and identified as to specific Project will be returned without being examined and considered rejected.

.6 Notify the Owner, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.

.7 Verify site measurements and affected adjacent Work are coordinated.

.8 Keep one Accepted copy of each Submittal on site.

1.04 SHOP DRAWINGS, PRODUCT DATA AND OTHER SUBMITTALS

.1 Refer to CCDC 2 GC 3.8 Shop Drawings and Supplementary General Conditions.

.2 Refer to Specifications for all other required Submittals.

.3 Submit for review and Acceptance Shop Drawings stamped and signed by professional engineer licensed in Province of Ontario, Canada.

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

installed. Indicate cross references to Contract Drawings and Specifications.

.5 Allow ten (10) Working Days for Owner review of each Submittal, unless otherwise specified.

.6 Adjustments requested on Shop Drawings by the Owner are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to the Owner and do not proceed with Work. Such adjustment shall be approved by a Change Directive or Change Order issued by the Owner in accordance with the Contract Documents.

.7 Make changes in Shop Drawings as the Owner may require, consistent with Contract Documents. When resubmitting, notify the Owner in writing of revisions other than those requested.

.8 Accompany Submittals with transmittal letter containing:

.1 Date.

.2 Project title and number.

.3 Contractor's name and address.

.4 Identification and quantity of each Shop Drawing, Product data, and sample.

.5 Other pertinent data.

.9 Submittals to 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 site measurements and compliance with Contract Documents.

.5 Details of appropriate portions of Work as applicable:

.1 Fabrication.

.2 Layout, showing dimensions, including identified site dimensions and clearances.

.3 Setting or erection details.

.4 Capacities.

.5 Performance characteristics.

.6 Standards.

.7 Operating weight.

.8 Wiring diagrams.

.9 Single line and schematic diagrams.

.10 Material being supplied, all connections, attachments, anchorages and

locations of exposed fastenings as applicable.

.11 Typical and special installation conditions, including setting or erection details.

.12 Relationship to adjacent work.

.13 Copy of associated Project warranty.

.10 After the Owner review and Acceptance, distribute copies.

.11 Submit electronic copy of Shop Drawings for requirements requested in Specifications and as the Owner may reasonably request. Submit electronic copies of Product data sheets or brochures for requirements requested in Specifications and as requested by the Owner where Shop Drawings will not be prepared due to standardized manufacture of Product.

.1 Product data: manufacturers' catalogue sheets, MSDS sheets, brochures, literature, performance charts and diagrams used to illustrate standard manufactured products or any other specified information.

.2 Delete information not applicable to Project.

.3 Supplement standard information to provide details applicable to Project.

.4 Cross-reference Product data information to applicable portions of Contract Documents.

.12 Submit electronic copies of test reports for requirements requested in Specifications and as requested by the Owner.

.1 Report signed by authorized official of testing laboratory that material, Product or system identical to material, Product or system to be provided has been tested in accord with specified requirements.

.13 Submit electronic copies of certificates for requirements requested in Specifications and as requested by the Owner.

.1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of Product, system or material attesting that product, system or material meets Specification requirements.

.2 Certificates must be dated after the award of the Contract, complete with the Project name.

.14 Submit electronic copies of manufacturers' instructions for requirements requested in Specifications and as requested by the Owner.

.1 Pre-printed material describing installation of Product, system or material, including special notices and Safety Data Sheets concerning impedances, hazards and safety precautions.

.15 Submit electronic copies of manufacturer's site reports for requirements requested in Specifications and as requested by the Owner.

.1 Material describing installation of Product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.

.16 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.

.17 Submit electronic copies of Operation and Maintenance Data for requirements requested in

Specifications and as requested by Owner, after a review of an electronic copy has been completed and Accepted by the Owner.

.1 Submit four (04) hard copies, unless otherwise specified, of reviewed and Accepted Operation and Maintenance Data.

.18 Delete information not applicable to Project.

.19 Supplement standard information to provide details applicable to Project.

.20 If upon review by the Owner, no major corrections are requested, electronic copies will be returned as Accepted or Accepted with comments (in the case of minor corrections) and fabrication and installation of Work may proceed. Requested minor corrections shall be made in a timely manner. If Shop Drawings are rejected, noted copy will be returned and resubmission of corrected Shop Drawings for review and Acceptance, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.

.21 Acceptance of the Shop Drawings does not mean confirmation that the Submittal does not include errors or omissions, defects or deficiencies.

1.05 SAMPLES

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

.2 Deliver samples prepaid to the Owner at the address provided during the Pre-Construction Meeting.

.3 Notify the Owner in writing at the time of submission of deviations in samples from the requirements of Contract Documents. Deviations may be rejected and the Contractor shall resubmit either a sample compliant with the Contract Documents or an alternative sample with written deviations.

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

.5 Adjustments made on samples by the Owner or the Owner are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to the Owner and do not proceed with Work. Such adjustment shall be approved by a Change Directive or Change Order issued by the Owner.

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

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

1.06 MOCK-UPS

.1 Erect mock-ups in accordance with section 01 43 00 - Quality Assurance.

1.07 PHOTOGRAPHIC DOCUMENTATION

.1 Submit electronic colour digital photography in accordance with section 01 32 33 – Photographic Documentation, Contract Documents, and as directed by the Owner.

.2 Provide photographs in the requested format to demonstrate progress and how deficient items

identified within the Owner review and inspection reports have been corrected.

END OF SECTION

1 GENERAL

1.01 REFERENCE STANDARDS

.1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations

.1 R.S.C., 1985, c. L-2

.2 Province of Ontario

.1 Occupational Health and Safety Act and Regulations for Construction Projects, R.S.O. [1990, c.0.1, as amended and O. Reg. 213/91 as amended] - Updated August 8, 2023.

.3 National Building Code of Canada (NBC):

.1 Part 8, Safety Measures at Construction and Demolition Sites.

.4 The Canadian Electric Code (as amended)

.5 Canadian Standards Association (CSA) as amended:

.1 CSA Z797-2009 Code of Practice for Access Scaffold.

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

.3 CSA Z462- Workplace Electrical Safety Standard.

.6 National Fire Code of Canada 2015 (as amended)

.1 Part 5 – Hazardous Processes and Operations and Division B as applicable and required.

.7 American National Standards Institute (ANSI):

.1 ANSI A10.3, Operations – Safety Requirements for Powder-Actuated Fastening Systems.

.8 Canadian Construction Documents Committee (CCDC)

.1 CCDC 2-2020, Stipulated Price Contract.

1.02 RELATED REQUIREMENTS

.1 Section 01 31 19 – Project Meetings

.2 Section 01 33 00 - Submittal Procedures

.3 Section 01 35 43 – Fire Safety Requirements

.4 Section 01 35 43 - Environmental Procedures

.5 Section 01 51 00 - Temporary Utilities

.6 Section 01 56 00 - Temporary Barriers and Enclosures

.7 ONTC Contractor Subcontractor Policy.

.8 ONTC HOT WORK Program.

.9 ONTC Electrical Safety Policy.

1.03 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit for Acceptance Project-specific Health and Safety Plan within seven (7) Working Days after Contract award and fifteen (15) Working Days prior to commencement of Work on site. Health and Safety Plan must include:

.1 Results of site-specific safety hazard assessment.

.2 Results of safety and health risk or hazard analysis for site tasks and operation found in work plan.

.3 Emergency Procedures.

.3 The Owner's review and Acceptance of Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.

.4 Submit electronic copies of Contractor's authorized representative's work site health and safety inspection reports to the Owner, and Authority Having Jurisdiction (AHJ) when required.

.5 Submit to the Owner copies of reports or directions issued by health and safety inspectors of the Authority Having Jurisdiction (AHJ).

.6 Submit to the Owner electronic copies of incident and accident reports.

.7 Submit to the Owner WHMIS Safety Data Sheets (SDS) and all other documentation required by Workplace Hazardous Materials Information System (WHMIS) requirements. Include and an update the Health and Safety Plan as required.

.8 Medical Surveillance: where prescribed by legislation, regulation or safety program, submit to the Owner certification of medical surveillance for site personnel prior to commencement of Work, and submit additional certifications for any new site personnel.

.9 On-site Contingency and Emergency Response Plan: address standard operating procedures to be implemented during emergency situations.

1.04 FILING OF NOTICE

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

.2 Provide copies of all notices to the Owner.

.3 Contractor shall agree to install proper site separation and identification in order to maintain time

and space at all times throughout life of Project.

1.05 SAFETY ASSESSMENT

.1 Conduct a site-specific hazard assessment based on review of Contract Documents, required Work, and Project site. Identify any known and potential health risks and safety hazards.

.2 Develop written site-specific Health and Safety Plan based on hazard assessment prior to beginning site Work and continue to implement, maintain, and enforce plan until final demobilization from site. Health and Safety Plan must address project specifications and, include, but not be limited to, the following:

.1 Primary requirements:

.1 Contractor's and ONTC safety policy.

.2 Identification of applicable compliance obligations.

.3 Definition of responsibilities for Project safety; include an organization chart for Project with safety responsibilities clearly indicated.

.4 General safety rules for Project.

.5 Job-specific safe work procedures.

.6 Inspection policy and procedures.

.7 Incident reporting and investigation policy and procedures.

.8 Occupational Health and Safety Committee/Representative procedures.

.9 Occupational Health and Safety meetings.

.10 Occupational Health and Safety communications and record keeping procedures.

.2 Summary of health risks and safety hazards resulting from analysis of hazard assessment, with respect to site tasks and operations which must be performed as part of the Work.

.3 List hazardous materials to be brought on site as required by Work.

.4 Indicate engineering and administrative control measures to be implemented at the Place of Work for managing identified risks and hazards.

.5 Identify personal protective equipment (PPE) to be used by workers.

.6 Identify personnel and alternates responsible for site safety and health.

.7 Identify personnel training requirements and training plan, including site orientation for new workers.

.3 Develop the plan in collaboration with all Subcontractors. Ensure that work/activities of Subcontractors are included in the hazard assessment and are reflected in the plan.

.4 Revise and update Health and Safety Plan as required, and re-submit for Acceptance in accordance with 01 33 00 – Submittal Procedures

.5 Review and Acceptance: the review and Acceptance of site-specific Health and Safety Plan shall not relieve the Contractor of responsibility for errors or omissions in final site-specific Health and Safety Plan or of responsibility for meeting all requirements of construction and Contract Documents.

1.06 MEETINGS

.1 Schedule and administer Health and Safety meeting with the Owner prior to commencement of Work. This meeting shall be included in the Pre-construction Meeting.

.2 Attend all subsequent Health and Safety meetings called by the Owner or the Owner.

1.07 REGULATORY REQUIREMENTS

.1 Conduct the Work in accordance with Section 01 41 00 - Regulatory Requirements.

1.08 PROJECT/SITE CONDITIONS

.1 Work at site may involve contact with:

.1 Public.

.2 ONTC employees.

.3 Other contractors and Owners.

.4 Third Party Property Owner.

.2 The Contractor is solely responsible for all utility detection and clearances prior to starting the Work.

.3 The Contractor will not rely solely upon the Drawings or other information provided for utility locations.

.4 Carry out any activities involving asbestos in accordance with applicable Provincial / Federal Regulations.

.5 Removal and handling of asbestos will be in accordance with applicable Provincial / Federal Regulations.

.6 Refer to reports in Attachment 1 to the Specifications for further site conditions and assessment reports for any noted hazardous or contaminated materials or substances present at Place of the Work. Contractor should their own assessments prior to commencing Work.

1.09 GENERAL REQUIREMENTS

.1 In accordance with 01 56 00 – Temporary Barriers and Enclosures, provide safety barricades and lights around work site as required to provide a safe working environment for workers and protection for pedestrian and vehicular traffic.

.2 Ensure that non-authorized persons are not allowed to circulate in designated construction areas of the work site.

.1 Provide appropriate means by use of barricades, fences, warning signs, traffic control personnel, and temporary lighting as required.

1.10 RESPONSIBILITY

.3 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.

.4 Contractor will be responsible and **assume the role of Constructor** as described in the Ontario Occupational Health and Safety Act and Regulations for Construction Projects.

.5 Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

.6 Provide first aid, hygiene, and medical facilities at the Place of the Work in accordance with requirements of provincial and local governmental occupational health, safety, and workers' compensation statutes, public health guidance publications (where warranted) and Contract Documents.

1.11 COMPLIANCE REQUIREMENTS

.1 Comply with Ontario Occupational Health and Safety Act, R.S.O. 1990, c. 0.1 and Ontario Regulations for Construction Projects, O. Reg. 213/91.

.2 Comply with all Federal and Provincial laws relating to Health and Safety including Acts and Regulations as well as Lower Tier Municipality By-Laws.

.3 Comply with all applicable industry safety standards.

.4 Comply with legislative requirements for work performed including, but not limited to:

.1 Qualifications of workers;

.2 Training;

.3 Supervision, and;

.4 Use of onsite equipment.

.5 Provide any and all personal protective equipment for Contractor's own workers where prescribed by legislation.

1.12 UNFORSEEN HAZARDS

.1 Should any unforeseen or peculiar safety-related factor, hazard or condition become evident during performance of the work, immediately stop work and advise Contractor's nominated Health and Safety Coordinator and follow procedures in accordance with Acts and Regulations of Province having jurisdiction and advise the Owner verbally and in writing.

1.13 CONTRACTOR HEALTH AND SAFETY CO-ORDINATOR

.1 Employ and assign to Work, competent and authorized representative as Health and Safety Coordinator. Health and Safety Coordinator must:

.1 Be responsible for completing Contractor's Health and Safety Training Sessions and ensuring that personnel that do not successfully complete required training are not permitted to enter site to perform Work.

.2 Maintain a training record/log of Contractor employee including all Subcontractors, suppliers and other parties retained by the Contractor for the execution of the Work, at the jobsite and electronic copy, available for the Owner and the Owner review at request.

.3 Be responsible for implementing, revising, enforcing daily and monitoring site-specific Contractor's site-specific Health and Safety Plan.

.4 Visit each Place of the Work regularly, at least biweekly or as required by health and safety laws and regulations, to ensure Work is being completed in compliance with Contractor's Health and Safety programs and all applicable laws and regulations.

.2 Contractor's nominated site supervisor may complete some of daily tasks of the Health and Safety Coordinator provided the site supervisor has the proper qualifications to complete those tasks.

1.14 POSTING OF DOCUMENTS

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

.2 Post legible versions of the following documents on site:

.5 Site Specific Health and Safety Plan.

.6 Sequence of work.

.7 Emergency procedures.

.8 Site drawing showing Project layout, locations of the first-aid station, marshalling stations, and emergency transportation provisions.

.9 Notice of Project.

.10 Site plans.

.11 Notice as to where a copy of the Workers' Compensation Act and Regulations is available on the work site for review by employees and workers.

.12 Workplace Hazardous Materials Information System (WHMIS) documents.

.13 WHIMS Safety Data Sheets (SDS).

.14 List of names of Joint Health and Safety Committee members, or Health and Safety Representative, as applicable.

.15 Others as required.

1.15 CORRECTION OF NON-COMPLIANCE

.1 Immediately address health and safety non-compliance issues identified by Authority Having Jurisdiction (AHJ), by the Owner.

.2 Provide the Owner with written report of action taken to correct non-compliance of health and safety issues identified.

.3 The Owner may stop Work if non-compliance of health and safety regulations is not corrected. The Contractor/Subcontractors will be responsible for any costs arising from such a “stop work order”.

1.16 BLASTING

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

1.17 POWDER ACTUATED DEVICES

.1 Use powder-actuated devices only after receipt of written permission from Owner.

1.18 ELECTRICAL SAFETY REQUIREMENTS

.1 Comply with authorities and ensure that, when installing new facilities or modifying existing facilities, all electrical personnel are completely familiar with existing and new electrical circuits and equipment and their operation.

.2 Before undertaking any Work, coordinate required energizing and de-energizing of new and existing circuits with the Owner.

.3 Maintain electrical safety procedures and take necessary precautions to ensure safety of all personnel working under this Contract, as well as safety of other personnel on site.

1.19 ELECTRICAL LOCKOUT

.1 Develop, implement and enforce use of established procedures to provide electrical lockout and to ensure the health and safety of workers for every event where work must be done on any electrical circuit or facility.

.2 Prepare the lockout procedures in writing, listing step-by-step processes to be followed by workers, including how to prepare and issue the request/authorization form. Have procedures available for

review upon request by the Owner or the Owner.

.3 Keep the documents and lockout tags at the site and list in a logbook for the full duration of the Contract. Upon request, make such data available for viewing by the Owner, the Owner or by any authorized safety representative.

1.20 HOT WORK:

.1 Hot Work Permit will be required; Contractor must notify the Owner five (5) Working Days in advance prior to any hot work activities and provide, for review, a completed Hot Work permit form including a plan to mitigate any risks identified by the Contractor in their job hazard analysis. Hot Work shall proceed only after receiving the Owner's approval.

1.21 SILICA

.1 Preventive measures to apply to the work site:

.1 Source reduction methods

.1 Work in wet environment or use tools with inflow of water in order to reduce dustiness, if not, collect dust at the source and retain it with a high efficiency filter not to propagate dust in the environment.

.2 Clean surfaces and tools with water, never with compressed air.

.3 Sand and pickle surfaces by using an abrasive containing less than 1 % of silica.

.4 When required, install shields or other containment device to prevent silica dust from migrating toward other workers or the public.

.2 Protection: Wear respiratory protection equipment (mask) during all operations that could generate silica dust.

1.22 WORK STOPPAGE

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

END OF SECTION

1 GENERAL

1.01 REFERENCE STANDARDS

.1 National Research Council of Canada (NRC):

1. National Building Code of Canada (NBC).
2. National Fire Code of Canada (NFC).

.2 National Fire Protection Association (NFPA):

1. NFPA 51B-[19], Standard for Fire Prevention During Welding, Cutting, and Other Hot Work.

.3 Ontario Fire Code.

.4 Ontario Occupational Health and Safety Act R.S.O 1990

.5 O.Reg 213/91 Construction Projects

.6 Canada Labour Code R.S.C., 1985 c L-2

.7 Canada Occupational Health and Safety Regulations SOR/86-304

.8 Canadian Construction Documents Committee (CCDC)

1. CCDC 2-2020, Stipulated Price Contract.

1.02 RELATED REQUIREMENTS

.1 Section 01 35 29.06 – Health and Safety Procedures

.2 Section 01 33 00 – Submittal Procedures

.3 Section 01 74 19 – Waste Management and Disposal

.4 ONTC Contractor Subcontractor Policy

.5 ONTC HOT WORK Program

1.03 CONSTRUCTION FIRE SAFETY

.1 Contractor is responsible for construction fire safety in accordance with national and provincial codes, laws and regulations.

1.04 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit fire safety plan for Acceptance before construction commences.

1.05 REPORTING FIRES

.1 Be aware at all times of nearest fire alarm pull station location, nearest telephone, and

emergency phone number.

.2 Report fire incidents to Fire Department immediately in the following sequence:

.1 Activate nearest fire alarm pull station, if any.

.2 Telephone the Fire Department then Owner

.1 Telephone:911.

.2 Contact Owner at ONTC RTC Hotline # 1-800-558-4129.

.3 Person activating fire alarm pull station to remain at main site entrance and direct Fire Department personnel to location of fire.

.4 When reporting a fire by telephone, give location of fire, building name or number, and be prepared to give basic directions (e.g., northeast corner of base compound, visual reference points).

.5 Promptly inform Owner and Consultant of fire incidents at Place of Work, regardless of size.

1.06 FIRE SAFETY PLAN

.1 Prepare a fire safety plan in cooperation with the local fire department and other applicable regulatory authorities for each Place of Work before beginning Work on site.

.2 Submit fire safety plan to the Consultant for Acceptance who may submit to local fire department for their review.

.3 Limit scope of fire safety plan to the Place of the Work only. Existing fire safety plans covering other existing buildings are not the responsibility of the Contractor.

.4 Prepare fire safety plan in conformance with NFC. Include:

.1 Emergency procedures in case of fire, including:

.1 sounding fire alarm

.2 notifying fire department

.3 instructing occupants on procedures to follow when fire alarm sounds.

.4 evacuating occupants, including special provisions for persons requiring assistance

.5 confining, controlling, and extinguishing the fire.

.2 Appointment and organization of designated supervisory staff to carry out fire safety duties.

.3 Training of supervisory staff and other occupants in their responsibilities for fire safety

.4 Documents, including diagrams, showing type, location, and operation of building fire emergency systems.

.5 Holding of fire drills

.6 Control of fire hazards in the building

.7 Inspection and maintenance of building facilities provided for the safety of occupants.

.5 Post fire safety plan at each entrance to Place of the Work or near each Place of the Work's health and safety board.

.6 Review fire safety plan a maximum of every three (03) months to ensure it takes into account changes in the use and other characteristics of the building or site. Revise fire safety plan when it can be improved.

1.07 FIRE PROTECTION SYSTEM IMPAIRMENT

.1 Maintain existing fire protection systems in an operational state at all times during construction.

.2 Use of fire hydrants, standpipes, or hose systems for purposes other than firefighting is prohibited.

.3 Existing fire protection and alarm systems will not be obstructed, shut off, disabled, or left inactive at end of each Working Day or shift without written authorization from the Owner.

.4 Submit a written request to the Owner and the Consultant for approval ten (10) Working Days in advance of planned interruption of services. Submit written notification for operation including shutting down active fire protection system, including water supply, fire suppression, fire detection, and life safety systems.

.5 Where an existing fire protection system that provides fire alarm monitoring becomes impaired in an existing building, provide a fire watch as directed by the Consultant.

.6 Where systems are affected or impaired during the Work, conduct Work on fire protection system in accordance with NFC.

1.08 TEMPORARY PORTABLE FIRE EXTINGUISHERS

.1 Provide portable extinguishers, or as otherwise directed by Fire Department.

.2 Provide supplemental portable extinguishers to the following areas or as otherwise directed by Fire Department :

.1 Adjacent to hot works

.2 Areas where combustibles materials are stored

.3 Adjacent to areas where flammable liquids or gases are stored or handled

.4 Near or on internal combustion engines

.5 Adjacent to temporary oil fired or gas fired equipment

.6 Adjacent to bitumen heating equipment

.7 Adjacent to each roof installation or repair work area

.3 Provide portable extinguishers classified and rated as 10-A:80B:C, minimum 20 pounds unless otherwise directed by the Fire Department.

.4 Provide dry chemical type extinguishers unless otherwise required by hazard being protected.

.5 Provide a sufficient number of portable extinguishers as per codes and laws requirements.

.6 Inspect and maintain extinguishers in accordance with NFC.

1.09 ACCESS FOR FIRE FIGHTING

.1 Provide and maintain access for firefighting operations in accordance with NFC.

.2 Submit written request to the Owner and the Consultant for approval a minimum of ten (10) Working Days before operation of activities that may cause problems that might impede fire department equipment access and personnel response, including but not limited to:

.1 violation of minimum horizontal and overhead clearances

.2 erecting of barricades and digging of trenches.

Note: Access routes are intended for the movement of fire department vehicles around buildings. Access aisles and access paths are intended for the movement of fire department personnel inside a building.

.3 Maintain a minimum 6.0-m clear horizontal width for access routes, or as otherwise directed by the Consultant.

.4 Maintain a minimum 5.0-m vertical clearance for access routes, or as otherwise directed by the Consultant.

1.10 SMOKING RESTRICTIONS

.1 Smoking is prohibited in buildings, including buildings under construction.

.2 Obey posted signs and restrict smoking to only existing designated smoking areas. Obey posted smoking restrictions near existing buildings.

.3 Provide a temporary approved non-combustible receptacle at each designated smoking area in accordance with the Fire Safety Plan.

1.11 WASTE MANAGEMENT

.1 Manage waste in accordance with Section 01 74 19 – Waste Management and Disposal, and as follows:

.1 Minimize waste materials.

.2 Do not burn waste materials.

.3 Remove waste from Place of Work at end of each Working Day or shift, or more frequently when directed by Fire Department.

.4 Storage:

.1 Store oily waste in approved receptacles to ensure maximum cleanliness and safety.

.2 Deposit greasy or oily rags and materials subject to spontaneous combustion in approved receptacles. Remove at end of each Working Day.

.5 Provide temporary waste bins no closer than 3.0 m to buildings.

1.12 FLAMMABLE AND COMBUSTIBLE LIQUIDS

.1 Handle, store, and use flammable and combustible liquids in accordance with NFC or as otherwise directed by the Fire Department.

.2 Store flammable and combustible liquids such as gasoline, kerosene, and naphtha in quantities not exceeding 45 litres. Store in approved safety cans bearing Underwriters' Laboratory of Canada or Factory Mutual approved certification mark. Obtain written authorization from Owner for storage of quantities of flammable and combustible liquids exceeding 45 litres.

.3 Transfer of flammable or combustible liquids within buildings or on jetties is prohibited.

.4 Transfer of flammable or combustible liquids in vicinity of open flames or any type of heat-producing device is prohibited.

.5 Use of flammable liquids having a flash point below 38 degrees C such as naphtha or gasoline as solvents or cleaning agents is prohibited.

.6 Storing flammable and combustible waste liquids on site is prohibited. Remove daily or more frequently as directed by Fire Department.

1.13 HOT WORKS

.1 Implement a hot works program in accordance with NFC, FMD 4004, and NFPA 51B. Apply Hot Works program to processes involving welding, cutting, roofing, and other hot works when directed by Owner or the Consultant.

.2 In accordance with Section 01 35 29.06 - Health And Safety Requirements, obtain a Hot Works permit 72 hours in advance from Owner for Hot Works in work area. Frequency of renewal for Hot Works permits is at discretion of the Owner.

.3 Provide fire watchers equipped with sufficient fire extinguishers. Determination of dangerous or hazardous areas along with level of protection necessary for fire watch is at discretion of the Owner or the Consultant.

.4 Provide fire watch service as required. Provide fire watchers trained in use of fire extinguishing equipment.

.5 Carry out hot works processes in areas free of combustible and flammable content.

.6 Where hot works must be carried out in areas where combustibles are present:

.1 Protect flammable and combustible materials within 15.0 m of hot works in accordance with NFC.

.2 Provide a fire watch during hot works and for a minimum of 60 minutes after work is complete, unless otherwise directed by the Consultant.

.3 Conduct a final inspection of area not less than 4 hours after completion of hot works, unless otherwise directed by the Consultant.

.7 Where there is a possibility of sparks leaking onto combustible materials in areas adjacent to areas where the hot works is carried out:

.1 Cover or close openings in walls, floors, or ceilings to prevent passage of sparks to such adjacent areas.

.2 Provide a fire watch during hot works, and a minimum 60 minutes after hot works is complete.

.3 Conduct a final fire watch inspection not less than 4 hours after hot works is complete, unless otherwise directed by the Consultant.

.8 Protection of flammable or combustible materials:

.1 Remove flammable and combustible materials including combustible or flammable dust or residue from area where hot works is carried out.

.2 When removal is not possible, protect materials with a non-combustible covering.

.9 Provide a temporary fire extinguisher within 3.0 m of hot works, minimum size of 20 lbs Type ABC extinguisher, unless otherwise directed by the Owner or the Consultant.

1.14 HAZARDOUS SUBSTANCES

.1 Perform Work involving the use of toxic or hazardous materials, chemicals or explosives, or otherwise creating hazard to life, safety or health, in accordance NFC.

.2 Provide temporary mechanical ventilation where flammable liquids, such as lacquers or urethanes are used. Eliminate sources of ignition. Provide written notification to the Consultant a minimum of five (5) Working Days before starting Work and immediately at completion of Work.

1.15 QUESTIONS OR CLARIFICATION

.1 Direct questions and requests for clarification on Fire Safety to the Consultant.

.2 The Owner or the Consultant will obtain clarifications from Fire Department. Do not contact Fire Department directly for notification, authorization, or any requests unless situation constitutes an immediate emergency.

1.16 FIRE INSPECTION

.1 Coordinate site inspections by Fire Department through the Consultant.

.2 Allow Fire Fighter unrestricted access to Place of Work.

.3 Cooperate with Fire Department during routine fire safety inspection of Place of work.

.4 Immediately remedy unsafe fire situations observed by Fire Department.

END OF SECTION

1 GENERAL

1.01 REFERENCE STANDARDS

.1 Canadian Construction Documents Committee (CCDC)

.1 CCDC 2-2020, Stipulated Price Contract.

1.02 SUMMARY

.1 The Work of this Section includes, but is not limited to the following:

.1 Hazardous Substances

.2 Environmental Protection

.3 Archaeology and Cultural Heritage

.4 Excess Soil Management

.5 Other Environmental Matters

1.03 GENERAL REQUIREMENTS

.1 Assume responsibility for the protection of the environment and the preservation of public health, in the course of and as affected by the Work of the Contract, in accordance with specified requirements and Environmental Laws, ordinances, rules, regulations, codes and orders of the authorities that have regulatory oversight of or authority over the Work ("Authorities having Jurisdiction")

.2 Give required notices and follow procedures set out by Authorities having Jurisdiction (AHJ) when working adjacent to or in waterways.

.3 Give required notices and follow procedures set out by Authorities having Jurisdiction when handling or encountering hazardous, toxic, controlled substances (hereinafter referred to as hazardous substances).

.4 The following conditions shall be regarded as a hazard to the environment, requiring appropriate action within the scope of this Section:

.1 Presence of friable asbestos.

.2 Presence of abandoned or disused equipment such as fuel tanks, PCB containing equipment and materials (including in-ground hydraulic hoists), batteries, septic tanks, grease / oil interceptors.

.3 Erosion, sedimentation and general disturbance of ecosystems.

.4 Other conditions identified by environmental jurisdictional authorities.

.5 Designated Substances and Hazardous Substance

1.04 DEFINITIONS

.1 "Canadian Environmental Protection Act, 1999 (Canada)" means the Canadian Environmental Protection Act, 1999, S.C. 1999, c. 33, as amended from time to time;

.2 "Designated Substances and Hazardous Substance" includes,

.1 a Hazardous Substance;

.2 those substances identified by Ontario Regulation 490/09 and Ontario Regulation 278/05 as amended, under the Occupational Health and Safety Act (Ontario);

.3 those substances identified and regulated under Part X Hazardous Substances, Can. Regulation 86-304, Canadian Occupational Health

and Safety Regulations;

.4 substances that are identified as falling under identified categories as part of the Workplace Hazardous Materials Information System (WHMIS) or GHS for Hazardous Substances under provincial or federal occupational health and safety legislation;

.5 polychlorinated biphenyls as identified in Ontario Regulation 362, as amended under the Environmental Protection Act (Ontario) and the PCB Regulations (SOR/2008-273), as amended, adopted under the Canadian Environmental Protection Act, 1999 (Canada); and

.6 mould, acrylonitrile, arsenic, asbestos (including asbestos-containing materials), benzene, coke oven emissions, ethylene oxide, isocyanates, lead, mercury, silica, and vinyl chloride;

.3 "Discharge" means any spill, release, discharge, emission, spraying, injection, inoculation, abandonment, deposit, leak, seep, pour, emptying, throwing, dumping, placing and exhaust to the environment of any solid, liquid, gas, odour, heat, sound, vibration, radiation or combination thereof, either directly or indirectly from human activities that causes or may cause an adverse effect on the environment, or that has not been authorized by the applicable Environmental Approvals;

.4 "Environmental Approvals" means any permit, certificate, registration, license, approval, ruling, variance, exemption or similar requirement relating to environmental matters or other authorization required under Environmental Laws;

.5 "Environmental Consultant" means a reputable, qualified and experienced environmental consulting or engineering firm employing individuals that has been retained by the Contractor to provide technical expertise and guidance to the Contractor on all the Contractor environmental obligations, the Environmental Approvals and all other environmental obligations and matters, including monitoring, managing and addressing soil and groundwater impacts and occupational health and safety;

.6 "Environmental Laws" means:

.1 all federal laws, statutes, by-laws, rules, regulations, orders, ordinances or other requirements having the force of law relating to the protection of the environment or wildlife, natural or cultural resources, archeological and heritage sites, human health or safety, or Hazardous Substances;

.2 all provincial regional and municipal laws, statutes, by-laws, rules, regulations, orders, ordinances or other requirements having the force of law relating to the protection of the environment or wildlife, natural or cultural resources, archeological and heritage sites, human health or safety, or Hazardous Substances.

.7 "Environmental Protection Act (Ontario)" means the Environmental Protection Act, R.S.O. 1990, c. E. 19, as amended from time to time;

.8 "Hazardous Waste" means a "hazardous waste" as such term is defined pursuant to R.R.O 1990, Regulation 347;

.9 "MECP" means the Ontario Ministry of the Environment and Conservation and Parks, and any successor ministry thereto;

.10 "Ontario Water Resources Act (Ontario)" means the Ontario Water Resources Act, R.S.O. c. O.40, as amended from time to time;

.11 "Qualified Person", as defined in O. Reg. 153/04, as amended

.12 "Spill" means, for the purposes of this Project and notwithstanding any less stringent definition under Environmental Laws, a Discharge that,

.1 arises, either directly or indirectly, from human activities; and

.2 causes or may cause an adverse effect on the environment.

.13 "Soil with Environmental Contaminants" means soil or sediment that is considered to be contaminated, i.e., if the quality exceeds the applicable Ministry of the Environment, Conservation and Parks (MECP) Generic Site Condition Standards at the Site for use under Part XV.1 of the Environmental Protection Act (Ontario) (O. Reg. 153/04) or site-specific standards approved by MECP.

.14 "Substances Posing Significant Hazard" means any biological, chemical or physical agent or combination thereof to which exposure of a worker is prohibited, regulated, restricted, limited or controlled by the occupational health and safety enforcement agency of the province/ territory where the Work is to be performed. Should no such provisions be in place in the province/territory where the Work is to be performed, the following substances shall be considered as "Substances Posing Significant Hazard": Asbestos, Silica, Mercury, Lead, Arsenic, Acrylonitrile, Benzene, and Isocyanates."

1.05 HAZARDOUS SUBSTANCES

.1 Submit documentation to the Consultant to show that all Subcontractors have been provided with lists of the Substances Posing Significant Hazard on site. This list must include the name of the substances indicated by the Owner to be on site and any such substance to be used or produced by the Contractor or subcontractors on site during the life of the Work.

.2 Procedures:

.1 Known Conditions: Follow specified requirements in Contract Documents. Review existing site conditions and identify, in writing, to the Consultant, any conditions that differ materially from those indicated in the Contract Documents.

.2 Unknown Conditions: Should an environmentally hazardous condition or a contaminated area be discovered, quarantine the area affected and do no Work that will disturb the hazardous material or contaminated area.

Notify the Consultant immediately of the situation verbally and in writing. Conform to Environmental Law.

.3 Hazardous Substances Disposal:

.1 Dispose of hazardous substances in accordance with Environmental Laws.

.2 Do not under any circumstances, dispose of hazardous substances by burning or burying on site or by discharging into the soil, waterways or drainage system.

1.06 ENVIRONMENTAL PROTECTION

.1 Erosion and Sediment Control:

.1 Minimize amount of bare soil exposed at one time. Stabilize disturbed soil within forty-five (45) days of disturbance to minimize erosion. Remove accumulated sediment resulting from construction activity from adjoining surfaces, drainage systems, and watercourses, and repair damage caused by soil erosion and sedimentation.

.2 Provide and maintain appropriate temporary measures such as silt fences, straw bales, ditches, geotextiles, drains, berms, terracing, riprap,

temporary drainage piping, sedimentation basins, vegetative cover, dikes, and other measures that may be required to prevent erosion and migration of silt, mud, sediment, and other debris.

.3 Do not disturb existing embankments or embankment protection.

.4 Conduct weekly inspection of erosion and sediment control measures to detect evidence of erosion and sedimentation. Promptly take corrective measures when necessary.

.5 If soil and debris from site accumulate in ditches or other low areas, remove accumulation and restore area to original condition.

.2 Site Drainage:

.1 Maintain grades to ensure proper site drainage.

.2 Prevent precipitation from infiltrating or from directly running off stockpiled materials. Cover stockpiled materials with an impermeable liner during periods of work stoppage including at end of each Working Day.

.3 Control surface drainage from cuts and fills, from borrow and waste disposal areas, from stockpiles, staging areas, and other work areas as required to prevent erosion and sedimentation.

.4 Control surface drainage by ensuring that gutters are kept open and water is not directed across or over pavements or sidewalks, except through pipes or properly constructed troughs. Ensure that runoff from unfinished areas is intercepted and diverted to suitable outlets.

.3 Plant Protection and Site Clearing:

.1 Protect all existing trees and landscaping which is to remain at the Place of Work, using methods and materials recommended by the Canadian Nursery Trades Association and as approved by the Consultant.

.2 If required, install tree protection zone fencing in accordance with Contract Documents and Drawings.

.3 Protect roots of designated trees to drip line during excavation and site grading to prevent disturbance or damage. Avoid unnecessary traffic, dumping and storage of materials over root zones.

.4 Minimize stripping of topsoil and vegetation.

.5 Restrict tree removal to area indicated or designated in the Contract Documents. No vegetation removal should occur between April 1 and August 30 to protect birds protected under the *Migratory Birds and Convention Act ("MBCA").*

.6 If vegetation removal must be undertaken between April 1 and August 30, a nest survey must be conducted by a qualified avian biologist to identify and locate active nests of species covered by the MBCA.

.7 Trees free of nests must be removed within 24 hours for nest sweep.

.8 Trees with active nests should be monitored periodically during MBCA window and must remain in place until young birds have fleged the nest. Nest sweep should be conducted by qualified Avian Biologist prior to tree being removed.

.4 Wildlife Habitat Protection

.1 Allow wildlife incidentally encountered during construction to passively move out of the work area.

.2 The Contractor shall comply with the following wildlife exclusion fencing resources:

.1 https://www.ontario.ca/page/reptile-and-amphibian-exclusion-fencing (OMECP 2020)

.5 Dewatering:

.1 Provide temporary drainage and pumping as necessary to dewater excavations, trenches, foundations, and other parts of the Work.

Maintain such areas free of water arising from groundwater or surface run-off, as required to keep them stable, dry, and protected from damage due to flooding.

.2 Maintain standby equipment necessary to ensure continuous operation of dewatering system.

.3 Do not pump water containing suspended materials or other harmful substances into waterways, sewers or surface drainage systems. Treat or dispose of such water in accordance with Environmental Law.

.6 Pollution Control:

.1 Take measures to prevent contamination of soil, water, and atmosphere by Spills, potentially causing environmental damage.

.2 Be prepared, by maintaining appropriate materials, equipment, and trained personnel on site, to intercept, clean up, and dispose of Spills that may occur.

.3 Promptly report spills and releases that may occur to Owner and Consultant.

.4 Contact manufacturer of Environmental Contaminant, if known and applicable, to obtain safety data sheets (SDS) and ascertain hazards involved and precautions and measures required in cleanup or mitigating actions.

.5 Take immediate action to contain and mitigate harmful effects of the Spill

.7 Dust and Particulate Control:

.1 Implement and maintain dust and particulate control measures in accordance with Environmental Law.

.2 Execute Work by methods that minimize dust from construction operations and spreading of dust on site or to adjacent properties.

.3 Provide temporary enclosures to prevent extraneous materials resulting from sandblasting or similar operations from contaminating air beyond immediate work area.

.4 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.

.5 Use appropriate covers on trucks hauling fine, dusty, or loose materials.

.8 Noise and Vibration Control:

.1 Take measures to control noise and vibration generated by the Work.

.2 All construction vehicles and equipment used in the Work shall comply with the noise limits provided by NPC-115 and NPC-118.

.3 Comply with the requirements of Authorities Having Jurisdiction and local Noise Control By-Laws to ensure noise generated by the Work is not excessive and not disturbing to the occupants of adjacent buildings / properties.

.4 The contractor shall notify the Owner and Consultant of any planned nighttime or weekend construction activities a minimum of thirty (30) days prior to the start of those activities.

.5 Vibration levels during construction of the Work shall comply with the limits noted in Table 7-5 of the Federal Transit Administration (FTA) Transit Noise and Vibration Impact Assessment Manual (September 2018). I

.6 The contractor shall monitor vibration at all structures or buildings where there is a potential to exceed the vibration limits.

.7 The contractor shall comply with Enbridge's Third Party Requirements in the Vicinity of Natural Gas Facilities Standard (2021-09-29).

.9 Snow Removal

.1 Allow no accumulation of ice and snow within the Place of the Work. There shall be no use of salt for de-icing in areas of building work.

.2 Remove snow from access routes to the Work to maintain uninterrupted progress of the Work.

.10 Maintaining existing sewerage flows

.1 Maintain existing sanitary sewage flows, where applicable, and provide alternative interim service utilizing duplicate portable sewage pumps, tank trucks and other approved means. Prevent interruption to service throughout the construction period and until the new works are placed in service.

.2 Provide and install all temporary sumps, bulkheads and/or other works in existing sewers, maintenance holes and service connections and provide temporary pumps in duplicate and pipelines to dewater and control the sewage.

.3 Discharge sewerage flows only to those sanitary sewers remaining in service or to tank trucks for approved disposal. Under no circumstances shall contaminated water be discharged or permitted to enter any drainage or natural watercourse.

.4 Temporarily drain or pump any leakage to permit work to be performed in the dry The Contractor's method shall be subject to review and Acceptance of the Consultant.

.11 Drainage ditches and storm sewers

.1 All ditches, drainage channels and/or storm sewer systems which may be affected by construction shall have their flows maintained at all times

during construction. Drainage shall not be impeded, and blockages or water backups are not permitted.

.2 Make allowance in prices for any problems that may be encountered because of ditch flows or storm sewer flows. Any damage because of water or flooding shall be the responsibility of the Contractor.

1.07 ARCHAEOLOGY AND CULTURAL HERITAGE

.1 Archaeology

.1 The Contractor shall comply with the following archaeological reference documents:

.1 2011 *Standards and Guidelines for Consultant Archaeologists* administered by the Ministry of Citizenship and Multiculturalism (MCM); and

.2 Archaeological reports completed for the Project.

.2 Before commencing any construction activities, the Contractor shall prepare, implement, and provide for the Consultant's review and Acceptance, an Archaeological Risk Management Plan setting out protocols for the discovery of human remains or undocumented archaeological resources. This Archaeological Risk Management Plan must be produced by a Licensed Professional Archaeologist. At a minimum it will include the following:

.1 Actions required resulting from the recommendations of the Archaeological reports;

.2 A protocol to be followed if human remains are discovered which includes how the Contractor will ensure that human remains are managed in compliance with Environmental Laws and all requirements of AHJ with respect to such discovery;

.3 A protocol to be followed by the Contractor if previously undocumented archaeological resources are discovered which describes how the Contractor will comply with Environmental laws regarding the management of previously undocumented archaeological resources;

.4 A process to ensure that the Contractor complies with Environmental laws for the management of archaeological sites.

.5 The Contractor shall treat the Archaeological Risk Management Plan as a living document and update it when any archaeological activities occur. Each Archaeological Risk Management Plan Update shall be submitted to the Owner and Consultant for review.

.3 Upon discovery of human remains or previously undocumented archaeological resources, all construction activities or other work that could have a detrimental impact in the immediate vicinity shall be stopped.

.4 Any archaeological materials that are discovered during the course of the Works shall be the responsibility of the Contractor for safekeeping until transferred out of the Contractor's control;

.5 Any future Stage 2, Stage 3 and/or Stage 4 archaeological assessments will adhere to the process noted above.

.6 All archaeological assessments will follow the MCM for Engaging Aboriginal Communities in Archaeology: A Draft Technical Bulletin for Consultant Archaeologists in Ontario.

.2 Cultural Heritage

.1 The Contractor shall comply with the following cultural heritage reference documents:

.1 ONTC Environmental Assessment and Permitting Toolkit, AECOM Canada Limited, 2021;

.2 Criteria for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes, MCM, 2016;

.3 Ontario Heritage Tool Kit, MCM, 2006;

.4 Standards and Guidelines for Conservation of Provincial Heritage Properties, MCM, 2010;

.5 Standards and Guidelines for Conservation of Provincial Heritage Properties: Heritage Identification Process, MCM, 2014;

.6 Information Bulletin No. 2: Strategic Conservation Plans for Provincial Heritage Properties, MCM, 2017;

.7 Information Bulletin No. 3: Heritage Impact Assessments for Provincial Heritage Properties, MCM, 2017;

.8 Standards and Guidelines for the Conservation of Historic Places in Canada (Parks Canada 2010)

.9 Cultural Heritage Reports (including but not limited to: Cultural Heritage Evaluation Reports, Heritage Impact Assessments, and Strategic Conservation Plans).

.2 Before commencing any construction activities, the Contractor shall prepare, implement, and provide for Consultant's review and Acceptance a Cultural Heritage Risk Management Plan. The plan shall include, at a minimum, the following requirements for all directly and indirectly impacted properties of known heritage significance or potential heritage significance:

.1 The actions required of the Contractor pursuant to the recommendations set out in the Cultural Heritage Reports, Cultural Heritage Evaluation Reports, and Heritage Impact Assessments, and to ensure the protection of identified built heritage resources and cultural heritage landscapes;

.2 The Contractors planned approach to carrying out the actions described in the above, including an approach to document, monitor and mitigate vibration to heritage structures during construction;

.3 A process for updating and resubmitting the Cultural Heritage Risk Management Plan;

.4 A process to ensure that the Contractor complies with Environmental Laws for the management of heritage resources;

.5 A process to ensure that the Contractor provides to the Owner any cultural heritage evaluation reports, cultural heritage reports, cultural heritage impact assessments, conservation plans, or any

other documentation as may be required of the Contractor pursuant to Environmental Law or the Cultural Heritage Reports, in addition to those provided with the Contract Documents.

1.08 EXCESS SOIL MANAGEMENT

.1 Soil and Excavated Materials Management Plan

.1 The Contractor shall prepare, submit for Acceptance to the Owner and Consultant and implement a soil and groundwater management strategy (a "Soil and Excavated Materials Management Plan") that describes how the Contractor will address the handling, management, treatment, reuse, storage, monitoring and disposal of soil and excavated materials (i.e., soil, fill, rock and solid Hazardous Waste and non-Hazardous Waste, including Environmental Contaminants) that is generated or encountered during the Works. The Soil and Excavated Materials Management Plan shall include, at a minimum, descriptions of:

.1 the general principles that the Contractor will apply for managing soil and excavated materials;

.2 the over-arching soil and excavated materials management strategy for the Project in terms of sustainable principles and compliance with regulatory requirements (including, but not limited to, On-site and Excess Soil Management Regulation – O. Reg. 406/19) and best practices;

.3 the estimated quantities of soil and excavated materials to be managed during the Works and proposed methods for minimizing these quantities;

.4 the strategy to reuse soil and excavated material;

.5 the strategy for stockpiling and monitoring the soil and excavated material at the Site, and to mitigate any exceedance of any Authorized Volume;

.6 a preliminary schedule indicating the affected areas to be excavated over the course of the Project, and the associated quantities for each stage of construction;

.7 protocols for characterizing soil and excavated materials quality and determining management, including handling, reuse, storage, transportation, documentation, treatment and disposal requirements;

.8 how soil and excavated materials will be temporarily staged or stored at the site or other worksites for reuse or stockpiled and monitored or transferred to disposal with regard for potential environmental effects and impacts to human health and safety;

.9 how soil and excavated materials quantities will be tracked and reported to the Owner during excavation, transport, treatment, disposal or stockpiling;

.10 how clean fill will be sourced and brought to the site;

.11 mitigation measured to address any impacts associated with the excavation, management, resue, stockpiling, transport, treatment or disposal of soil and excavated materials;

.12 a monitoring plan in which monitoring of the contaminated and hazardous stored soil and excavated material are recorded and reported; and

.13 how the discovery of Environmental Contaminants in areas not previously identified will be managed including a general plan of action for the remediation, storage or removal of Environmental Contaminants as detailed in the Contamination Management Plan defined below

.2 The Contractor shall adhere to groundwater and dewatering management.

.3 The Contractor shall submit the Soil and Excavated Materials Management Plan for Acceptance by the Owner and Consultant.

1.09 CONTAMINATION MANAGEMENT PLAN

.1 The Contractor shall prepare the Contamination Management Plan and submit it to the Owner and the Consultant for Review and Acceptance. The Contamination Management Plan shall include:

.1 the date and time that the Environmental Contaminants was discovered;

.2 a description of the Environmental Contaminants including the location (municipal address and/or UTM coordinates) and a figure depicting the location of the Environmental Contaminants;

.3 a detailed description of the circumstances under which the Environmental Contaminants was discovered, including the preliminary field assessment and observations;

.4 a detailed description of the handling and management of the Environmental Contaminants prior to submittal of the Contamination Management Plan;

.5 a detailed description of the preliminary field investigation including date, time and depth of samples collected, sampling methods, number of samples collected, chemical parameters, media tested and an explanation of the delineation method for Environmental Contaminants;

.6 a figure depicting sampling locations, sample exceedances and estimated vertical and horizontal extent of the Environmental Contaminants in relation to the site;

.7 copies of borehole and test pit logs for sample locations related to the Environmental Contaminants, including soil description and classification;

.8 copies of laboratory certificates of analysis for the samples collected, including grain size analysis (if applicable);

.9 sampling and analysis requirements in accordance with O. Reg. 406/19;

.10 a description of management options for the Environmental Contaminants and the Contractor's preferred management option, including a description of whether containment measures are required to avoid re-contamination or migration of the Environmental Contaminants;

.11 an implementation plan, including a detailed description of how Environmental Contaminants will be managed and estimated quantities of soil and groundwater to be disposed off-site and reused within the Project, if applicable;

.12 any impact to the Project Schedule caused by the discovery of Environmental Contaminants;

.13 additional costs, if any, associated with incremental measures required to manage the Environmental Contaminants;

.14 name and address of the receiver site for the soil containing Environmental Contaminants;

.15 additional information as requested by the Owner and/or Consultant; and

.16 rationale for assigning responsibility for the Environmental Contaminants, including an assessment and comparison of the discovered Environmental Contaminants characteristics against available baseline environmental information such as the Project's Soil and Groundwater Characterization Report.

.2 The Contractor's Qualified Person shall supervise the extraction, transport, removal, disposal or discharge of contaminated media identified in the Contamination Management Plan.

.3 In accordance with Environmental Law, the Contractor shall be responsible for the characterization, testing, and analysis of soil and groundwater that requires off-Site disposal, off-Site reuse or on-Site reuse, to the satisfaction of the receiver or disposal site and to the satisfaction of Owner and Consultant.

.4 The Contractor shall be responsible for registration with the Resource Productivity and Recovery Authority (RPRA) and recordkeeping for disposal of regulated Waste, as applicable.

.5 The Contractor shall update the Contamination Management Plan with additional information following the implementation of the Contamination Management Plan (the "Updated Contamination Management Plan") and the Contractor shall submit such updated plan to the Owner and Consultant in accordance with Project submission timeframes. The Updated Contamination Management Plan shall include:

.1 a summary of the information presented in the Contamination Management Plan;

.2 a detailed description of the handling and management of the Environmental Contaminants following submittal of the Contamination Management Plan;

.3 a detailed description of the handling and management of the Environmental Contaminants following submittal of the Contamination Management Plan;

.4 a detailed description of field investigations conducted during implementation of the Contamination Management Plan including date, time and depth of samples collected, sampling methods, number of samples collected, chemical parameters, media tested and explanation of the delineation method for Environmental Contaminants;

.5 a figure depicting sampling locations, sample exceedances and vertical and horizontal extent of the Environmental Contaminants remediated on site;

.6 copies of borehole and test pit logs for sample locations related to the Environmental Contaminants, including soil description and classification;

.7 quantity of soil and groundwater disposed outside the Lands

and reused within the lands;

.8 name and address of the receiver site for the Environmental Contaminants;

.9 electronic copies of waste manifests or bills of lading;

.10 a description of containment measures for the Environmental Contaminants employed to avoid re-contamination or migration of Environmental Contaminants;

.11 a description of whether the Environmental Contaminants entered lands outside of the Project site;

.12 a description of post-implementation monitoring or sampling needed; and

.13 signature of the Contractor's Qualified Person who supervised the implementation of remediation activities and preparation of the Updated Contamination Management Plan.

.6 The Contractor is encouraged to seek opportunities for beneficial reuse (rather than remove or replace) for as much soil from the Project as possible in a manner that is consistent with Ontario Regulation 406/19, provided that the Contractor complies with its obligations under this Contract.

.7 The Contractor shall evaluate reuse options to consider site-specific excess soil quality criteria in cases where soil is geotechnically suitable for reuse as engineered fill, including where such soil may be subject to some reconditioning such as drying or wetting, but soil quality does not meet the applicable generic excess soil quality standard.

.8 The Contractor shall reuse (rather than remove or replace), as feasible, as much soil on site as possible in a manner that is consistent with Ontario Regulation 153/04, Ontario Regulation 406/19 and the MECP's Rules for Soil Management and Excess Soil Quality Standards, as amended, provided that the Contractor complies with its obligations under this Contract.

.9 The Contractor shall evaluate reuse options in cases where soil is geotechnically stable for reuse but soil quality does not meet the applicable generic excess soil quality standard.

1.10 MANAGEMENT, REMOVAL AND REMEDIATION OF SOIL WITH ENVIRONMENTAL CONTAMINANTS

.1 The Contractor shall be responsible for excavating, handling, managing, stockpiling, removing, and transporting of soil and excavated material as required to complete the Project, including soil and excavated material containing Environmental Contaminants. The Contractor shall reuse or dispose of soil and excavated material that does not contain Environmental Contaminants at its own cost.

.2 The Contractor shall be permitted to reuse any soil and excavated material containing Environmental Contaminants as part of the Works provided the Contractor's reuse of such soil complies with Environmental Laws and MECP Guidelines, Standards and Rules. The Contractor shall not be entitled to any additional compensation from the Owner where such soil or excavated material is reused.

.3 Upon discovery of soil containing Environmental Contaminants that will require excavation to complete the Project and that the Contractor will not reuse, the Contractor shall notify the Owner and Consultant. Such notification shall clearly indicate the anticipated volume of soil containing Environmental Contaminants

that will be excavated and not reused. The Contractor shall not be permitted to provide such notification until the Contamination Management Plan has been submitted for Acceptance to the Owner and Consultant. The Owner shall, no later than fifteen (15) Working Days following Notice in Writing from the Contractor that contains all information provided in the notification, described above, and the Contamination Management Plan, direct the Contractor either to:

.1 dispose of such soil containing Environmental Contaminants; or

.2 stockpile such soil containing Environmental Contaminants on the Place of the Work (or Station Location).

.4 The Owner may specify a maximum volume that is to be disposed of or stockpiled (the "Authorized Volume"). Where the Owner has specified an Authorized Volume, the Contractor shall be required to submit a new notification for any remaining soil containing Environmental Contaminants following completion of the disposal or stockpiling of the Authorized Volume in order to receive further direction from the Owner, including a revised Authorized Volume.

.5 If the Contractor is directed to dispose of soil containing Environmental Contaminants, then:

.1 the Contractor shall proceed to dispose of the soil at a licensed facility in Ontario and inform the Owner of the selected facility;

.2 the Contractor shall be compensated with an agreed upon pricing for each ton of excavated soil containing Environmental Contaminants that is disposed, up to any Authorized Volume and Invoicing and such compensation shall be deemed to include all handling, shipping and disposal fees and costs and all administrative and profit costs of the Contractor.

.6 If the Contractor is directed by the Owner to stockpile such soil containing Environmental Contaminants on the Site, then the Contractor shall:

.1 utilize an agreed upon laydown area;

.2 provide geomembrane ground protection to prevent leaching of Environmental Contaminants;

.3 provide a full geomembrane cover over the stockpile;

.4 provide a permanent monitoring system;

.5 comply with the portions of the On-site and Excess Soil Management Regulation (O. Reg. 406/19) regarding stockpiling, the MECP Rules for Soil Management and Excess Soil Quality Standards and the MECP Management of Excess Soil - A Guide for Best Management Practices;

.6 develop and submit to the Owner a monitoring program for the stockpiled soils for review and Acceptance by the Consultant.

1.11 WEEKLY SOIL AND EXCAVATED MATERIALS REPORT

.1 The Contractor shall provide a template of the Weekly Soil and Excavated Materials Report to the Consultant.

.2 The Contractor shall submit a weekly report for soil and excavated material to the Consultant (each a "Weekly Soil and Excavated Materials Report") that includes at a minimum:

.1 analytical results of chemical samples collected for soil, groundwater or other material in the area of the Works before and after construction;

.2 record of quantity of excavated material, reused at the site in metric tonnes;

.3 record of excavated material stockpiled at the site in metric tonnes;

.4 all back-up documents of soils, groundwater or other materials removed from site, including tickets indicating soil or other material quantity, landfill or final treatment or disposal location;

.5 Site reports complete with photos and back-up documents on all soil, groundwater or other materials remedial work activities;

.6 documentation related to any unforeseen site issues during soil, groundwater or other materials remedial work activities;

.7 a cost table indicating all associated costs in the removal, management, transportation, treatment and disposal of the soil, groundwater or other materials in the area of the Works;

.8 a description of how the discovery of Environmental Contaminants in areas not previously identified will be managed including the preparation of a plan for the re-use, stockpile, remediation or removal of Environmental Contaminants; and

.9 reporting as to how all management activities and best practices have been implemented.

1.12 HAZARDOUS SUBSTANCES BROUGHT ONTO THE SITE

.1 Notwithstanding any Environmental Laws or any other provision, all products and materials, goods or other items which in their natural, original state, or through environmental transformation or degradation contain Hazardous Substances, that are brought onto the site by the Contractor or any person for whom Contractor is at law responsible shall be and remain the sole and exclusive property and responsibility of Contractor and shall not become the property or responsibility of the Owner, notwithstanding their incorporation into or affixation to the site as part of the Work, and notwithstanding any termination or expiration of the Project. Any resulting Environmental Contaminants at the site in respect of any Hazardous Substances so brought onto the site and the remediation and/or removal thereof and the cost of such remediation and/or removal shall be the sole responsibility of the Contractor.

1.13 SPILL PREVENTION PLAN

.1 The Contractor shall prepare, submit, and implement a Spill Prevention Plan (a "Spill Prevention Plan"). The Spill Prevention Plan shall describe the measures the Contractor will take to prevent Spills of liquid chemicals, fuels and lubricants, and manage or otherwise mitigate the effects of any such Spills to construction personnel and the environment during the term of the Project. The Spill Prevention Plan shall consider site-specific characteristics, and include, at a minimum, the following:

.1 the types and nature of liquid chemicals, fuels and lubricants to

be used during the performance of the initial Works;

.2 the facilities and procedures to be used for storing and handling such materials, including Spill response, containment and clean-up materials;

.3 monitoring and inspection procedures, including monthly inspections of Spill response and safety equipment, to ensure that management requirements are maintained and that inspections are documented;

.4 employee training on the storage and use of liquid chemicals, fuels and lubricants and the prevention of Spills;

.5 subsurface infrastructure (for example, weeping tile, infiltration galleries, etc.) that may influence the destination of any Spill material;

.6 the identification of municipal and natural discharge locations (for example, municipal catch basins) and drainage pathways on the Site, and a description of the direction of flow in the event of a Spill;

.7 Spill response procedures for each type of material that may be spilled, and the various environmental media that may be affected (for example, atmosphere, water bodies, ground surface);

.8 procedures for clean-up and restoration of surfaces and environmental media that may be affected by the Spill; and

.9 procedures for notification and reporting of Spill events to Contractor and to Authorities Having Jurisdiction, as applicable.

.2 The Contractor shall submit the Spill Prevention Plan to the for review and Acceptance.

.3 The Contractor shall ensure that a hard copy of the latest revision of the Spill Prevention Plan is available in all site trailers and all site offices.

.4 After each and any occurrence of a Spill, irrespective of the quantity or characteristics of the material spilled, the Contractor shall prepare and submit a spill prevention occurrence report (a “Spill Prevention Occurrence Report”) to the Consultant. The Spill Prevention Occurrence Report shall summarize how all Spill Prevention Plan activities were implemented during the remediation and management of the occurrence of the Spill and the associated outcomes.

1.14 DESIGNATED SUBSTANCES AND HAZARDOUS SUBSTANCE MANAGEMENT PLAN

.1 The Contractor shall review the “Designated Substances Survey Report – Matheson Station”.

.2 The Contractor shall prepare and implement a Designated Substances and Hazardous Substance Management Plan (a “Designated Substances and Hazardous Substance Management Plan”). The Contractor shall submit the Designated Substances and Hazardous Substance Management Plan for review and Acceptance. The Designated Substances and Hazardous Substance Management Plan shall describe:

.1 how the Contractor will manage all Designated Substances and

Hazardous Substance, including, but not limited to, abatement, handling, transportation, testing, removal, disposal and/or ultimate disposition of all Designated Substances and Hazardous Substance determined to be present, or generated as part of the Works;

.2 the general principles that the Contractor will apply for managing the necessary removal of Designated Substances and Hazardous Substances;

.3 the Contractor's over-arching Designated Substances and Hazardous Substance management strategy in terms of sustainable principles and compliance with Environmental Laws and best practice;

.4 locations of Designated Substances and Hazardous Substances to be abated, managed or removed by Contractor during the Work. The Contractor shall carry out necessary testing for Designated Substances and Hazardous Substances under section 30 of the Occupational Health and Safety Act (Ontario), and under section 8 Regulation 278/05, and protect workers from working with or in proximity to or from being otherwise exposed to Designated Substances at the Site or the Works. The Designated Substances and Hazardous Substance Management Plan shall describe all applicable processes for same;

.5 the Contractor's protocols for safe handling, abatement, management, and removals, including disposal requirements;

.6 how the Contractor will ensure that no adverse impacts will result to adjacent properties during the abatement, handling, management or removal of Designated Substances and Hazardous Substances;

.7 how the Contractor will conduct its activities in compliance with the Occupational Health and Safety Act (Ontario) and all applicable law and industry practices;

.8 the further necessary measures the Contractor will take to ensure the safety of all personnel accessing the Site and the Works, to the standards of applicable Occupational Health and Safety Law;

.1 the Contractor's contingency plans to mitigate adverse impacts; and

.2 the Contractor's reporting procedures to document and report to the Owner how all testing, management activities, best practices and mitigation measures have been implemented.

.3 Contractor acknowledges that section 30(5) of the Occupational Health and Safety Act (Ontario) shall not apply to the circumstances of the site and the Works of the Owner, given the obligations of the Contractor set out in Section 1.13.2.4.

.4 The Contractor shall prepare and submit a Designated Substances and Hazardous Substance implementation report (a "Designated Substances and Hazardous Substance Implementation Report") to the Consultant for Acceptance. The Designated Substances and Hazardous Substance Implementation Report shall summarize how all Designated Substances and Hazardous Substance

Management Plan activities were implemented during the Works and the associated outcomes.

1.15 OTHER ENVIRONMENTAL MATTERS

.1 Organic Materials

.1 Organic materials from excavation operations may contain peat, topsoil and subsoil materials. Contractor shall remove these materials from the Site in accordance with Environmental Laws and best practice. The Contractor shall not allow burial or reuse of any excavated organic materials on the site.

.2 Protection/Decommissioning of Existing Monitoring Wells

.1 The Contractor shall be responsible for temporary protection and final decommissioning of all existing or newly installed monitoring wells in accordance with Ontario Regulation 903 under the Ontario Water Resources Act (Ontario), as directed by the Owner, including with respect to:

.1 any and all monitoring wells installed as part of geotechnical, environmental, or hydrogeological investigations in connection with the Project; and

.2 all wells installed as part of the studies undertaken by the Owner and that were provided as part of the project background information.

.2 The Contractor shall, prior to Ready-for-Takeover (unless the Owner provides an alternative timing), decommission any wells installed by the Contractor as part of its own investigation and monitoring work as necessary to complete the Works.

2 Products

2.01 NOT USED

3 Execution

3.01 NOT USED

3.02 END OF SECTION

1 GENERAL

1.01 SUMMARY

.1 This Section references laws, bylaws, ordinances, rules, regulations, codes, orders of Authority Having Jurisdiction (AHJ), and other legally enforceable requirements applicable to the Work and that are or become enforced during performance of the Work.

1.02 REFERENCE STANDARDS AND REFERENCE DOCUMENTS

.1 If specified referenced standards do not indicate an edition or version, the latest edition or revision issued by the publisher at the time of RFP closing shall apply, except as follows:

.1 If a particular edition or revision date of a specified standard is referenced in an applicable code or other regulatory requirement, the edition or version in the regulatory reference shall apply.

.2 The specified reference standards establish minimum requirements. If Contract Documents indicate requirements that conflict with a reference standard, the more stringent requirements shall apply.

.3 If multiple reference standards are specified and the standards establish different requirements, the most stringent requirement shall apply.

.4 In case of discrepancy or uncertainties, refer to the Consultant for interpretation or clarification.

.5 Canadian Construction Documents Committee (CCDC)

.1 CCDC 2-2020, Stipulated Price Contract.

1.03 CODES

.1 Building Code: Perform Work in accordance with the Ontario Building Code including amendments up to the time of RFP closing and other codes of provincial or local application.

.2 Fire Code: Perform Work in accordance with the Ontario Fire Code 2020 including amendments up to the time of RFP closing and other codes of provincial or local application.

.3 Energy Code: Perform Work in accordance with the National Energy Code of Canada for Buildings (NECB) 2020 and Part 12 of OBC Resource Conservation and Environmental Integrity and Supplementary Standard SB-10 whichever is more stringent, including amendments up to the time of RFP closing and other codes of provincial or local application.

.4 Plumbing Code: Perform Work in accordance with Ontario Plumbing Code Part 7 of OBC. including amendments up to the time of RFP closing and other codes of provincial or local application.

.5 If there is a conflict or discrepancy between codes, the most stringent requirements shall apply.

.6 Specific design and performance requirements listed in Specifications and indicated on Drawings may exceed minimum requirements established by referenced Codes; these requirements will govern over the minimum requirements listed in the referenced Codes.

1.04 FEES

.1 Except as otherwise specified, Contractor shall apply for, obtain, and pay fees associated with permits, licenses, certificates, and approvals required by regulatory requirements and Contract Documents, based on General Conditions of Contract and the following:

.1 Regulatory requirements and fees in force at the time of RFP closing, and

.2 A change in regulatory requirements or fees scheduled to become effective after the time of RFP closing and of which public notice has been given before the time of RFP closing.

2 PRODUCTS

2.01 EASEMENTS AND NOTICES

.1 Owner will obtain permanent easements and rights of servitude that may be required for performance of the Work.

.2 Contractor shall give notices required by regulatory requirements.

2.02 PERMIT REQUIREMENTS

.1 Construction Related Permits:

.1 **Municipal building permit is not required**.

.2 If required, MTO Building and Land Use Permits will be obtained by the Owner.

.3 Obtain and pay for all other required Certificates, Licenses and other permits required by regulatory municipal, provincial or federal authorities to complete the Work.

.4 Contractor will require that specific Subcontractor[s] obtain and pay for permits required by authorities having jurisdiction (AHJ), where their work is affected by work requiring permits.

.5 Contractor shall display permits in a conspicuous location at the Place of the Work.

.2 Occupancy Permits:

.1 Contractor shall apply for obtain and pay for any required permits and or certificates where required by AHJ.

.2 Contractor shall correct deficiencies in accordance with the Consultant’s instruction. If a deficiency is not corrected, the Owner reserves the right to make correction and charge Contractor for costs incurred.

.3 Contractor shall turn all permits and certificates over to Owner.

END OF SECTION

1 GENERAL

1.01 REFERENCE STANDARDS

.1 Canadian Construction Documents Committee (CCDC)

.1 CCDC 2-2020, Stipulated Price Contract.

.2 ASTM International (ASTM):

.1 ASTM E329-[20]Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection

.3 International Organization for Standardization (ISO):

.1 ISO 9001: [2015], Quality Management Systems – Requirements

1.02 SUMMARY

.1 This section describes administrative and procedural requirements for proactive Contractor activities to assure the quality of construction before and during execution of the Work.

1.03 RELATED REQUIREMENTS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 01 45 00 – Quality Control

1.04 ADMINISTRATIVE REQUIREMENTS

.1 Contractor is responsible for self-performed testing and inspections and submittal of test reports to the Consultant.

.2 The Owner may employ and pay for quality audit services performed through third-party observation and testing to validate the Contractor's performance of the Work and perform whole Work testing at completion of Project.

.3 Contractor to provide a Quality management system that establishes a standardized approach to managing quality of materials and workmanship during the execution of Work in accordance with ISO 9001. The quality management system shall consist of plans, procedures, and organization necessary to produce complete the Work in compliance with the Contract Document requirements.

1.05 ACTION AND INFORMATION SUBMITTALS

.1 Submit in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit a Quality Management Plan to the Consultant for review and Acceptance prior to Preconstruction meeting.

.1 The plan shall identify personnel, procedures, control, instructions, test, records, and forms to be used. The Owner will consider an interim plan for the first twenty (20) Working Days of operation. The Contractor may begin mobilization during the interim period.

.2 The Work will be permitted to begin only after Acceptance of the Quality Management Plan or Acceptance of an interim plan applicable to the portion of the Work to be started.

.3 The Quality Management Plan shall include, as a minimum, the following to cover all Work both at the Place of the Work, and in off-site locations (such as manufacturing facilities), including Work by Subcontractors, fabricators, suppliers, and purchasing agents:

.1 A description of the quality control organization, including a chart showing lines of authority and acknowledgment that the quality control staff shall implement the three-phase control system for all aspects of the work specified. The staff shall include the person responsible for quality who shall report to the Contractor's project manager.

.2 The name, qualifications (in resume format), duties, responsibilities, and authorities of each person assigned a quality control function.

.3 A copy of the letter to the person responsible for quality signed by an authorized official of the firm which describes the responsibilities and delegates sufficient authorities to adequately perform the functions of person responsible for quality, including authority to stop work that is not in compliance with the Contract Documents. The person responsible for quality shall issue letters of direction to all other various quality control representatives outlining duties, authorities, and responsibilities. Copies of these letters will also be supplied to the Consultant.

.4 Procedures for scheduling, reviewing, certifying, and managing Submittals, including those of Subcontractors, offsite fabricators, suppliers, and purchasing agents. These procedures shall be in accordance with the Contract Documents.

.5 Control, verification, and acceptance testing procedures for each specific test to include the test name, specification paragraph requiring test, portion of the Work to be tested, test frequency, and person responsible for each test.

.6 Procedures for tracking preparatory, initial, and follow-up control phases and control, verification, and acceptance tests, including documentation.

.7 Procedures for tracking defects and deficiencies from identification through Acceptable corrective action. These procedures will establish verification that identified deficiencies have been corrected.

.8 Reporting procedures, including proposed reporting formats.

.9 A list of the definable features of Work. A definable portion of the Work is a task which is separate and distinct from other tasks and has separate control requirements. This list will be agreed upon with the Consultant during a coordination meeting.

.10 Acceptance of the Contractor's Quality Management Plan is required prior to the start of the Work. Acceptance is conditional and will be predicated on satisfactory performance during the Work.

.11 The Owner reserves the right to require the Contractor to make changes in its Quality Management Plan and operations, as necessary, to obtain the quality specified.

.12 Refer to the Contract Documents for additional requirements.

.4 Submit a detailed testing and inspections schedule for Acceptance to the Consultant in accordance with the Contractor's Quality Management Plan.

.5 Submit certificates for Products, process and system for Acceptance by the Consultant.

.6 Submit formal testing and inspections reports per ASTM E329 and as indicated in Specifications to the Consultant in accordance with the Contract Documents.

.7 Submit one digital copy of each Quality Assurance inspection and test report to the Consultant, except where Specifications indicate otherwise.

.8 Submit mill test certificates, as required, in technical Specifications and as indicated on Drawings.

1.06 Quality Control Organization:

.1 The requirements for the quality control organization are a person responsible for quality and sufficient number of additional qualified personnel to ensure compliance to Contract Documents.

.2 Provide a quality control organization which shall be available at all times during progress of the Work and with complete authority to take any action necessary to ensure compliance with the Contract Documents.

1.07 QUALIFICATIONS

.1 Manufacturers' Qualifications:

.1 specializes in manufacturing the Products specified in the Specifications.

.2 minimum three (03) years documented experience with a record of successful performance.

.2 Suppliers' Qualifications:

.1 authorized to distribute manufacturer's Products

.2 has capacity to supply required Products without delaying the Project

.3 Fabricators' Qualifications:

.1 experienced in producing Products required for this Project

.2 successful record of in-service performance

.3 sufficient production capacity to fabricate required Products without delaying the

Project

.4 Installer Qualifications:

.1 firm or individual experienced in design and installation, application, and erection of materials to the extent required for this Project

.2 successful record of in-service performance

.5 Testing and Inspecting Agency Qualifications:

.1 accredited organizations by the Standards Council of Canada for testing and inspection

.2 capable of reliably performing testing of building products and inspections of construction activities in accordance with ISO 9001 and ASTM E329.

.6 Licensed Professionals Qualifications:

.1 individual registered or licensed to practice their respective design profession as defined by the statutory requirements of the professional registration laws of the province, state or jurisdiction in which the Project is to be constructed.

1.08 CERTIFICATIONS

.1 Ensure that certification of Products, processes, and systems includes physical and examination testing as specified in ASTM E329 SO 9001 to confirm compliance with Specifications requirements.

1.09 COORDINATION

.1 Coordinate and schedule tests and inspections with accredited testing, inspection agencies as indicated in Contract Documents and in accordance with ASTM E329 requirements.

.2 Coordinate Contractor’s Quality Management system with the Consultant for reporting, scheduling access and incidental labor required by Quality Auditor’s reports if required.

.3 When attendance is required, notify the Consultant in advance before proceeding with tests and inspections, and additional tests and inspections as may be reasonably requested by the Consultant.

.4 Coordinate testing and inspections schedule with Subcontractor, testing agencies, and other affected parties.

1.10 SITE SAMPLES

.1 Testing agency is responsible for obtaining representative samples of those materials required to be tested and evaluated in accordance with the Contractual Documents.

.2 Ensure testing agency performs sampling in accordance with ASTM E329.

.1 When sampling collection is required by testing agency, ensure proper protection, handling and storing of samples.

.3 Testing agency to document procedures and appropriate techniques to select samples.

.4 Record details of environmental conditions present during the sampling, such as rain or freezing weather that may affect testing of sample or interpretation of test results.

1.11 Mock-ups

.1 Mock-ups can be used as a reference for assessing quality of workmanship and site-applied finishes as requested in the Project's Contract Documents.

.2 Prepare mock-ups for Work specifically requested in Specifications. Except when required in other sections, obtain the Consultant's Acceptance to construct and install mock-ups. When not required, Contractor shall indicate the use of mock-ups in their Quality Management Plan.

.3 Assemble mock-ups at the Place of the Work in locations acceptable to the Consultant, or where location is indicated in the technical Specifications.

.4 Schedule mock-ups ready for the Consultant review and Acceptance in orderly sequence, to avoid delays in Work.

.1 Failure to prepare mock-ups in ample time is not considered sufficient reason to request an extension of Contract Time. Claims for extension of Contract Time by reason of such default will not be considered.

.5 Consult with the Consultant in scheduling dates for construction and review of mock-ups. Provide sufficient notice as directed by the Consultant.

.6 Construct mock-ups using materials, finishes, colours, and methods proposed for the completed Work. Mock-ups to demonstrate proposed workmanship and range of aesthetic appearance.

.7 Where a mock-up represents or affects multiple Specification sections, coordinate activities to ensure mock-ups are complete.

.8 Modify or replace mock-ups when unacceptable to the Consultant.

.9 Maintain acceptable mock-ups in an undisturbed condition as a standard for judging the completed Work.

.10 Demolish and remove mock-ups at conclusion of the Work or when Acceptable to the Consultant.

END OF SECTION

1 GENERAL

1.01 REFERENCE STANDARDS

1. Canadian Construction Documents Committee (CCDC)

    .1 CCDC 2-2020, Stipulated Price Contract.

1.02 SUMMARY

.1 This Section describes administrative and procedural requirements for reactive activities to verify that completed Work conforms to Contract Documents requirements.

.2 Having inspection and testing agencies employed by Contractor or the Owner does not relieve the Contractor of their responsibility to perform Work in accordance with Contract Documents.

1.03 ADMINISTRATIVE REQUIREMENTS

.1 Allow and coordinate access to Work on site, manufacturing off site, and fabrication off site with inspection and testing agencies, the Consultant and the Owner.

.2 Retain and pay for inspection and testing that are designated for Contractor's own Quality Management Plan, and when testing and inspection are required by Authorities Having Jurisdiction (AHJ).

.3 Provide advanced notice, minimum five (05) Working Days to the Consultant and to each inspection/testing agency for inspection and testing required by Contract Documents or by (AHJ).

.4 Where Owner cooperation, input or participation is required to fully perform inspection and test activities, particularly in relation to the correct operation of Products Supplied by Other and installed by the Contractor, provide a minimum ten (10) Working Days' notice to the Consultant.

.5 In advance of each test, notify appropriate agency and the Consultant in the order that attendance arrangements can be made.

.6 Employment of inspection and testing agencies does not relax or remove responsibility to perform Work in accordance with Contract Documents.

1.04 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit schedule of testing and inspection activities to the Consultant, applicable Subcontractors, testing agencies, Owner, and other affected parties. Include the following:

    .1 List each testing and inspection agency

.2 Identify types of tests and inspections for each agency, and cross reference to applicable specification section number-title in Contract Documents

.3 Description of test and inspection

.4 Identify applicable reference standard

.5 Identify test and inspection method

.6 Indicate number of each test and inspection required

.3 Submit one digital copy of each quality assurance inspection and test report to the Consultant, except where a technical Specification section indicates otherwise.

.4 Submit reports for inspection and testing required by Contract Documents or by AHJ and performed by Contractor-retained inspection and testing agencies within ten (10) Working Days after inspection or test is completed, except where a technical Specification section indicates a different time period.

.5 Submit one digital copy of each quality control inspection and test report to the Consultant, except where a technical Specification section indicates otherwise. Maintain copies available at Place of the Work in accordance with Section 01 78 00 - Closeout Submittals.

.6 Deliver copies of quality control reports to Subcontractor of Work being inspected or tested.

1.05 SITE QUALITY CONTROL PROCEDURES

.1 Provide labor, Construction Equipment, and temporary facilities to obtain and handle test samples and materials on site. Arrange for sufficient space to store and cure test samples.

.2 Deliver samples and materials required for testing, as requested in technical Specification sections. Submit with reasonable promptness and in an orderly sequence to avoid delays in Work.

.3 Before Project start, photograph Project site and existing conditions in accordance with Section 01 33 00 – Submittal Procedures.

1.06 TESTING AND INSPECTION SERVICES

.1 The Owner may retain and pay for independent inspection and testing agencies to inspect, test, or perform other quality control reviews of parts of the Work, in addition to those carried by the Contractor.

.2 Consultant may order any part of the Work to be reviewed or inspected if the Work is suspected to be not in accordance with Contract Documents. If, upon review such Work is found not in accordance with Contract Documents, the Contractor shall correct such Work and pay cost of additional review and correction.

.3 Provide equipment required for executing inspection and testing by appointed agencies.

.4 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and testing to ascertain full degree of defect. Correct defect and irregularities as advised

by Consultant at no cost to Owner. Pay costs for retesting and re-inspection.

.5 Quality control testing and inspection reports to include the following:

.1 Project name and number

.2 Testing/Inspection agency's name, address, telephone number, and website

.3 Date of issuing report

.4 Dates and locations of tests, inspections, or samples

.5 Description of the Work and test and inspection method

.6 Numbers and titles of associated Specification sections

.7 Test and inspection data and interpretation of test results (e.g., pass or fail)

.8 Ambient conditions at time of test, inspection, or sampling

.9 Recommendations on re-testing and re-inspecting, if applicable.

END OF SECTION

1 GENERAL

1.01 REFERENCE STANDARDS

.1 Canadian Construction Documents Committee (CCDC)

.1 CCDC 2-2020, Stipulated Price Contract.

1.02 ACTION AND INFORMATIONAL SUBMITTALS

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

1.03 TEMPORARY ELECTRICITY

.1 When Electrical power is not available at site, make all necessary arrangements and pay for all costs for a temporary electrical service of sufficient capacity to supply temporary lighting, operation of power tools, cranes and equipment for all construction, implementation, and inspection and testing purposes. Supply and install necessary temporary cables and other electrical equipment and make all temporary connections as required. If generators are used, they should be of the kind that minimize noise impact to surrounding areas and residents.

.2 Arrange for connection with appropriate utility company. Pay costs for installation, maintenance, and removal.

.3 When Electrical power supply is available at site and supply is metered to ONTC, subject to agreement of the Consultant, it may be provided for construction use at no cost. Contractor shall ensure their use shall not cause the overall use to exceed supply voltage and capacity. Connect to existing power supply in accordance with Canadian Electrical Code.

.4 Electrical power systems installed under this Contract may be used for construction requirements only with prior approval from the Consultant if warranties are not affected. Repair damage to electrical system caused by the Contractor’s use under this Contract.

.5 Temporary power distribution wiring shall comply with Ontario Electrical Safety Code. Obtain inspection certificates for temporary electrical work.

1.04 TEMPORARY FIRE PROTECTION

.1 Provide and maintain temporary fire protection equipment during performance of Work in accordance with Section 01 35 35 – Fire Safety Protection.

1.05 TEMPORARY HEATING COOLING AND VENTILATING

.1 Provide temporary heating as required during construction period, including attendance, maintenance and fuel.

.2 Construction heaters used inside building must be vented to outside or be of the flameless (vent free) type. Solid fuel salamanders are not permitted.

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

.1 Facilitate progress of Work.

.2 Protect Work and Products against dampness and cold.

.3 Prevent moisture and condensation on surfaces.

.4 Provide ambient temperatures and humidity levels for storage, installation, and curing of materials.

.5 Provide adequate ventilation to meet health regulations for safe working environment.

.4 Maintain minimum temperatures recommended by applicable codes and regulations in areas where construction is in progress.

.5 Ventilating:

.1 Prevent accumulations of dust, fumes, mists, vapours, or gases in occupied areas during construction.

.2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.

.3 Dispose of exhaust materials in a manner that will not result in harmful exposure to persons.

.4 Ventilate storage spaces containing hazardous or volatile materials.

.5 Ventilate temporary sanitary facilities.

.6 Continue operating ventilation and exhaust system after cessation of work process until complete removal of harmful contaminants is ensured.

.6 Permanent heating, ventilating, and air conditioning system of building must not be used.

1.06 TEMPORARY LIGHTING

.1 Provide and maintain temporary lighting throughout Project. Ensure level of illumination on all work area is suitable and will meet or exceed the requirement of Health and Safety regulations and as per applicable codes and standards.

.2 Electrical lighting systems installed under this Contract may be used for construction requirements only with prior approval of the Consultant if warranties are not affected.

.1 Repair damage to lighting systems caused by use under this Contract.

.2 Replace lamps that have been used for more than [3] months.

.3 Temporary lighting installed under this Contract shall not cause light nuisance and or adversely impact ONTC Operations and surrounding areas and properties. Make adjustments to the satisfaction of Owner.

1.07 TEMPORARY SANITARY FACILITIES

.1 Provide sanitary facilities in accordance with Occupational Health and Safety requirements in the

Place of the Work. Use of Owner's existing sanitary facilities or new sanitary facilities is not allowed.

1.08 TEMPORARY TELECOMMUNICATIONS

.1 If required, provide and pay for temporary telephone, data hook up equipment necessary for own use and use of the Consultant.

1.09 TEMPORARY WATER

.1 When available, Owner will provide water for construction use. Otherwise, the Contractor will be responsible for the water supply and all associated costs.

.2 Arrange for connection with appropriate utility company and pay costs for installation, maintenance, and removal as required.

2.01 INSTALLATION AND REMOVAL

.1 Provide temporary utilities to execute Work expeditiously.

.2 Remove all such temporary utilities from site after use.

.3 Be responsible for the careful and reasonable use of Owner-supplied utilities. Make good and remediate any damage caused by use under this contract.

.4 Pay costs for installation, maintenance and removal.

END OF SECTION

1 GENERAL

1.01 REFERENCE STANDARDS

.1 Canadian Construction Documents Committee (CCDC)

.1 CCDC 2-2020, Stipulated Price Contract.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB 1.189-[00], Exterior Alkyd Primer for Wood.

.2 CGSB 1.59-[97], Alkyd Exterior Gloss Enamel.

.3 CSA Group (CSA)

.1 CSA-A23.1/A23.2-[04], Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.2 CSA-0121-[M1978(R2003)], Douglas Fir Plywood.

.3 CAN/CSA-S269.2-[M1987(R2003)], Access Scaffolding for Construction Purposes.

.4 CAN/CSA-Z321-[96(R2001)], Signs and Symbols for the Occupational Environment.

.4 U.S. Environmental Protection Agency (EPA) / Office of Water

.1 EPA 832R92005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

1.02 ACTION AND INFORMATIONAL SUBMITTALS

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

1.03 INSTALLATION AND REMOVAL

.1 For each Place of the Work prepare site plan indicating proposed location and dimensions of the Construction Area to be fenced and used by Contractor, number of trailers if required, area for parking vehicles, avenues of ingress/egress to fenced area and details of fence installation. Construction Area shall be within the area indicated in the Contract Drawings. Submit site plan to Consultant for review and Acceptance.

.2 Indicate use of supplemental or other staging areas.

.3 Provide construction facilities in order to execute Work expeditiously.

.4 After use remove from site all such work installed under this section 01 52 00 – Construction Facilities. Reinstate area to same or better state before start of Project.

1.04 SCAFFOLDING

.1 Scaffolding in accordance with CAN/CSA-S269.2.

.2 Provide and maintain scaffolding, ramps, ladders, platforms, temporary stairs.

1.05 HOISTING

.1 Provide, operate and maintain hoists, cranes required for moving of workers, materials and equipment. Make financial arrangements with Subcontractors for their use of hoists.

.2 Hoists and cranes to be operated by qualified operator.

1.06 ELEVATORS

.1 When applicable, permanent elevators are not to be used by Contractor, Subcontractor or supplier personnel or for transporting of materials unless approved by the Owner. Co-ordinate use with the Owner if use is permitted.

.2 If use of elevators is approved by the Owner, provide protective coverings for finish surfaces of walls, floors and entrances.

1.07 SITE STORAGE/LOADING

.1 Confine Work and operations of employees to the Construction Area. Do not unreasonably encumber premises with Products.

.2 Do not load or permit to load any part of Work with weight or force that will endanger Work. Be solely responsible and liable for damages resulting from violation of this requirement.

.3 Products shall be stored only in areas designated or approved by the Consultant and shall not be left on the ground or in undesignated areas.

.4 Site storage and loading requirements to be in accordance with Ontario Occupational Health and Safety Act and Regulations for Construction Projects.

1.08 CONSTRUCTION PARKING

.1 Parking may be permitted on site provided it does not disrupt performance of Work. Arrange with the Consultant and obtain approval before site usage. Show location of agreed parking on site plan.

.2 Parking within the Construction Area shall be managed by the Contractor as long as it does not affect work performance or Safety.

.3 Provide and maintain adequate access to Project sites.

.4 Parking arrangements shall be in accordance with location specific restrictions contained in section 011400 – Work Restrictions.

1.09 TEMPORARY SECURITY

.1 Contractor is responsible for the security of the Place of the Work and any off-site other locations used by the Contractor for the execution of the Contract such as off-site temporary storage spaces.

.1 Temporary Site Security:

1. Site Fencing: Before beginning excavation and before construction activities begin, provide temporary site enclosure fencing with lockable gates to prevent unauthorized access.
2. Extent of Fencing: To enclose entire Project site or a portion sufficient to accommodate construction activities as indicated on Drawings.

3. Distribute gate keys to authorized personnel only. Supply Consultant and Owner with one set of keys each.

.2 Temporary Building Security:

1. Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized access, vandalism, theft, and similar security violations.
2. Distribute building entrance keys to authorized personnel only. Supply Owner and Consultant with one set of keys each.

1.10 OFFICES

.1 Provide one field office for the duration of the Work. The field office can be located within the Contractor Construction trailer and shall have proper heating, lighting, and ventilation and be of sufficient size to accommodate site meetings.

.2 Provide one workspace in field office for use by the Owner and the Consultant.

.3 Provide marked and fully stocked first-aid case in a readily available location.

.4 Subcontractors to provide their own offices as necessary. Arrange with the Consultant location of these offices.

.5 Maintain offices in a clean condition.

1.11 EQUIPMENT, TOOL AND MATERIALS STORAGE

.1 Provide and maintain, in clean and orderly condition, lockable weatherproof storage space (sea-cans, sheds, etc.) for storage of tools, equipment and materials.

.2 Locate materials not required to be stored in weatherproof storage space on site in manner to cause least interference with work activities.

.3 Ensure all equipment, tools and materials (including salvaged material) are stored clear of the rail Right of Way in a position where it they will not interfere with train operations and employee movements. Ensure all equipment, tools and materials and are secured in such a manner that they cannot fall or be placed foul of the rail line.

1.12 SANITARY FACILITIES

.1 Provide sanitary facilities for workforce in accordance with governing regulations and ordinances and in accordance with 01 51 00 – Temporary Facilities.

.2 Post notices and take precautions as required by local health authorities. Keep area and premises in sanitary condition.

1.13 CONSTRUCTION SIGNAGE

.1 No other signs or advertisements, other than warning signs, are permitted on site.

.2 Signs and notices for safety and instruction in English Graphic symbols to CAN/CSAZ321.

.3 Maintain approved signs and notices in good condition for duration of Project and dispose of offsite on completion of Project or earlier if directed by the Consultant.

.4 Provide signage in compliance O. Reg. 213/91 CONSTRUCTION PROJECTS, Canada Occupational Health and Safety Regulations SOR/86-304, Ontario Occupational Health and Safety Act, R.S.O. 1990 and applicable laws and standards.

.5 The Owner may supply or instruct the Contractor to supply other signs. Signs shall be installed by the Contractor. Specification of signage will be provided by the Owner. Any additional cost will be valued as per Contract Documents.

1.14 PROTECTION AND MAINTENANCE OF TRAFFIC

.1 Provide access and temporary relocated roads as necessary to maintain traffic.

.2 Maintain and protect traffic on affected roads during construction period except as otherwise specifically directed by the Consultant.

.3 Provide measures for protection and diversion of traffic, including provision of watch-persons and flag-persons, erection of barricades, placing of lights around and in front of equipment and work, and erection and maintenance of adequate warning, danger, and direction signs

.4 Protect travelling public from damage to person and property.

.5 Contractor’s traffic on roads selected for hauling material to and from site to interfere as little as possible with public traffic.

.6 Verify adequacy of existing roads and allowable load limit on these roads. Contractor shall be responsible for repair of damage to roads caused by construction operations.

.7 Construct access and haul roads necessary only after obtaining the Consultant’s approval.

.8 Access roads: constructed with suitable grades and widths; sharp curves, blind corners, and dangerous cross traffic shall be avoided.

.9 Provide necessary lighting, signs, barricades, and distinctive markings for safe movement of traffic.

.10 Dust control: adequate to ensure safe operation at all times.

.11 Location, grade, width, and alignment of construction and hauling roads: subject to approval by the Owner.

.12 Lighting: to assure full and clear visibility for full width of access road and work areas during night work operations.

.13 Provide snow removal during period of Work.

.14 Remove, upon completion of Work, access roads designated by the Owner.

1.15 CLEAN-UP

.1 Remove construction debris, waste materials, packaging material from work site daily.

.2 Clean dirt or mud tracked onto paved or surfaced roadways.

.3 Store materials resulting from demolition activities that are salvageable.

.4 Stack stored new or salvaged material not in construction facilities at a location approved by the Consultant.

2.01 TEMPORARY EROSION AND SEDIMENTATION CONTROL

.1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of Authorities Having Jurisdiction, sediment and erosion control drawings, sediment and erosion control plan, specific to site, that complies with EPA 832/R-92-005 or requirements of Authorities Having Jurisdiction, whichever is more stringent.

.2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

.3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

END OF SECTION

1 General

1.1 SUMMARY

.1 This Specification covers the operational requirements and traffic control for heavy civil contracts when roadway traffic is to be accommodated during construction.

.2 The Contractor shall complete all Work relevant to this section in accordance with Ontario Provincial Standard Specification (OPSS):

.1 OPSS.PROV 706 – TEMPORARY TRAFFIC CONTROL DEVICES

.2 Sections – Measurement for Payment and Basis of Payment are not used.

1.2 RELATED REQUIREMENTS

.1 Section 32 11 16.01 - Granular Sub-base

.2 Section 32 11 23 - Aggregate Base Courses

.3 Section 32 12 16 - Asphalt Paving

1.3 REFERENCE STANDARDS

.1 Canadian Construction Documents Committee (CCDC)

.1 CCDC 2-2020, Stipulated Price Contract.

.2 Ministry of Transportation, Ontario (MTO) – Ontario Traffic Manual, Book 7: Temporary Conditions.

1.4 PROTECTION OF PUBLIC TRAFFIC

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

.2 When working on travelled way:

.1 Place equipment in position to minimize interference and hazard to travelling public.

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

.3 Do not leave equipment on travelled way overnight.

.3 Close lanes of road only after receipt of written approval from Owner and Authority Having Jurisdiction (AHJ).

.1 Before re-routing traffic, erect suitable signs and devices to Ontario Traffic Manual, Book 7: Temporary Conditions.

.4 Keep travelled way graded, free from potholes and of sufficient width for required number of lanes of traffic.

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

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

.5 Provide gravelled detours or temporary roads as needed to facilitate passage of traffic around restricted construction area:

.1 Place and compact granular sub-base in accordance with Section 32 11 16.01 - Granular Sub-base.

.2 Place and compact granular base in accordance with Section 32 11 23 - Aggregate Base Courses.

.3 Place and compact asphalt concrete pavement in accordance with Section 32 12 16 - Asphalt Paving.

.6 Provide and maintain road access and egress to property fronting along Work under Contract and in other areas as indicated, except where other means of road access exist that meet approval of Owner and AHJ.

1.5 INFORMATION AND WARNING DEVICES

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

.2 Supply and erect signs, delineators, barricades and miscellaneous warning devices to Ontario Traffic Manual, Book 7: Temporary Conditions.

.3 Place signs and other devices in locations recommended in Ontario Traffic Manual, Book 7: Temporary Conditions.

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

.5 Continually maintain traffic control devices in use:

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

.2 Remove or cover signs which do not apply to conditions existing from day to day.

1.6 CONTROL OF PUBLIC TRAFFIC

.1 Provide competent flag personnel, trained in accordance with, and properly equipped to Ontario Traffic Manual, Book 7: Temporary Conditions for situations as follows:

.1 When public traffic is required to pass working vehicles or equipment that block all or part of travelled roadway.

.2 When it is necessary to institute one-way traffic system through construction area or other blockage where traffic volumes are heavy, approach speeds are high and traffic signal system is not in use.

.3 When workmen or equipment are employed on travelled way over brow of hills, around sharp curves or at other locations where oncoming traffic would not otherwise have adequate warning.

.4 Where temporary protection is required while other traffic control devices are being erected or taken down.

.5 For emergency protection when other traffic control devices are not readily available.

.6 In situations where complete protection for workers, working equipment and public traffic is not provided by other traffic control devices.

.7 At each end of restricted sections where pilot cars are required.

.8 Delays to public traffic due to contractor’s operators: 15 minutes maximum.

.2 Where roadway, carrying two-way traffic, is restricted to one lane, for 24 hours each day, provide portable traffic signal system.

.1 Adjust, as necessary, and regularly maintain system during period of restriction.

.2 Ensure signal system meets requirements of Ontario Traffic Manual, Book 7: Temporary Conditions.

1.7 OPERATIONAL REQUIREMENTS

.1 Maintain existing conditions for traffic throughout period of contract except that, when required for construction under contract and when measures have been taken as specified and approved by Owner and AHJ to protect and control public traffic, existing conditions for traffic to be restricted.

.2 Maintain existing conditions for traffic crossing right-of-way.

2 Products

NOT USED

3 Execution

NOT USED

END OF SECTION

1 GENERAL

1.01 REFERENCE STANDARDS

.1 Canadian Construction Documents Committee (CCDC)

.1 CCDC 2-2020, Stipulated Price Contract.

.2 Canadian General Standards Board (CGSB)

.1 CGSB 1.59-[97], Alkyd Exterior Gloss Enamel.

.2 CAN/CGSB 1.189-[00], Exterior Alkyd Primer for Wood.

.3 CSA Group (CSA)

.1 CSA-O121-[M1978(R2003)], Douglas Fir Plywood.

1.02 RELATED REQUIREMENTS

.1 Section 01 14 00 – Work Restrictions

.2 Section 01 52 00 – Construction Facilities

.3 Section 01 55 26 – Traffic Controls

.4 Section 01 57 00 – Temporary Controls.

.5 Section 01 74 00 – Cleaning

.6 Section 01 74 19 – Waste Management and Disposal.

1.03 INSTALLATION AND REMOVAL

.1 Provide temporary controls in order to execute Work expeditiously.

.2 Remove from site all such work after use.

1.04 HOARDING

.1 Unless otherwise specified, erect temporary site enclosures using self-supporting 1.8m high metal fence. Provide lockable truck gate(s). Maintain fence in good repair.

.2 Provide barriers around trees and plants designated to remain. Protect from damage by equipment and construction procedures.

1.05 GUARD RAILS AND BARRICADES

.1 Provide secure, rigid guard rails and barricades as required by applicable Laws, codes and governing authorities.

1.06 WEATHER ENCLOSURES

.1 Provide weather tight closures to unfinished door and window openings, and other openings in floors and roofs.

.2 Close off floor areas where walls are not finished; seal off other openings; enclose building interior work for temporary heat.

.3 Design enclosures to withstand wind pressure and snow loading.

1.07 DUST TIGHT SCREENS

.1 Provide dust tight screens or insulated partitions to localize dust generating activities, and for protection of workers, finished areas of Work and public.

.2 Maintain and relocate protection until such Work is complete.

1.08 ACCESS TO SITE

.1 Provide and maintain access roads, sidewalk crossings, ramps and construction runways as may be required for access to Work.

1.09 PUBLIC TRAFFIC FLOW

.1 Provide and maintain competent signal flag operators, traffic signals, barricades and flares, lights, or lanterns as required to perform Work and protect public.

.2 Ensure public use of operational facilities is protected appropriately. Reference section 01 14 00 – Work Restrictions, for details of operational facilities.

1.10 FIRE ROUTES

.1 Maintain access to property including overhead clearances for use by emergency response vehicles.

1.11 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY

.1 Protect surrounding private and public property from damage during performance of Work.

.2 Be responsible for damage incurred.

1.12 PROTECTION OF FINISHES

.1 Provide protection for finished and partially finished finishes and equipment during performance of Work.

.2 Provide necessary screens, covers, and hoardings.

.3 Confirm with the Owner locations and installation of protection of finishes five (5) Working Days prior to installation.

.4 Be responsible for damage incurred due to lack of or improper protection.

1.13 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for recycling in accordance with Sections 01 74 00 – Cleaning and 01 74 19 – Waste Management and Disposal.

END OF SECTION

1 GENERAL

1.01 SUMMARY

.1 This Specification covers the requirements for temporary controls of soil erosion and sediment loss, control of pests, control of pollution entering the soil, prevention of pollution in stormwater, control of site dust, and site security.

1.02 REFERENCE STANDARDS

.1 Canadian Construction Documents Committee (CCDC)

.1 CCDC 2-2020, Stipulated Price Contract.

.2 The Contractor shall complete all Work relevant to this section in accordance with Ontario Provincial Standard Specification (OPSS):

.1 OPSS.PROV 804 – TEMPORARY EROSION CONTROL

.2 OPSS.PROV 805 – TEMPORARY SEDIMENT CONTROL

.3 Sections – Measurement for Payment and Basis of Payment are not used.

1.03 TEMPORARY PEST CONTROL

.1 Perform pest control to minimize attraction and harboring of rodents, insects, and other pests. Perform extermination and control procedures at regular intervals.

.2 Project shall be free of pests and their residues at Substantial Performance of the Work.

.3 Perform pest control in accordance with integrated pest management principles with no hazardous or toxic substances released into stormwater or environment.

1.04 TEMPORARY ENVIRONMENTAL CONTROL

.1 Use construction methods that comply with environmental regulations and minimize possible air, waterway, and subsoil contamination and pollution.

.2 Meetings: Train persons on equipment fueling, spill prevention and response, good housekeeping protocols, material handling, and waste material handling before their first day on site.

.3 Management:

.1 Monitor and repair leaks of polluting liquids on vehicles. Prevent leaks of antifreeze, brake fluid, diesel fuel, gasoline, oil, transmission fluid, and other liquids that may be harmful to the environment or storm drainage systems.

.2 Store petroleum products in clearly labelled sealed containers. Provide spill kits and impermeable tarps at fueling and maintenance areas.

.3 Supply a collection skid or similar material for waste materials.

.4 Tightly seal and store paint containers, sealers, and curing compounds in a protected location when not required. Prevent excess materials from discharging into storm drainage system.

.5 Prevent concrete trucks from discharging surplus concrete or drum wash water on site.

.6 Place absorbent materials to soak up excess form release agents. Replace absorbent materials when saturated.

.7 When applying fertilizer, minimize the discharge of pollutants into stormwater.

1.05 TEMPORARY SITE DUST CONTROL

.1 Provide measures to prevent airborne dust to adjacent properties and walkways

according to requirements of AHJ and meeting requirements of authority having jurisdiction, including but not limited to the local municipality.

.2 Create and implement a site-specific dust control plan.

.3 Dust Control Windbreaks: Geotextile fabric attached to snow or temporary site fencing with fence posts and tie wires. Other measures will be considered.

.4 If surface water taking in excess of 50,000 L/day is required for dust suppression or other activities, the contractor is to prepare an Environmental Activity and Sector Registry (EASR) as outlined in Ontario Regulation 63/16 (O. Reg.), made under the Environmental Protection Act, Registrations Under Part 11.2 of the Act – Water Taking.

1.06 TEMPORARY SECURITY

.1 Temporary Site Security:

.1 Site Fencing: Before beginning excavation and before construction activities begin, provide temporary site enclosure fencing with lockable gates to prevent unauthorized access.

.2 Extent of Fencing: To enclose entire Project site or a portion sufficient to accommodate construction activities as indicated on Drawings.

.3 Distribute gate keys to authorized personnel only. Supply Owner with one set of keys.

.2 Temporary Building Security:

.1 Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized access, vandalism, theft, and similar security violations.

.2 Distribute building entrance keys to authorized personnel only. Supply Owner with one set of keys.

1.07 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit information in accordance with Section 01 33 00 - Submittal Procedure.

.2 Submit the following:

.1 Stormwater Pollution Control Plan (SWPCP): Submit SWPCP indicating methods, plans, and details of controls including:

.1 SWPCP coordinator information and their responsibilities

.2 Stormwater pollution prevention team to assist in implementation of SWPCP during construction

.3 Description of existing site conditions, including:

.1 existing land use of the site, such as wooded areas, grassed areas, pavements, buildings, and other structures,

.2 location of surface waters on or adjacent to Project site, such as lakes, ponds, rivers, streams, wetlands, and similar water features,

.3 soil types on Project site,

.4 water bodies that will receive site runoff, including the eventual main body of water that receives stormwater, and

.5 drainage areas and potential stormwater contaminants.

.4 Stormwater management controls and various Best Management Practices required to reduce erosion, sediment, and pollutants in stormwater discharge.

.5 Proposed waste water management equipment and materials.

.6 Facility monitoring plan and how controls will be coordinated with construction activities.

.7 Schedule and allowances to amend the plan if required.

.8 Sample inspection log.

.2 Erosion and Sedimentation Control Plan:

.1 Submit drawings indicating location of erosion and dust control methods,

.2 Describe methods for maintaining, cleaning and repairing erosion and dust control methods, and

.3 Submit product data indicating actual materials including:

.1 Measures used to prevent soil loss by stormwater runoff and wind erosion.

.2 Methods used to protect soil stockpiles and berms.

.3 Methods used to prevent loss of sediment into storm sewers or adjacent waterways.

.4 Methods to prevent site dust and particulate matter pollution.

3 During the course of work, submit detailed digital photographs indicating temporary sediment and erosion control measures.

.4 Site Quality Control Submittals: Submit logs of inspection and maintenance of control measures.

2 PRODUCTS

2.1 REGULATORY REQUIREMENTS

.1 Protect storm sewers and roadways in accordance with local municipal requirements.

.2 Protect waterways and ground water in accordance with AHJ.

.3 The Contractor is notified of the presence of existing utilities within Project limits, including but not limited to Bell, North Bay Hydro, Enbridge, Hydro One, Northern Ontario Wire. Care shall be taken during construction operations to avoid damages to the existing utilities. The Contractor shall provide protection and/or support to all existing utilities as required to facilitate their construction operations. The Contractor shall familiarize themselves with utility plans prior to undertaking works in these locations.

3 EXECUTION

3.1 CLOSEOUT ACTIVITIES

.1 Remove temporary control measures shortly before Substantial Performance of the Work or when acceptable to the Owner.

.2 Restore landscape areas that were damaged by temporary control measures.

3.2 MAINTENANCE

.1 Inspection and Maintenance:

.1 Inspect, repair, and maintain temporary control measures during construction.

.2 Inspect control measures weekly to prevent unwanted situations such as odours, mosquitoes, and weeds. Confirm control measures are working properly. Repair or replace when required.

.3 Repair silt fences and erosion control fabric when damaged.

.4 Perform non-routine inspection and maintenance arising from unplanned incidents such as repairs after severe weather and accidental damage.

.5 Record each inspection and maintenance event in a daily log. Keep a copy of logs at the Project site. Maintain permanent file of logs until final acceptance of the Work.

END OF SECTION

1 GENERAL

1.01 REFERENCE STANDARDS

.1 Canadian Construction Documents Committee (CCDC)

.1 CCDC 2-2020, Stipulated Price Contract.

1.02 RELATED REQUIREMENTS

.1 Section 01 11 00 - Summary Of Work.

.2 Section 01 45 00 - Quality Control.

.3 Section 01 73 00 – Execution.

1.03 QUALITY

.1 Products, materials, equipment and articles incorporated in Work shall be new, not damaged or defective, and of best quality for purpose intended. If requested, furnish evidence as to type, source and quality of Products provided.

.2 Procurement policy is to acquire, in cost effective manner, items containing highest percentage of recycled and recovered materials practicable consistent with maintaining satisfactory levels of competition. Make reasonable efforts to use recycled and recovered materials in execution of Work.

.3 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.

.4 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.

.5 Unless otherwise indicated in Specifications, maintain uniformity of manufacture for any particular or like item.

.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.

1.04 AVAILABILITY

.1 Immediately upon signing Contract, review Product delivery requirements and anticipate foreseeable supply delays for items. If delays in supply of Products are foreseeable, notify the Consultant of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.

.2 In event of failure to notify the Consultant at commencement of Work and should it subsequently appear that Work may be delayed for such reason, the Owner reserves right to substitute more

readily available products of similar character, at no increase in Contract Price or Contract Time.

1.05 STORAGE, HANDLING AND PROTECTION

.1 Handle and store Products in a 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, etc. 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 the Consultant.

.9 Touch-up damaged factory finished surfaces at own expense and to the Consultant satisfaction. Use touch-up materials to match original. Do not paint over name plates.

1.06 TRANSPORTATION

.1 Pay costs of transportation of Products required in performance of Work, unless otherwise specified.

.2 Transportation cost of Products Supplied By Others will be paid for by the Owner. Unload, handle, store and protect such Products.

1.07 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 the Consultant in writing, of conflicts between Specifications and manufacturer's instructions, so that the Consultant will establish course of action.

.3 Improper installation or erection of Products, due to failure in complying with these requirements, authorizes the Consultant to require removal and re-installation at no increase in Contract Price or Contract Time.

1.08 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 the Consultant if required Work is such as to make it impractical to produce required results.

.2 Do not employ anyone unskilled in their required duties. The Owner and the Consultant reserve the 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 the Consultant, whose decision is final.

1.09 CO-ORDINATION

.1 Ensure co-operation of workers in laying out Work. Maintain efficient and continuous supervision.

.2 Be responsible for coordination and placement of openings, sleeves and accessories.

.3 Co-ordinate with the Consultant delivery times. Ensure to provide sufficient notices for large deliveries that may impact traffic or block roads.

1.10 CONCEALMENT

.1 In finished areas conceal pipes, ducts and wiring in floors, walls and ceilings, except where indicated otherwise.

.2 Before installation, inform the Consultant if there is interference. Install as directed by the Consultant.

1.11 REMEDIAL WORK

.1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Co-ordinate adjacent affected Work as required.

.2 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of Work.

1.12 LOCATION OF FIXTURES

.1 Consider location of fixtures, outlets, and mechanical and electrical items indicated as approximate.

.2 Inform the Consultant of conflicting installation and propose alternative solution for Acceptance.

1.13 FASTENINGS

.1 Provide metal fastenings and accessories in same texture, colour and finish as adjacent materials, unless indicated otherwise.

.2 Prevent electrolytic action between dissimilar metals and materials.

.3 Use non-corrosive hot dip galvanized steel fasteners and anchors for securing exterior work, unless stainless steel or other material is specifically requested in affected specification Section.

.4 Space anchors within individual load limit or shear capacity and ensure they provide positive permanent anchorage. Wood, or any other organic material plugs are not acceptable.

.5 Keep exposed fastenings to a minimum, space evenly and install neatly.

.6 Fastenings which cause spalling or cracking of material to which anchorage is made are not acceptable.

1.14 FASTENINGS - EQUIPMENT

.1 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.

.2 Unless otherwise specified, use heavy hexagon heads, semi-finished. 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.

1.15 PROTECTION OF WORK IN PROGRESS

.1 Prevent overloading of parts of building or structures. Do not cut, drill or sleeve load bearing structural member, unless specifically indicated without written approval of the Consultant.

1.16 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, [and/or building occupants] [and pedestrian and vehicular traffic].

.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.

END OF SECTION

1 GENERAL

1.01 REFERENCE STANDARDS

.1 Canadian Construction Documents Committee (CCDC)

.1 CCDC 2-2020, Stipulated Price Contract.

1.02 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 45 00 – Quality Control.

1.03 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit the following before Work begins at the Place of Work:

.1 Service locations: Document locations and extents of service lines in work areas.

.3 Submit the following informational submittals as Work progresses:

.1 Land Survey information: Name address, and registration information.

.4 Submit documentation that verifies accuracy of site engineering work when requested by the Consultant.

.5 Submit certificate signed by surveyor indicating elevations and locations of completed Work that conform to Contract Documents and those that do not conform.

1.04 QUALIFICATIONS

.1 Surveyor: Qualified, registered land surveyor, licensed to practice at the Place of the Work, and acceptable to the Consultant.

1.05 SETTING OUT OF WORK

.1 Survey existing conditions and correlate with all requirements indicated in the Specifications.

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

.3 Provide devices needed to lay out and construct work.

.4 Review existing conditions and identify, in writing to the Consultant, any conditions that differ materially from those indicated in the Contract Documents.

1.06 RECORDS

.1 Maintain a complete, accurate log of control and survey work as Work progresses.

.2 On completion of foundations and major site improvements, prepare a certified survey showing

dimensions, locations, angles, and elevations of Work. Keep copies available at the job site with other progress documentation. Submit to the Consultant at request.

.3 Record locations of maintained, re-routed, and abandoned service lines.

.4 Provide a final survey of building and structure location, surrounding grades as affected by the Work and buried utilities.

1.07 SUBSURFACE CONDITIONS

.1 Promptly notify the Consultant in writing if subsurface conditions at Place of Work differ materially from those indicated in Contract Documents, or a reasonable assumption of probable conditions based thereon.

.2 After prompt investigation, should the Consultant determine that conditions do differ materially, instructions will be issued by the Owner for changes in Work as provided in Changes and Change Orders.

1.08 LOCATION OF EQUIPMENT AND FIXTURES

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

.2 Employ competent person to lay out Work in accordance with the Contract Documents.

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

.4 Submit Shop Drawings which indicate relative position of various services and equipment to the Consultant for review and Acceptance. Contractor is responsible for coordination of all equipment and services before installation.

2.01 NOT USED

.1 Not Used.

3.01 EXAMINATION REQUIREMENTS

.1 Verification of Conditions:

.1 Verify that substrate and other conditions are acceptable for installation of materials, assemblies, and systems in accordance with manufacturer’s instructions and recommendations.

.2 Inspect existing conditions, including elements subject to damage or movement during cutting and patching.

.3 After uncovering, inspect conditions affecting performance of Work.

.4 Examine conditions, with installers, for defects affecting performance of the Work. Where Work of one Section depends on Work of other Sections being properly completed, verify

that Work is complete and suitable to receive the subsequent work.

.5 Proceed with installation only after unacceptable conditions are remedied.

.6 Proceeding with cutting, patching, or installation will be considered Contractor's acceptance of existing conditions.

.2 Existing Services:

.1 Confirm locations and extent of service lines in area of Work before beginning work on site. Submit findings.

.2 Immediately notify the Consultant if unknown services are encountered. Confirm findings in writing.

.3 Remove abandoned service lines within 2 m of structures. Cap or seal lines at cut-off points as indicated on Drawings.

.3 Pre-Installation Testing:

.1 Perform manufacturer-recommended pre-installation site test of substrate and submit to the Consultant a report of test results indicating whether test results meet the manufacturer's minimum requirements and recommendations.

.4 Evaluation and Assessment:

.1 Verify that pre-existing substrate conditions are acceptable for installation of materials, assemblies, and systems in accordance with manufacturer's instructions and recommendations.

.2 Proceed with installation only after unacceptable conditions are remedied. The remedial work will be completed by the Contractor to the satisfaction of the Consultant. Cost of such remedial work shall be as per Contract Documents.

3.02 PREPARATION

.1 Protection of In-Place Conditions:

.1 Provide supports to ensure structural integrity of surroundings. Provide devices and methods to protect other portions of Project from damage.

.2 Provide protection from weather and other potentially damaging conditions at areas which will be exposed when uncovering work. Maintain excavations free of water.

.2 Perform surface preparation in compliance with Contract Documents.

.3 Survey Reference Points:

.1 Locate and confirm reference points before starting site Work. Protect permanent reference points during construction.

.2 Changes or relocations should not be made without prior written notice to the Consultant.

.3 Notify the Consultant if a reference point is lost or destroyed.

.4 Surveyor to replace reference points in accordance with original land survey.

.5 Notify the Consultant if a reference point requires relocation because of necessary changes in grades or locations.

.4 Survey Requirements:

.1 Unless otherwise indicated in Specifications, establish minimum two permanent benchmarks on site, referenced to established benchmarks by survey reference points. Record locations with horizontal and vertical data in Project As-Built Record Drawings.

.2 Establish lines and levels, location and layout, by instrumentation.

.3 Stake for grading, fill and topsoil placement and landscaping features.

.4 Stake slopes and berms.

.5 Establish pipe invert elevations.

.6 Stake batter boards for foundations.

.7 Establish foundation column locations and floor elevations.

.8 Establish lines and levels for mechanical and electrical work.

.5 If Contractor is found to be in error, all costs incurred to correct condition shall be assumed by the Contractor, unless otherwise specified in Contract Documents.

END OF SECTION

1 GENERAL

1.01 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.

1.02 REFERENCE STANDARDS

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

1.03 RELATED REQUIREMENTS

.1 Section 01 14 00 – Work Restrictions

.2 Section 01 33 00 - Submittal Procedures.

.3 Section 01 45 00 – Quality Control.

1.04 ACTION AND INFORMATIONAL 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 in advance of 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 Province of Ontario, Canada for the Consultant review and Acceptance. Include evidence of unsatisfactory structural integrity of the elements according to the Consultant.

.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 Owner or other contractor(s).

.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 for each Place of the Work indicating relative location of various services and equipment upon the request of the Consultant.

.6 Submit a work plan for review and Acceptance 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 specific description of reinstatement activities following completion of the Work.

.4 the effect of cutting or altering on work by Owner or other contractors;

.5 written acknowledgment by other contractors affected by cutting or altering, if applicable; and

.6 proposed date(s) and time(s) Work will be executed.

1.05 QUALIFICATIONS

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

2 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 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 the Consultant in writing, of conflicts between Specifications and manufacturer's instructions, so that the Consultant can establish course of action.

.5 Improper installation or erection of Products, due to failure in complying with these requirements, authorizes the Consultant 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 as 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 in Specifications are approximate.

.2 Notify the Consultant of impending installation and obtain Acceptance 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 or 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 are not acceptable.

3.03 CUTTING AND PATCHING

.1 Proceed with cutting and patching only after the review and Acceptance by the Consultant of all Submittals listed in Article 1.03, Actions and Informational Submittals.

.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 the Consultant.

.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 the Consultant.

END OF SECTION

1 GENERAL

1.01 REFERENCE STANDARDS

.1 Canadian Construction Documents Committee (CCDC)

.1 CCDC 2-2020, Stipulated Price Contract.

1.02 PROJECT CLEANLINESS

.1 Maintain Place of the Work in tidy condition, free from accumulation of waste material and debris.

.2 Remove waste materials from site at daily regularly scheduled times or dispose of as directed by the Consultant.

.3 Do not burn waste materials on site.

.4 Clear snow and ice from access to Place of the Work, bank/pile snow in designated areas only approved by Owner, or remove from site, as agreed upon at outset of Contract.

.5 Make arrangements with and obtain permits from Authorities Having Jurisdiction (AHJ) for disposal of waste and debris.

.6 Provide on-site steel containers for collection of waste materials and debris.

.7 Provide and use marked separate bins for recycling. Refer to Section 01 74 19 - Waste Management and Disposal.

.8 Dispose of waste materials and debris at appropriate off-site facilities.

.9 Clean interior areas prior to start of finishing Work and maintain areas free of dust and other contaminants during finishing operations.

.10 Store volatile waste in covered metal containers and remove from premises at end of each Working Day, unless authorized otherwise by the Consultant.

.11 Provide adequate ventilation during use of volatile or noxious substances. Use of existing or new ventilation systems is not permitted for this purpose.

.12 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.

.13 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate new or existing systems or facilities.

1.03 FINAL CLEANING

.1 When Work is Substantially Performed remove surplus Products, tools, Construction Equipment not required for performance of remaining Work.

.2 Remove waste products and debris other than that caused by others and leave Place of the Work clean and suitable for occupancy.

.3 Prior to final review, remove remaining surplus Products, tools and Construction Equipment.

.4 Remove waste materials from site at regularly scheduled times or dispose of as directed by Owner or the Consultant.

.5 Do not burn waste materials on site.

.6 Make arrangements with and obtain permits from Authorities Having Jurisdiction (AHJ) for disposal of waste and debris.

.7 Clean and polish glass, mirrors, hardware, wall tile, stainless steel, chrome, porcelain enamel, baked enamel, plastic laminate, wood, and mechanical and electrical fixtures. Replace broken, scratched or disfigured glass.

.8 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fitments, walls, floors and ceilings, and at exterior of building.

.9 Clean lighting reflectors, lenses, and other lighting surfaces.

.10 Vacuum, clean, and dust 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 and sweep roofs, gutters, areaways, and sunken wells.

.16 Sweep and wash clean paved areas.

.17 Clean equipment and fixtures to sanitary condition; clean or replace filters of mechanical equipment.

.18 Clean roofs, downspouts, and drainage systems.

.19 Remove debris and surplus materials from crawl areas and other accessible concealed spaces.

.20 Remove snow and ice from access to Place of the Work.

1.04 WASTE MANAGEMENT AND DISPOSAL

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

END OF SECTION

1 GENERAL

1.01 SUMMARY

.1 The Project shall generate the least amount of waste possible. Contractor shall implement processes to ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors be employed by the Contractor.

1.02 REFERENCE STANDARDS

.1 Canadian Construction Documents Committee (CCDC)

.1 CCDC 2-2020, Stipulated Price Contract.

.2 ASTM International (ASTM)

.1 ASTM E1609 01, Standard Guide for Development and Implementation of a Pollution Prevention Program

1.03 DEFINITIONS

.1 Clean Waste: Untreated and unpainted; not contaminated with oils, solvents, sealants or similar materials.

.2 Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, re-modeling , repair and demolition operations.

.3 Hazardous: Exhibiting the characteristics of hazardous substances including properties such as ignitability, corrosiveness, toxicity, or reactivity.

.4 Non-hazardous: Exhibiting none of the characteristics of hazardous substances, including properties such as ignitability, corrosiveness, toxicity, or reactivity.

.5 Non-toxic: Not poisonous to humans either immediately or after a long period of exposure.

.6 Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.

.7 Recycle: To remove a waste material from the Project site to another site for remanufacture into a new product for reuse by others.

.8 Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form; recycling does not include burning, incinerating, or thermally destroying waste.

.9 Return: To give back reusable items or unused products to vendors for credit.

.10 Reuse: To reuse a construction waste material in some manner on the Project site.

.11 Salvage: To remove a waste material from the Project site to another site for resale or reuse by others.

.12 Sediment: Soil and other debris that has been eroded and transported by storm or well production run off water.

.13 Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.

.14 Toxic: Poisonous to humans either immediately or after a long period of exposure.

.15 Trash: Any product or material unable to be reused, returned, recycled, or salvaged.

.16 Volatile Organic Compounds (VOC's): Chemical compounds common in and emitted by many building products over time through outgassing:

.1 Solvents in paints and other coatings;

.2 Wood preservatives; strippers and household cleaners;

.3 Adhesives in particleboard, fiberboard, and some plywood; and foam insulation.

.4 When released, VOC's can contribute to the formation of smog and can cause respiratory tract problems, headaches, eye irritations, nausea, damage to the liver, kidneys, and central nervous system, and possibly cancer.

.17 Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

1.04 RELATED REQUIREMENTS

.1 Section 01 31 19 - Project Meetings

.2 Section 01 33 00 - Submittal Procedures

.3 Section 01 51 00 - Temporary Utilities

.4 Section 01 74 00 – Cleaning.

1.05 ADMINISTRATIVE REQUIREMENTS

.1 Coordination: Coordinate waste management requirements with all divisions of the Work for the Project and ensure that requirements of the Waste Management Plan (WMP) are followed.

.2 Preconstruction Meeting: During the pre-construction meeting arranged in accordance with Section 01 31 19 - Project Meetings, discuss the Contractor's Waste Management Plan and to develop mutual understanding of the requirements for a consistent policy towards waste reduction and recycling.

1.06 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit required information in accordance with Section 01 33 00 - Submittal Procedures.

.2 Action Submittals: Provide the following Submittals for Acceptance before starting any Work of this section:

.1 WMP: Submit to the Consultant for review a draft WMP including a preliminary analysis of

anticipated site-generated waste by listing a minimum of five (5) construction or demolition waste streams that have potential to generate the most volume of material indicating methods that will be used to divert construction waste from landfill and source reduction strategies. The Owner and the Consultant may provide comments within five (05) Working Days. Update as required and resubmit to the Consultant the final WMP for Acceptance within (05) Working Days.

.2 WMP shall include, but not limited to:

.1 Material Streams: Analysis of the proposed jobsite waste being generated, including material types and quantities forming a part of identified material streams in the WMP materials removed from site destined for alternative daily cover at landfill sites and land clearing debris cannot be considered as contributing to waste diversion and will be included as a component of the total waste generated for the site.

.2 Recycling Haulers and Markets: Investigate local haulers and markets for recyclable materials, and incorporate into WMP.

.3 Alternative Waste Disposal: Prepare a listing of each material proposed to be salvaged, reused, recycled or composted during the course of the Project, and the proposed local market for each material.

.4 Landfill Materials: materials that cannot be recycled, reused or composted.

.5 Landfill Options: The name of the landfill where trash will be disposed of; landfill materials will form a part of the total waste generated by the Project.

.6 Materials Handling Procedures: A description of the means by which any recycled waste materials will be protected from contamination, and a description of the means to be employed in recycling the above materials consistent with requirements for acceptance by designated facilities.

.7 Transportation: A description of the means of transportation of the recyclable materials, whether materials will be site separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler and removed from the site, and destination of materials.

1.07 PROJECT CLOSEOUT SUBMITTALS

.1 Diversion Documentation: Submit as constructed information in accordance with Section 01 78 00 - Closeout Submittals as follows:

.1 Waste Management Report: Submit for this Project in a format acceptable to submittal requirements and that includes the following information:

.1 Accounting: Submit information indicating total waste produced by the Project.

.2 Composition: Submit information indicating types of waste material and quantity of each material.

.3 Diversion Rate: Submit information indicating total waste diverted from landfill as a

percentage of the total waste produced by the Project.

.4 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.

1.08 DELIVERY, STORAGE, AND HANDLING

.1 Storage Requirements: Implement a recycling/reuse program that includes separate collection of waste materials as appropriate to the Project waste and the available recycling and reuse programs in the Project area.

.1 Provide separate containers for reusable and/or recyclable materials such as:

.1 Metals.

.2 Wood.

.3 Plastics

.2 Handling Requirements: Clean materials that are contaminated before placing in collection containers and ensure that waste destined for landfill does not get mixed in with recycled materials:

.1 Deliver materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to recycling process.

.2 Arrange for collection by or delivery to the appropriate recycling or reuse facility.

.3 Hazardous Waste and Hazardous Materials: Handle in accordance with applicable regulations.

2.01 NOT USED

.1 Not Used.

3.01 WASTE MANAGEMENT PLAN IMPLEMENTATION

.1 Contractor is responsible for designating an on-site party or parties responsible for instructing workers and overseeing and documenting results of the WMP for the Project.

.2 Distribute copies of the WMP to the job site foreman, each Subcontractor, the Owner, the Consultant and other site personnel as required to maintain WMP.

.3 Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, composting and return methods being used for the Project to employees and Subcontractors at appropriate stages of the Project.

.4 Layout and label a specific area to facilitate separation of materials for potential recycling, salvage, reuse, composting and return:

.1 Recycling and waste bin areas are to be kept neat and clean and clearly marked in order to avoid contamination of materials.

.2 Hazardous wastes shall be separated, stored, and disposed of in accordance with local

regulations.

.5 Submit to the Consultant a monthly summary of waste generated by the Project including details of waste diverted for recycling:

.1 Submittal of waste summary can coincide with application for progress payment, or similar milestone event as agreed upon between the Owner and the Contractor.

.2 Monthly waste summary shall contain the following information:

.1 The amount in tonnes or m 3 and location of material landfilled,

.2 The amount in tonnes or m 3 and location of materials diverted from landfill, and

.3 Indication of progress based on total waste generated by the Project with materials diverted from landfill as a percentage.

3.02 CONTRACTOR'S RESPONSIBILITY

.1 Subcontractors shall cooperate fully with the Contractor to implement the WMP.

.2 The Contractor shall be responsible for all additional costs incurred by the Owner and the Contractor arising from the failure to comply with the WMP.

END OF SECTION

1.01 GENERALREFERENCE STANDARDS

.1 Canadian Construction Documents Committee (CCDC)

.1 CCDC 2-2020, Stipulated Price Contract.

1.02 ADMINISTRATIVE REQUIREMENTS

.1 Acceptance of Work Procedures:

.1 Contractor's Inspection: conduct inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.

.1 Notify the Consultant in writing of satisfactory completion of Contractor's inspection and submit verification that corrections have been made.

.2 Request the Owner inspection.

.2 The Owner Inspection:

.1 The Owner, the Consultant and the Contractor will inspect the Work and identify defects and deficiencies.

.2 Contractor to correct Work as directed.

.3 Completion Tasks: submit written certificates in English that tasks have been performed as follows:

.1 Work: completed and inspected for compliance with Contract Documents.

.2 Defects: corrected and deficiencies completed.

.3 Equipment and systems: tested, adjusted and balanced and fully operational.

.4 Certificates required by Authority Having Jurisdiction submitted and approved.

.5 Operation of systems: demonstrated to Owner's personnel.

.6 Commissioning of equipment and systems: completed in accordance with 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS and copies of final Commissioning Report submitted to the Consultant.

.7 Apply for certification of Substantial Performance of the Work and Ready-For-Takeover in accordance with the Contract Documents.

.8 Submit all Close-Out Documentation described in GC 5.5.1.2.and section 01 78 00 – Closeout Submittals

.9 Work: complete and ready for final inspection.

.4 Final Inspection:

.1 When completion tasks are done, request final inspection of Work by the Owner and the Consultant.

.2 When Work is incomplete according to the Owner or the Consultant, complete outstanding items and request re-inspection.

1.03 FINAL CLEANING

.1 Clean in accordance with Section 01 74 00 - Cleaning.

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

.2 Waste Management: separate waste materials for recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION

1 GENERAL

1.01 REFERENCE STANDARDS

.1 Canadian Construction Documents Committee (CCDC)

.1 CCDC 2-2020, Stipulated Price Contract.

1.02 SUMMARY

.1 Comply with the requirements of this section and other related sections. When the Project is being completed at multiple sites, the requirements shall be met at each location as applicable.

1.03 ADMINISTRATIVE REQUIREMENTS

.1 Pre-warranty Meeting:

.1 Convene meeting with the Owner and the Consultant, in accordance with Section 01 31 19 - Project Meetings to:

.1 Verify Project requirements.

.2 Review manufacturer's installation instructions and warranty requirements.

.3 Establish communication procedures for:

.1 Notifying construction warranty defects.

.2 Determine priorities for type of defects.

.3 Determine reasonable response time.

.2 Contact information for bonded and licensed company for warranty work action: provide name, telephone number and address of company authorized for construction warranty work action.

.3 Ensure contact is located within local service area of warranted construction, is continuously available, and is responsive to inquiries for warranty work action.

1.04 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit to the Consultant for review and Acceptance the operating and maintenance manual (in English). Schedule the Submittal such that Acceptance is received prior to the commencement of training of O&M personnel.

.3 Following completion of training of operations and maintenance personnel, provide four hard (4) copies and an electronic copy in PDF format of finalized operations and maintenance manual.

.4 Provide spare parts, maintenance materials and special tools of same quality and manufacture as Products provided in Work.

.5 Provide evidence, if requested, for type, source and quality of Products supplied.

.6 Provide a complete set of As-Built Record Drawings sealed by an engineer licensed in the province

of Ontario.

.7 Provide all other required Closeout Documentation in accordance with the Contract Documents.

1.05 OPERATIONS AND MAINTENANCE MANUAL

.1 FORMAT

.1 Organize data as 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:

.1 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.

.1 Bind in with text; fold larger drawings to size of text pages.

.9 Provide CAD files in dwg format.

.2 CONTENTS

.1 Table of Contents for Each Volume: provide title of Project;

.1 Date of submission; names.

.2 Addresses, and telephone numbers of Consultant and Contractor with name of responsible parties.

.3 Schedule of Products and systems, indexed to content of volume.

.2 Include the following contents:

.1 As-Built Record Drawings

.2 Product data, and samples.

.3 Site test records.

.4 Inspection certificates.

.5 Manufacturer’s certificates.

.6 Inventory of spare parts, special tools and maintenance materials.

.7 Maintenance Management System (MMS) identification system used.

.8 WHMIS information.

.9 WHMIS Safety Data Sheets (SDS).

.10 Electrical Panel inventory containing a detailed inventory of electrical circuitry for each panel board. Duplicate of inventory inside each panel.

.11 Other documents as required and specified in other sections of Specifications.

.12 Provide digital photos, if requested, for site records.

.3 For each Product or system:

.1 List names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.

.4 Product Data: mark each sheet to identify specific Products and component parts, and data applicable to installation; delete inapplicable information.

.5 Provide a set of As-Built Record Drawings that accurately reflect as-constructed, as-built or as-fabricated Work and that have been sealed by a professional engineer licensed in the Province of Ontario.

.1 Provide hard copies within the operations and maintenance manuals and electronic copies in both native CAD format and PDF.
.2 Label each document “AS-BUILT RECORD” in neat, large, printed letters.

.6 Drawings: supplement Product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.

.7 Typewritten Text: As required to supplement Product data.

.1 Provide logical sequence of instructions for each procedure, incorporating manufacturer’s instructions.

.7 Label record documents and file in accordance with section number listings.

.8 Maintain record documents in clean, dry and legible condition.

.1 Do not use record documents for construction purposes.

.9 Keep record documents and samples available for inspection by the Owner and the Consultant.

.10 Specifications: 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.

. .11 Training: Refer to Section 01 79 00 - Demonstration and Training.

.3 EQUIPMENT AND SYSTEMS

.1 For each item of equipment and each system include description of unit or system, and component parts.

.2 Give function, normal operation characteristics and limiting conditions.

.3 Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.

.4 Panel board circuit directories: provide electrical service characteristics, controls, and communications.

.5 Include installed colour coded wiring diagrams.

.6 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences.

1. Include regulation, control, stopping, shut-down, and emergency instructions.
2. Include summer, winter, and any special operating instructions.

.7 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

.8 Provide servicing and lubrication schedule, and list of lubricants required.

.9 Include manufacturer's printed operation and maintenance instructions.

.10 Include sequence of operation by controls manufacturer.

.11 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

.12 Provide installed control diagrams by controls manufacturer.

.13 When applicable, provide Contractor's coordination drawings, with installed colour-coded piping diagrams.

.14 When applicable, provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

.15 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

.16 Include test and balancing reports as specified in Section 01 45 00 - Quality Control and Section 01 91 13 - General Commissioning Requirements.

.17 Additional requirements: As specified in individual Specification sections.

.4 MATERIALS AND FINISHES

.1 Building Products, applied materials, and finishes: Include Product data, with catalogue number, size, composition, and colour and texture designations.

.1 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.

.2 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.

.3 Additional requirements: As specified in individual Specifications sections.

1.06 FINAL SURVEY

.1 Submit final site survey certificate in accordance with Section 01 71 00 - Examination and Preparation, certifying that elevations and locations of completed Work are in conformance, or non-conformance with Contract Documents.

1.07 MAINTENANCE MATERIALS

.1 Spare Parts:

- .1 Provide spare parts, in quantities specified in individual Specification sections.
- .2 Provide items of same manufacture and quality as items in Work.
- .3 Deliver to site; place and store.
- .4 Receive and catalogue items.
  - .1 Submit inventory listing to the Consultant.
  - .2 Include approved listings in operation & maintenance manual.
- .5 Obtain receipt for delivered products and submit before final payment.

.2 Extra Stock Materials:

- .1 Provide maintenance and extra materials, in quantities specified in individual Specification sections.
- .2 Provide items of same manufacture and quality as items in Work.
- .3 Deliver to site; place and store.
- .4 Receive and catalogue items.
  - .1 Submit inventory listing to the Consultant.
  - .2 Include approved listings in operation & maintenance manual.
- .5 Obtain receipt for delivered Products and submit before final payment.

.3 Special Tools:

- .1 Provide special tools, in quantities specified in individual Specification section.
- .2 Provide items with tags identifying their associated function and equipment.
- .3 Deliver to site; place and store.
- .4 Receive and catalogue items.
  - .1 Submit inventory listing to the Consultant.
  - .2 Include approved listings in operation & maintenance manual.

1.08 DELIVERY, STORAGE, AND HANDLING

.1 Store, at a location agreed with the Consultant, spare parts, maintenance materials, and special

tools in a 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 to the satisfaction of the Owner and the Consultant.

1.09 WARRANTIES AND BONDS

.1 Develop warranty management plan to contain information relevant to warranties and extended warranties.

.2 Submit warranty management plan, twenty (20) Working Days before planned pre-warranty meeting, to the Consultant review and Acceptance.

.3 Warranty management plan to include required actions and documents to assure that the Owner receives all warranties to which it is entitled.

.4 Provide plan in narrative form and contain sufficient detail to make it suitable for use by future maintenance and repair personnel.

.5 Submit, warranty information made available during construction phase with each application for payment.

.6 Assemble approved information in binder, submit upon acceptance of Work and 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 (10) days after completion of applicable item of work.

.4 Verify that documents are in proper form, contain full information, and are notarized.

.5 Co-execute Submittals when required.

.6 Retain warranties and bonds until time specified for submittal.

.7 Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Early Occupancy or Ready-for-Takeover is verified.

.8 Conduct joint 04 month and 09 month warranty inspection, measured from date determined above in clause 1.14.7.

.9 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.

.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.

.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 Contractor's plans for attendance at 04 and 09 month post-construction warranty inspections.

.5 Procedure and status of tagging of equipment covered by extended warranties.

.6 Post copies of instructions near selected pieces of equipment where operation is critical for warranty and/or safety reasons.

.10 Respond in timely manner to oral or written notification of required construction warranty repair work.

.11 Written verification to follow oral instructions.

1.10 WARRANTY TAGS

.1 Tag, at time of installation, each warranted item. Provide durable, oil- and water-resistant tag approved by Owner.

.2 Attach tags with copper wire and spray with waterproof silicone coating.

.3 Leave date of Acceptance until Project is accepted for occupancy.

.4 Indicate the 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.

END OF SECTION

1 GENERAL

1.01 REFERENCE STANDARDS

.1 Canadian Construction Documents Committee (CCDC)

.1 CCDC 2-2020, Stipulated Price Contract.

1.02 ADMINISTRATIVE REQUIREMENTS

.1 Demonstrate scheduled operation and maintenance of equipment and systems to Owner's personnel before date of Substantial Performance of the Work.

.2 The Owner will provide a list of personnel to receive instructions and coordinate their attendance at agreed-upon times.

.3 Preparation:

.1 Verify conditions for demonstration and instructions comply with requirements.

.2 Verify that designated personnel are present.

.3 Ensure equipment has been inspected and put into operation in accordance with specified Contract Documents.

.4 Ensure testing, adjusting, and balancing have been performed in accordance with Section 01 91 13 - General Commissioning Requirements, and equipment and systems are fully operational.

.4 Demonstration and Instructions:

.1 Demonstrate start-up, operation, control, adjustment, troubleshooting, servicing, and maintenance of each item of equipment at agreed-upon times at the designated location.

.2 Instruct personnel in phases of operation and maintenance using operations and maintenance manuals as basis of instruction.

.3 Review contents of operations and maintenance manual in detail to explain aspects of operation and maintenance.

.4 Prepare and insert additional data in operations and maintenance manuals when needed during instructions.

.5 The amount of time to be provided for instruction of each item of equipment or system shall be agreed with the Owner in advance.

1.03 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit, for Acceptance, a plan including a schedule of times and dates for the demonstration of each item of equipment and each system. Ensure plan is submitted such that Acceptance is received two weeks before designated dates.

.3 Submit reports within one week after completion of demonstration, provided that demonstration

and instructions have been satisfactorily completed.

.4 Include in report time and date of each demonstration, with list of persons present.

.5 Provide sufficient copies of completed operations and maintenance manuals for use in demonstrations and instructions.

1.04 QUALITY ASSURANCE

.1 When specified in individual Sections requiring manufacturer to provide authorized representative to demonstrate operation of equipment and systems:

.1 Provide demonstration and training as per this section.

.2 Submit written report that demonstration and instructions have been completed.

END OF SECTION

1 GENERAL

1.01 SUMMARY

1.02 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.

1.03 REFERENCE STANDARDS

.1 Canadian Construction Documents Committee (CCDC)

.1 CCDC 2-2020, Stipulated Price Contract.

1.04 RELATED REQUIREMENTS

.1 Section 01 31 19 – Project Meetings

.2 Section 01 32 16.16 Construction Progress Schedule Critical Path Method

.3 Section 01 45 00 - Quality Control.

.4 Section 01 77 00 - Closeout Procedures.

.5 Section 01 78 00 - Closeout Submittals.

.6 Section 01 79 00 - Demonstration and Training.

.7 01 91 13.13 – Commissioning Plan

.8 01 91 13.16 – Commissioning Forms

1.05 ABBREVIATIONS

.1 AFD: Alternate Forms of Delivery, service provider

.2 Cx: Commissioning

.3 EMCS: Energy Monitoring and Control Systems

.4 O&M: Operations and Maintenance.

.5 PI: Product Information

.6 PV: Performance Verification

.7 TAB: Testing, Adjusting and Balancing.

1.06 ADMINISTRATIVE REQUIREMENTS

.1 Coordination:

.1 The Consultant will observe some or all commissioning activities at their discretion.

.2 Owner's Performance Testing: Performance testing of equipment or systems by the Owner or the Consultant will not relieve Contractor from compliance with specified start-up and testing procedures.

.3 Cooperate fully with the Owner and the Consultant during stages of Acceptance and Ready-for-Takeover.

.4 Coordination with Authorities Having Jurisdiction (AHJ):

.1 Where specified start-up, testing or commissioning procedures duplicate verification requirements of AHJ, arrange for AHJ to witness procedures to avoid duplication of tests and to facilitate an earlier acceptance of equipment or facility.

.2 Obtain certificates of approval, acceptance, and compliance with rules and regulations of AHJ.

.3 Submit copies of certificates to the Consultant within three (03) days of test.

.2 Commissioning Meetings:

.1 Arrange Cx meeting(s) as per this section and in accordance with other Specification sections.

.2 Provide agenda, in accordance with section 01 91 13 – Project Meetings, a minimum of five (05) Working Days before meeting(s).

.3 Use Cx meetings to resolve issues, monitor progress, and identify defects and deficiencies relating to Cx.

.4 Continue Cx meetings on a regular basis, including during equipment start-up period, and functional testing period until commissioning deliverables have been addressed.

.5 At 60% construction completion stage arrange a separate Cx scope meeting to review progress, discuss schedule of equipment start-up activities and prepare for Cx. Additional 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.

.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 Provide twenty (20) Working Days' notice before beginning commissioning.

.2 The Owner and the Consultant will observe start-up and testing.

.3 The Consultant and/or Owner may 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 the 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.

.5 Excess Administration:

.1 Contractor shall pay the costs related to Consultant's excess contract administration if third and subsequent verifications occur where:

.1 Verification of reported results fail to receive the Owner or Consultant's Acceptance.

.2 Repetition of second verification again fails to receive Acceptance.

.3 The Consultant deems Contractor's request for second verification was premature.

.2 The cost of the Consultant's excess contract administration will be based on a rate of $260 per hour.

1.07 ACTION AND INFORMATIONAL SUBMITTALS

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

.1 Submit, for review and Acceptance, no later than six (06) weeks after award of Contract:

.1 draft Cx documentation and

.2 preliminary Cx schedule.

.2 Request changes to Submittals in writing to the Consultant and obtain written Acceptance or rejection at least eight (8) weeks before start of Cx.

.3 Where Cx procedures are not specified, submit proposed ones to the Consultant and obtain written Acceptance at least eight (8) weeks before start of Cx.

.4 Submit additional documentation relating to Cx process as required by the Consultant.

.5 If instruments installed in Contract will be used for Cx of TAB and PV, then submit TAB and PV instrument calibration certificates for review.

.6 Submit EMCS sensor calibration certificates.

.2 Commissioning Schedule:

.1 Create and submit detailed Cx schedule in accordance with section 01 32 16.16 – Construction Progress Schedule and section 01 91 13.13 – Commissioning Plan. The Contractor shall ensure the Cx schedule is incorporated into the Construction Schedule.

.2 Allow in the schedule adequate time for Cx activities such that activities are completed prior to the required occupancy date, including commissioning activities prescribed in the Specifications 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 the 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 the Consultant or Owner 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 Consultant for review and Acceptance.

1.08 MAINTENANCE MATERIALS SUBMITTALS

.1 Supply and document maintenance materials, spare parts, and special tools as specified in other Specification sections.

1.09 SITE CONDITIONS

.1 Where Cx of weather-dependent, occupancy-dependent, or seasonally-dependent equipment or

systems cannot be conducted under near-rated or near-design conditions, extrapolate part-load results to design conditions, if acceptable to the Consultant, with manufacturer's assistance in accordance with equipment manufacturer's instructions, data, and approved formulae.

2 PRODUCTS

2.01 NOT USED

.1 Not used.

3 EXECUTION

3.01 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 Accepted. Complete Cx in the most effective and timely manner available.

.1 Objectives: Verify that installed equipment, systems and integrated systems operate in accordance with Contract Documents and design criteria and intent.

.2 Contractor shall be responsible for the entire 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.

COMMISSIONING OVERVIEW

.1 Refer to Section 01 91 13.13 - Commissioning Plan for additional Cx responsibilities.

.2 Cx activities supplement the site quality control and testing procedures described in relevant technical Specification sections.

.3 Conduct Cx in coordination with other activities carried out during the Project delivery stages.

.4 Cx shall identify issues early on in the construction 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 Owner's facility operations personnel.

.5 The Owner will verify *Ready-For-Takeove*r has been achieved in accordance with the requirements of GC 12.1.1 and after:

.1 Completed Cx documentation has been received, reviewed for suitability, and reviewed and Accepted by the Consultant.

.2 Equipment, components and systems have been commissioned, and

.3 O&M training has been completed.

3.02 PRE-COMMISSIONING REVIEW

.1 Before Construction:

.1 Review Contract Documents and confirm in writing to the 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, documentation 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 Consultant for Acceptance.

.7 Verify systems have been cleaned thoroughly.

.8 Complete TAB procedures on systems and submit TAB reports to Consultant for review and Acceptance.

.9 Verify “As-Built” system schematics are available.

.4 Inform Consultant in writing of defects and deficiencies in installed Work together with plan for rectification.

3.03 STARTING AND TESTING

.1 Contractor to bear all costs associated with Cx activities, including, but not limited to, costs of the following:

.1 inspections, including disassembly and re-assembly after approval, and for starting, testing, adjusting, and;

.2 temporary testing equipment.

.3 required personnel and test equipment.

3.04 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.

3.05 MANUFACTURER SERVICES

.1 During factory testing, manufacturer, through the Contractor, to:

.1 Coordinate time and location of testing.

.2 Arrange for Consultant to observe testing.

.3 Submit testing documentation for review and Acceptance by Consultant.

.4 Obtain written Acceptance of test results and documentation from the 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 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 Specification sections 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.

3.06 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 the 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 may result in re-evaluation of equipment by an independent testing agency selected by the Owner. 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 the Consultant .

.2 Major equipment/systems: If evaluation report indicates that equipment damage is minor, perform corrective measures acceptable to the Consultant.

.3 If evaluation report indicates that major equipment damage has occurred, the 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.

3.07 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 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 Substantial Completion.

3.08 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 labor and materials and assume costs for re-commissioning.

3.09 START OF COMMISSIONING

.1 Notify Consultant at least ten (10) Working Days before start of Commissioning

.2 Start Cx after elements affecting start-up and performance verification of systems have been completed.

3.10 TEMPORARY INSTRUMENTS AND EQUIPMENT

.1 Provide all required instruments and equipment required to complete commissioning.

3.11 COMMISSIONING PERFORMANCE VERIFICATION

.1 Carry out Cx:

.1 under actual and 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 Where applicable, make EMCS trending information available as supporting documentation for performance verification.

3.12 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 the 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 the Consultant.

3.13 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 Consultant.

.2 Calibrated EMCS sensors may be used to obtain performance data if sensor calibration has been completed and accepted.

3.14 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 the Consultant.

.2 Costs associated with re-commissioning defective and deficient work is the responsibility of Contractor.

3.15 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.

3.16 DEFICIENCIES AND DEFECTS

.1 Correct deficiencies and defects found during start-up and Cx to satisfaction of Owner and the Consultant.

.2 Report concerns, deficiencies, and defects affecting Cx to Owner and the Consultant in writing. Stop Cx until problems are rectified. Proceed only with written Acceptance from the Consultant.

3.17 CLOSEOUT ACTIVITIES

.1 Completion of Commissioning:

.1 Upon completion of Cx, leave systems in normal operating mode, unless otherwise agreed with the Consultant.

.2 Except for warranty and seasonal verification activities specified in Cx Specifications, complete Cx before issuance of Substantial Completion Certificate of Completion.

.3 Cx to be considered complete when contract Cx deliverables have been submitted and Accepted by the 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- Demonstration and Training.

END OF SECTION

1 GENERAL

1.01 SUMMARY

.1 Section Includes:

.1 Description of overall structure of Plan and roles and responsibilities of commissioning team.

1.02 REFERENCE STANDARDS

.1 Canadian Construction Documents Committee (CCDC)

.2 CCDC 2-2020, Stipulated Price Contract.

1.03 RELATED REQUIREMENTS

.1 Section 01 45 00 - Quality Control.

.2 Section 01 77 00 - Closeout Procedures.

.3 Section 01 78 00 - Closeout Submittals.

.4 Section 01 79 00 - Demonstration and Training.

1.04 GENERAL

.1 Provide fully functional facilities and or systems:

.1 Systems, equipment and components meet user's functional requirements before date of Acceptance, and operate consistently at peak efficiencies and within specified energy budgets under normal loads.
.2 Facility user and O&M personnel have been fully trained in aspects of installed systems.
.3 Optimized life cycle costs.
.4 Complete documentation relating to installed equipment and systems.

.2 Term "Cx" in this section means "Commissioning".

.3 Use this Cx Plan as master planning document for Cx:

.1 Outlines organization, scheduling, allocation of resources, documentation, pertaining to implementation of Cx.
.2 Communicates responsibilities of team members involved in Cx Scheduling, documentation requirements, and verification procedures.
.3 Sets out deliverables relating to O&M, process and administration of Cx.
.4 Describes process of verification of how built works meet Owner requirements.
.5 Produces a complete functional system prior to issuance of Certificate of Occupancy.
.6 Management tool that sets out scope, standards, roles and responsibilities,

expectations, deliverables, and provides:

.1 Overview of Cx.
.2 General description of elements that make up Cx Plan.
.3 Process and methodology for successful Cx.

.4 Acronyms:

.1 Cx - Commissioning.
.2 O&M - Operations and Maintenance.
.3 EMCS - Energy Monitoring and Control Systems.
.4 WHMIS Safety Data Sheets (SDS).
.5 PI - Product Information.
.6 PV - Performance Verification.
.7 TAB - Testing, Adjusting and Balancing.
.8 WHMIS - Workplace Hazardous Materials Information System.

.5 Commissioning terms used in this Section:

.1 Bumping: short term start-up to prove ability to start and prove correct rotation.

.2 Deferred Cx - Cx activities delayed for reasons beyond Contractor's control due to lack of occupancy, weather conditions, need for heating/cooling loads.

1.05 DEVELOPMENT OF CX PLAN

.1 Submit for Acceptance a draft Cx Plan. Cx Plan shall be 100% completed within eight (8) weeks of award of Contract. Cx Plan shall take into account:

.1 Shop Drawings and Product data.
.2 Approved changes to Contract Documents.
.3 Contractor's Construction Schedule.
.4 Cx schedule.
.5 Contractor's, Subcontractor's, suppliers' requirements.
.6 Project construction team's and Cx team's requirements.

.2 Submit completed Cx Plan to the Consultant for Acceptance.

1.06 REFINEMENT OF CX PLAN

.1 During construction phase, revise, refine and finalize Cx Plan to include:

.1 Changes resulting from Owner program modifications.

.2 Accepted design and construction changes.

.2 Revise, refine and update every four (4) weeks during construction phase. At each revision, indicate revision number and date.

.3 Submit each revised Cx Plan to Consultant for review and obtain Acceptance.

.4 Include testing parameters at full range of operating conditions and check responses of equipment and systems.

.5 Final Cx Plan shall be Accepted six (6) weeks prior to start of Commissioning.

1.07 COMPOSITION, ROLES AND RESPONSIBILITIES OF CX TEAM

.1 Contractor to maintain overall responsibility for the Project and is the sole point of contact between members of commissioning team.

.2 Contractor will select Cx Team consisting of following members:

.1 Quality assurance team will ensure Cx activities are carried out to ensure delivery of a fully operational Project including:

.1 Review of Cx documentation from operational perspective.

.2 Review for performance, reliability, durability of operation, accessibility, maintainability, operational efficiency under conditions of operation.

.3 Protection of health, safety and comfort of occupants and O&M personnel.

.4 Monitoring of Cx activities, training, development of Cx documentation.

.5 Work closely with members of Cx Team.

.2 Construction Team: Contractor, subcontractors, suppliers and support disciplines, are responsible for construction/installation in accordance with Contract Documents, including:

.6 Testing.

.7 TAB.

.8 Performance of Cx activities.

.9 Delivery of training and Cx documentation.

.10 Assigning one person as point of contact with Consultant and Cx Manager for administrative and coordination purposes.

.3 Contractor's Cx Agent implements specified Cx activities including:

.1 Demonstrations.

.2 Training.

.3 Testing.

.4 Preparation, submission of test reports.

.4 The Consultant is responsible for:

.1 Verifying implementation of final Cx Plan

.2 Monitoring of day to day Cx activities

.3 witnessing any or all Cx activities

.5 Owner: represents lead role in Operation Phase and onwards and is responsible for:

.1 Receiving facility.

.2 Day-To-Day operation and maintenance of facility.

1.08 CX PARTICIPANTS

.1 Employ the following Cx participants, as required, to verify performance of equipment and systems:

.1 Installation Contractor/Subcontractor:

.2 Equipment and systems except as noted.

.2 Equipment manufacturer: equipment specified to be installed and started by manufacturer:

.1 To include performance verification.

.3 Specialist subcontractor: equipment and systems supplied and installed by specialist subcontractor.

.4 Specialist Cx agency:

.1 Possessing specialist qualifications and installations providing environments essential to client's program but are outside scope or expertise of Cx specialists on this project.

.5 Owner:

.1 Coordinates Owner's staff participation in Cx activities as required.

.6 Ensure that Cx participant:

.1 Could complete work within scheduled time frame.

.7 Available for emergency and troubleshooting service during first year of occupancy by user for adjustments and modifications outside responsibility of O&M personnel as per warranties terms. Provide names of participants to the Consultant and details of instruments and procedures to be followed for Cx [8] weeks prior to starting date of Cx for review and Acceptance.

1.09 EXTENT OF CX

.1 Commission all new systems/equipment installed as part of the Work, including but not limited to, the systems contained in section 01 11 00 – Summary of Work and detailed in the technical Specifications.

.

1.10 DELIVERABLES RELATING TO THE CX PROCESS

.1 General:

.1 Start-up, testing and Cx requirements, conditions for acceptance and specifications form part of relevant technical sections of these specifications.

.2 Definitions:

.1 Cx as used in this section includes:

.1 Cx of components, equipment, systems, subsystems, and integrated systems.

.2 Factory inspections and performance verification tests.

.3 Deliverables: submit in accordance with 01 33 00 - Submittal Procedures:

.1 Cx Specifications.
.2 Startup, pre-Cx activities and documentation for systems, and equipment.
.3 Completed installation checklists (ICL).
.4 Completed product information (PI) report forms.
.5 Completed performance verification (PV) report forms.

.6 Results of Performance Verification Tests and Inspections.
.7 Description of Cx activities and documentation.
.8 Description of Cx of integrated systems and documentation.
.9 Tests Reports.
.10 Training Plans.
.11 Cx Reports.
.12 Prescribed activities during warranty period.

.4 Consultant to witness tests and reports of results provided to the Owner.

.5 Consultant may participate.

1.11 PRE-CX ACTIVITIES AND RELATED DOCUMENTATION

.1 Items listed in the Cx Plan shall include the following:

.1 Pre-Start-Up inspections.
.2 The Consultant may monitor some or all of these pre-start-up inspections.
.3 Include completed documentation with Cx report.
.4 Conduct pre-start-up tests: conduct pressure, static, flushing, cleaning, and "bumping" during construction as specified in technical sections. To be witnessed and verified by Consultant and does not form part of Cx specifications.
.5 Include completed documentation in Cx report.

.2 Complete following Pre-Cx activities as relevant to the Work with reference to technical Specifications:

.1 Pre-Cx activities - ARCHITECTURAL AND STRUCTURAL:

.2 Pre-Cx activities - MECHANICAL:
.1 HVAC equipment and systems:
.1 "Bump" each item of equipment in its "stand-alone" mode.
.2 At this time, complete pre-start-up checks and complete relevant documentation.
.3 After equipment has been started, test related systems in conjunction with control systems on a system-by-system basis.
.4 Perform TAB on systems. TAB reports to be Accepted by Consultant.

.3 Pre-Cx activities EMCS:
.1 EMCS trending to be available as supporting documentation for performance verification.
.2 Perform point-by-point testing in parallel with start-up.
.3 Carry out point-by-point verification.
.4 Demonstrate performance of systems, to be witnessed by Consultant prior to start of Final Acceptance Test period.
.5 Perform final Cx and operational tests during demonstration period and test period.
.6 Only additional testing after foregoing have been successfully completed to be "Off-Season Tests".

.4 Pre-Cx activities - LIFE SAFETY SYSTEMS
.1 Include all equipment and systems.
.2 Reports of test results to be witnessed by Consultant before verification.

.5 Pre-Cx activities - ELECTRICAL:

.1 High voltage distribution systems over 750 V.
.2 Low voltage distribution systems under 750 V.
.3 Requires independent testing agency to perform pre- energization and post-energization tests.
.4 Emergency power generation systems
.5 Transfer switches: test by simulating loss of power. Verify availability of power at equipment requiring same.
.6 Uninterruptible power systems: test under full and partial load conditions.
.7 Lighting systems:
.8 Emergency lighting systems:
.9 Tests to include verification of lighting levels and coverage, initially by disrupting normal power.
.10 Low voltage systems: these include:
.11 Clock, communications, low voltage lighting control systems and data communications systems.
.12 Security, surveillance and intrusion alarm systems: to include verification by Owner and Consultant

1.12 START-UP

.1 Start-up components, equipment and systems.

.2 Consultant to monitor some or all of these start-up activities.

.1 Rectify start-up deficiencies to satisfaction of the Consultant.

.3 Performance Verification (PV):

.1 Contractor's Cx Agent to perform.
.2 Repeat when necessary until results are acceptable to Consultant.
.3 Use modified generic procedures to suit project requirements.
.4 Consultant to review and Accept reported results using approved PI and PV forms.
.5 Owner and Consultant reserve right to verify up to 30% of reported results at random.
.6 Failure of randomly selected item shall result in rejection of PV report or report of system startup and testing.

1.13 CX ACTIVITIES AND RELATED DOCUMENTATION

.1 Perform Cx using procedures developed by Contractor and Accepted by Consultant.

.2 Consultant to monitor Cx activities.

.3 Upon satisfactory completion, Contractor performing tests to prepare Cx Report using Accepted PV forms.

.4 Consultant may witness reported results of Cx activities and forward to Owner.

.5 Owner and Consultant reserve right to verify a percentage of reported results at no cost to Contractor.

1.14 CX OF INTEGRATED SYSTEMS AND RELATED DOCUMENTATION

.1 Cx to be performed by specified Cx specialist, using procedures Accepted by the Consultant.

.2 Tests to be witnessed by Consultant and documented on Accepted report forms.

.3 Upon satisfactory completion, Cx specialist to prepare Cx Report, to be submitted to Consultant for review and Acceptance.

.4 Owner and Consultant reserve right to verify percentage of reported results.

1.15 CX SCHEDULES

.1 Prepare detailed Cx Schedule and submit to Consultant for review and Acceptance. Integrate Cx schedule into Project Construction Schedule such that there is a complete Critical Path for the entire Work. Include:

.1 Milestones, testing, documentation, training and Cx activities of components, equipment, subsystems, systems and integrated systems, including:

.1 Design criteria, design intents.
.2 Pre-TAB review
.3 Cx agents' credentials
.4 Cx procedures
.5 Cx Report format
.6 Discussion of heating/cooling loads for Cx
.7 Submission of list of instrumentation with relevant certificates
.8 Notification of intention to start TAB
.9 TAB: after successful start-up, correction of deficiencies and verification of normal and safe operation.
.10 Notification of intention to start Cx: 14 days before start of Cx.
.11 Notification of intention to start Cx of integrated systems: after Cx of related systems is completed 14 days before start of integrated system Cx.
.12 Identification of deferred Cx.
.13 Implementation of training plans.
.14 Cx reports: immediately upon successful completion of Cx.

.2 Detailed training schedule to demonstrate no conflicts with testing, completion of Project and hand-over to Owner.

.3 Cx schedule for verification of performance in all seasons and wear conditions.

.2 Consultant, Contractor and Contractor's Cx Agent will monitor progress of Cx against this schedule.

1.16 CX REPORTS

.1 Submit reports of tests, witnessed and verified by Consultant.

.2 Include completed and certified PV reports in properly formatted Cx Reports.

.3 Before reports are Accepted, reported results to be subject to verification by Consultant or Owner.

1.17 ACTIVITIES DURING WARRANTY PERIOD

.1 Cx activities must be completed before issuance of Substantial Performance of the Work Certificate. It is anticipated that certain Cx activities may be necessary during Warranty Period,

including:

.1 Fine tuning of HVAC systems.
.2 Adjustment of ventilation rates to promote good indoor air quality and reduce deleterious effects of VOCs generated by off-gassing from construction materials and furnishings.

1.18 TRAINING PLANS

.1 Refer to Section 01 79 00 - Demonstration and Training.

1.19 FINAL SETTINGS

.1 Upon completion of Cx to satisfaction of the Consultant, lock control devices in their final positions, indelibly mark settings marked and include in Cx Reports.

2 PRODUCTS

2.01 NOT USED

.1 Not Used.

3 EXECUTION

3.01 NOT USED

.1 Not Used.

END OF SECTION

1 GENERAL

1.01 SUMMARY

.1 Section Includes:

.1 Commissioning forms to be completed for equipment, system and integrated system.

.2 Related Requirements

.1 Section 019113 -General Commissioning Requirements.

1.02 INSTALLATION/START-UP CHECK LISTS

.1 Include the following data:

.1 Product manufacturer's installation instructions and recommended checks.

.2 Special procedures as specified in relevant technical sections.

.3 Items considered good installation and engineering industry practices deemed appropriate for proper and efficient operation.

.2 Equipment manufacturer's installation/start-up check lists are acceptable for use. As deemed necessary by Consultant supplemental additional data lists will be required for specific Project conditions.

.3 Use check lists for equipment installation. Document check list verifying checks have been made, indicate deficiencies and corrective action taken.

.4 Installer to sign check lists upon completion, certifying stated checks and inspections have been performed. Return completed check lists to Consultant. Check lists will be required during Commissioning and will be included in Operations and Maintenance Manual (O&M) at completion of Project.

.5 Use of check lists will not be considered part of commissioning process but will be stringently used for equipment pre-start and start-up procedures.

1.03 PRODUCT INFORMATION (PI) REPORT FORMS

.1 Product Information (PI) forms compiles gathered data on items of equipment produced by equipment manufacturer, includes nameplate information, parts list, operating instructions, maintenance guidelines and pertinent technical data and recommended checks that is necessary to prepare for start-up and functional testing and used during operation and maintenance of equipment. This documentation is included in the operations and maintenance manual at completion of Work.

.2 Prior to Performance Verification (PV) of systems complete items on PI forms related to systems and obtain Consultant's Acceptance.

1.04 PERFORMANCE VERIFICATION (PV) FORMS

.1 PV forms to be used for checks, running dynamic tests and adjustments carried out on equipment

and systems to ensure correct operation, efficiently and function independently and interactively with other systems as intended with Project requirements.

.2 PV report forms include those developed by Contractor records measured data and readings taken during functional testing and Performance Verification procedures.

.3 Prior to PV of integrated system, complete PV forms of related systems and obtain Consultant's Acceptance.

1.05 CHANGES AND DEVELOPMENT OF NEW REPORT FORMS

.1 Develop appropriate verification forms and submit to the Consultant for Acceptance prior to use.

.1 Additional commissioning forms to be in same format.

1.06 COMMISSIONING FORMS

.1 Use Commissioning forms to verify installation and record performance when starting equipment and systems.

.2 Strategy for Use:

.1 Contractor's Commissioning Agent to prepare and use Project-specific Commissioning forms, Accepted by Consultant.

.2 Contractor will provide required Shop Drawings information and verify correct installation and operation of items indicated on these forms.

.3 Confirm operation as per design criteria and intent.

.4 Identify variances between design and operation and reasons for variances.

.5 Verify operation in specified normal and emergency modes and under specified load conditions.

.6 Record analytical and substantiating data.

.7 Verify reported results.

.8 Form to bear signatures of recording technician and reviewed and signed off by Consultant.

.9 Submit immediately after tests are performed.

.10 Reported results in true measured SI unit values.

.11 Provide Consultant with originals of completed forms.

.12 Maintain copy on site during start-up, testing and commissioning period.

.13 Forms to be both hard copy and electronic format with typed written results in Operation and Maintenance Manual.

1.07 LANGUAGE

.1 English

2 PRODUCTS

2.01 NOT USED

.1 Not Used.

3 EXECUTION

3.01 NOT USED

.1 Not Used.

END OF SECTION

Advanced Blast Booth Systems with Integrated Recovery, Airwash, and Handling Technologies

Executive Summary

Industrial abrasive blasting is a critical process for surface preparation in industries such as aerospace, shipbuilding, heavy equipment manufacturing, and steel fabrication. A properly engineered blast booth, supported by an efficient recovery, airwash, and abrasive handling system, not only ensures maximum productivity and operator safety but also reduces long-term operational costs. This document outlines the design, components, and advantages of a modern heavy-duty blast booth system equipped with advanced recovery and abrasive cleaning technologies.

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1. Blast Booth Design and Construction

Structural Integrity

- **Structural Frame Style Steel Framework**: The booth is constructed using a hoop-style support structure with **12-gauge galvanized Lynx panels**, providing superior strength and corrosion resistance.
- **Durability and Modularity**: Modular panels allow easy replacement, scalability, and maintenance while resisting long-term abrasive wear.
- **Structural Frame** will need to support the optional man lift system.

Accessibility and Safety

- **Front Entry Door**: Positioned for streamlined material flow, reducing handling and downtime. If space restraints allow, a preferred rubber roll up door will be installed.
- **Personnel Doors**: Two-four heavy-duty access doors with observation windows and illuminated exit signage for operator safety and compliance with OSHA standards.
- **Illumination**: High-powered LED ceiling-mounted lights ensure uniform visibility, reducing operator fatigue and improving precision. No Lexan overlay shields shall be used in the blast booth lighting design.
- **Control**: A **PLC-based booth control panel** centralizes operations, safety interlocks, and system diagnostics. Remote log in may be a desired option.

2. Air Ventilation and Dust Collection System

Air Quality Control

- **Dust Collector Integration**: High-capacity dust collectors connected via ducting to booth exhaust plenums maintain clean air and visibility.
- **Exhaust Plenums**: Positioned strategically at the rear side walls to optimize air movement and abrasive fallout. Plenums must be designed to deliver any residual abrasive directly to the conveyor system to be cleaned and reclaimed.
- **Drop-Out Baffles**: Capture heavier abrasive particles before entering the filtration stage.

Filtration Efficiency

- **Pulse-Jet Cleaning System**: Automatic on/off pulsing maintains consistent airflow and reduces maintenance frequency.
- **High-Efficiency Cartridge Filters**: MERV-15 rated filters achieve fine particulate capture while maintaining system performance.
- **Air-to-Cloth Ratio**: Engineered to ensure efficient dust collection without overloading filter capacity.
- **Noise Mitigation**: Exhaust silencers are available for compliance with occupational noise standards.
- **Fitlers**: must be cartridge style filters with a cantilever locking system for maintenance, safety and improved air quality

Environmental Monitoring

- **Real-Time Environmental Data**: PLC system tracks static pressure (8–10" w.g.) and airflow, ensuring consistent compliance with indoor air quality standards.

3. Abrasive Recovery System

Conveyor Technology

- **Bushing Vibratory Conveyor**: A maintenance-friendly system with no bearings or bushings exposed to abrasive, reducing downtime.
- **Motor Pit Access**: Cover plates allow simple inspection and maintenance.
- **Debris Management**: Integrated live trash sieve removes oversized debris and contaminants prior to entering the bucket elevator/air wash system.
- **Operator Safety**: Pedestrian-rated floor grating supports foot traffic while allowing abrasive to fall into recovery channels.

4. Abrasive Handling and Airwash System

Elevator and Separation

- **High-Capacity Bucket Elevator**: Rapidly transports recovered abrasive for continuous blasting cycles.
- **Adjustable Airwash System**: Engineered for multiple media types, ensuring versatility for steel grit, aluminum oxide, or garnet.
- **Airflow Engineering**: Required CFM is calculated per system capacity, guaranteeing optimal performance without excessive energy consumption.
- **T-Pulse Cleaning**: Advanced pulsing within the Airwash system ensures consistent abrasive cleanliness, extending media life.

Demands of Airwash Separation

- Removes dust, fines, and broken abrasive particles.
- Ensures only high-quality, reusable abrasive is returned to storage.
- Deliver media to the abrasive hopper with blast pots positioned directly under the hopper.

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5. Abrasive Storage and Distribution

- **Hopper Storage Capacity**: 300 cubic feet, positioned directly above blast pots for gravity-fed efficiency.
- **Multi-Outlet Configuration**: Four outlets enable simultaneous multi-operator blasting.
- **Continuous Supply**: Eliminates bottlenecks and ensures uninterrupted operation.

---

6. Abrasive Blasting Equipment

Blast Pots

- **Capacity**: 6.5 cubic foot blast pots rated at 150 PSI for extended blasting cycles.
- **Metering Valve**: Equipped with Tera or Thompson II precision metering valves.
- **Pressure Hold Design**: Reduces air consumption and eliminates downtime during refills.
- **Safety Features**: Remote abrasive cutoff, electric deadman switches, and spider plate assemblies.

Operator Safety and Comfort

- **Blast Suits and Gloves**: Designed for abrasion resistance and ergonomic comfort.
- **NIOSH-Approved Blast Helmets**: Integrated airflow, noise reduction, and anti-fog visors.
- **Grade D Breathing Air**: Supplied via booth-mounted distribution panels with CO alarms and filtration.
- **Noise Reduction**: #7 blast nozzle engineered for high velocity while reducing decibel output.

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7. Electrical Controls and Automation

Smart Control System

- **PLC with HMI Touchscreen**: Intuitive interface with real-time monitoring of booth subsystems.
- **System Visualization**: Graphical representations of components, motor status, and operation monitoring.
- **Environmental Monitoring**: Tracks pressure, air quality, and system health.
- **Electrical Controls** must have capacity for optional man lift safety and operations

Operational Features

- **One-Button Start**: Automated sequencing for dust collection, ventilation, and recovery.
- **Alarm Management**: Historical tracking of faults, enabling predictive maintenance.
- **Maintenance Scheduler**: Organizes tasks, records history, and issues reminders.
- **Safety**: Multiple E-stops positioned throughout booth for rapid emergency response.

Conclusion

A modern blast booth system with integrated recovery, airwash, and abrasive handling technologies significantly enhances operational efficiency, operator safety, and cost savings. By engineering each subsystem—ventilation, recovery, handling, and control—into a unified platform, operators gain a robust solution designed for longevity, compliance, and performance.

Investing in such a system ensures:

- Reduced abrasive consumption and disposal costs.
- Enhanced operator safety and working conditions.
- Lower maintenance downtime.
- Compliance with environmental and occupational safety regulations.

This holistic approach to blast booth engineering positions facilities for long-term success in demanding industrial environments.

Optional LPI or Equivalent Man Lifts

Integrated Engineered Man Lifts for Blast Booth Applications

Executive Summary

Industrial blasting operations often face challenges related to operator safety, productivity, and access to complex geometries on large components. Traditional scaffolding and manual positioning limit efficiency and increase downtime. To address these challenges, **Engineered Man lift systems** mounted to the **structural framework of the blast booth** provide a safe, reliable, and flexible access solution. These lifts extend into the booth, enabling operators to perform blasting tasks at multiple heights and orientations while maintaining maximum safety standards and productivity.

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1. Introduction

Surface preparation is critical in industries such as aerospace, automotive, defense, oil and gas, and heavy equipment manufacturing. Large-scale blast booths provide controlled environments where abrasive blasting can remove coatings, rust, and contaminants prior to coating or finishing.

However, reaching high or complex surfaces inside these booths remains a challenge. Workers often rely on ladders, scaffolds, or rolling platforms—methods that are time-consuming, labor-intensive, and present significant safety hazards.

Engineered Man lift systems designed to integrate with blast booth structures offer a purpose-built solution. These lifts extend horizontally and vertically into the booth, providing ergonomic access while reducing cycle time and operator risk.

2. System Overview

2.1 Structural Mounting

- The lift system is **mounted directly to the structural steel framework of the blast booth**.
- Support rails, guide beams, and safety anchor points are engineered in coordination with the booth manufacturer.
- This integration ensures the lift moves freely without interfering with booth walls, dust collection ductwork, or airflow patterns.

2.2 Extension Mechanism

- Man Lifts feature **cantilevered or telescoping arms** that extend into the booth.
- The extension allows operators to work across the entire length, width, and height of the booth without repositioning components or scaffolding.
- Configurations can be designed to cover both **sides of the booth simultaneously**, ensuring full coverage for large components.

2.3 Operator Platform

- Enclosed or semi-enclosed platforms with non-slip flooring.
- Ergonomic controls for lift height, extension, and travel.
- Blast-rated safety glass or grated panels for visibility.
- Integrated air supply lines for blasting equipment.

2.4 Safety Features

- **Explosion-proof electrical systems** where required.
- ANSI/OSHA-compliant fall protection.
- Emergency stop functions accessible at multiple points.
- Safety interlocks preventing lift extension when booth doors are open or booth is not in blast-ready condition.

PART 3 – RFP SPECIFICATIONS
SCHEDULE 3-A-3
ISSUE FOR TENDER DRAWINGS

Refer to the Issue for Tender Drawings as outlined below, and which are attached to this Schedule 3-A-3.

Drawing No.	Description	Date
Issued for Tender Drawings Prepared by AECOM		
ONTC Grit Blast - Architectural		
A-101	Ground Floor Plan and Partial RCP	03-May-2024
A-150	Building and Wall Sections	
A-401	Enlarged Partial Floor Plan and Details	
A-402	Enlarged Partial Floor Plan and Partial Roof Plan	
A-403	Roof Details	
A-401	Exterior Elevations	
A-600	Schedules and Details	
AD101	Ground Floor Demolition Plan	
ONTC Grit Blast – Mechanical		
Q-001	Demolition Ground Floor Plan – Process	08-March-2024
Q-002	Demolition Roof Plan – Process	
Q-003	Demolition Isometric View – Process	
Q-100	Building Isometric – Process	
Q-101	Foundation Plan – Process	
Q-102	Low Level Ground Floor Plan – Process	
Q-103	High Level Ground Floor Plan – Process	
Q-104	Ceiling Level Plan – Process	
Q-105	High Roof Plan – Process	
Q-106	Reclaim and M/E Room	
Q-107	Reflected Ceiling Plan	
Q-108, Q-109, Q-110	Building Sections – Process	
Q-111	Isometric View – Blast Bay and Addition – Process	
Q-112	Isometric Views	
Q-113	3-Axis Man Lift	
Q-114	Ceiling and Wall Panel General Arrangement	
Q-115	Process Design Notes and Schematics	
Q-116	Process Schedules and Schematics	
P-100	Isometric View – Overall Building – Plumbing and Drainage	
P-101	Foundation Plan – PD	
P-102	Ground Floor Plan - PD	
P-103	High Level Plan – PD	
P-104	High Roof Plan – PD	
P-105, P-106	Building Sections – PD	
P-107	Building Isometric – PD	
P-108, P-109	Partial Ground Floor Plan	

PART 3 – RFP SPECIFICATIONS
SCHEDULE 3-A-3 *cont'd*
ISSUE FOR TENDER DRAWINGS

Refer to the Issue for Tender Drawings as outlined below, and which are attached to this Schedule 3-A-3.

Drawing No.	Description	Date
Issued for Tender Drawings Prepared by AECOM		
ONTC Grit Blast – Mechanical (continued)		
FP-100	Building Isometric -FP	08-March-2024
FP-101, FP-102	Low Level Ground Floor Plan – FP	
FP-103	Building Isometric – FP	
M-100	Isometric View – Overall Building HVAC	
M-101	Ground Floor Plan – HVAC	
M-102, M-103	High Level Plan – HVAC	
M-104	Reflected Ceiling Plan	
M-105	Building Sections – HVAC	
M-106	Partial HVAC Plans	
M-107, M-108	Building Sections – HVAC	
M-109	Building Isometric – HVAC Ductwork	
M-110	Mechanical Equipment Schedules	
M-111	Heating and Control Schematic	
ONTC Grit Blast – Issued for Budget Drawings		
S-001	Structural General Notes	03-May-2024
S-002, S-003	Structural Typical Details	
S-101	Ground Floor and Mechanical Room Mid-Height Plans	
S-102	Roof Framing Plan	
S-301	Elevations and Sections	
S-401	Enlarged Partial Plans	
S-402, S-501	Section Details	
SD-100	Ground Floor Demolition Plan	
ONTC Grit Blast – Electrical		
E-101	Legend and General Notes	11-March-2024
E-201	Ground Floor Power and Lighting Removal Plan	
E-202	Roof Removal Power Plan	
E-301	Ground Floor Classification Plan	
E-302	Ground Floor Lighting Plan	
E-303	Ground Floor Power Plan	
E-304	Roof Power and Fire Alarm Plan	
E-305	Ground Floor Fire Alarm Plan	
E-401	Existing/Removal Single Line Diagram	
E-402	New Single Line Diagram	
E-403	Fire Alar, Riser Diagram	
E-501, E-502	Schedules	
	Project Manual - Blast Bay Upgrade	

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DESIGNER: Designer
PROJECT MANAGEMENT INITIALS:

LEGEND

DENOTES AREAS NOT IN CONTRACT

FIRE SAFETY LEGEND

PATH OF TRAVEL

1 HOUR FIRE RESISTANCE RATING

GENERAL NOTES

1. FOR LOCATION OF EQUIPMENT BASES, SEE BUILDING MECHANICAL, ELECTRICAL AND STRUCTURAL DRAWINGS. CARRY FLOOR FINISHES UP AND OVER EQUIPMENT BASES TO SUIT EQUIPMENT SUPPLIED.
2. FOR LOCATION OF ADDITIONAL ROOF PENETRATIONS SEE BUILDING MECHANICAL, ELECTRICAL, PROCESS DRAWINGS AND ALL SPECIFICATIONS.
3. REFER TO BUILDING MECHANICAL AND ELECTRICAL DRAWINGS FOR ADDITIONAL PENETRATIONS IN MASONRY WALLS. PROVIDE LINTELS OVER ALL OPENINGS AS PER LINTEL SCHEDULE ON STRUCTURAL DRAWINGS. DESIGN LINTELS AS PER REQUIREMENTS OF THE ONTARIO BUILDING CODE (2012).
4. ALL STEEL LINTELS ARE TO BE HOT DIPPED GALVANIZED WITH MINIMUM 200 mm BEARING AT EACH END. PROVIDE BOND BREAKER ON FULL BEARING SURFACE UNDER LOOSE LINTELS.
5. ALL INTERIOR MASONRY OPENINGS ARE TO RECEIVE LINTELS AS DETAILED IN STRUCTURAL DRAWINGS.
6. REINFORCE ALL NEW MASONRY WALLS AS PER STRUCTURAL AND ARCHITECTURAL DETAILS.
7. UNLESS OTHERWISE INDICATED, PLAN DIMENSIONS ARE TO COLUMN GRID ON CENTERLINES, NOMINAL SURFACE OF MASONRY AND FACE OF CONCRETE WALLS.
8. REPETITIVE FEATURES ARE NOT DRAWN IN THEIR ENTIRETY AND SHALL BE COMPLETELY PROVIDED AS IF DRAWN IN FULL.
9. WHERE DOOR IS LOCATED NEAR CORNER OF ROOM AND IS NOT LOCATED BY DIMENSION ON PLAN OR DETAILS, LOCATE 100 mm FROM FACE OF STUD (WALL) TO FACE OF ROUGH OPENING. LOCATE 150 mm FROM FACE OF WALL TO EDGE OF ROUGH OPENING AT CAST IN PLACE CONCRETE WALLS, AND 200 mm AT CMU WALLS.
10. VERIFY ALL ROUGH-IN DIMENSIONS FOR EQUIPMENT PROVIDED OR INSTALLED AS PART OF THIS CONTRACT.
11. ALL OPENINGS THROUGH FIRE SEPARATION WALLS AND SLABS MUST BE APPROVED ULC RATED FIRESTOP AND SMOKESEAL ASSEMBLIES.
12. ALL OPENINGS THROUGH EXTERIOR AND INTERIOR NON-RATED WALLS MUST BE PROPERLY SEALED AND CAULKED AND WITH METAL FLASHING (WHERE APPLICABLE) WITH APPROVED ASSEMBLIES. U.N.O.
13. ALL JUNCTIONS OF WALLS WITH CEILING AND FLOOR SLAB TO BE SEALED.
14. DIMENSIONS GIVING TO EXISTING WALLS ARE APPROXIMATION ONLY. CONTRACTOR TO VERIFY ALL DIMENSIONS ON SITE.
15. ALL FLOOR DRAINS TO HAVE A 2% MAX SLOPE.
16. ALL DIMENSIONS SHOWN ON ARCHITECTURAL DRAWINGS ARE IN MILLIMETERS UNLESS NOTED OTHERWISE.

CEILING TYPES

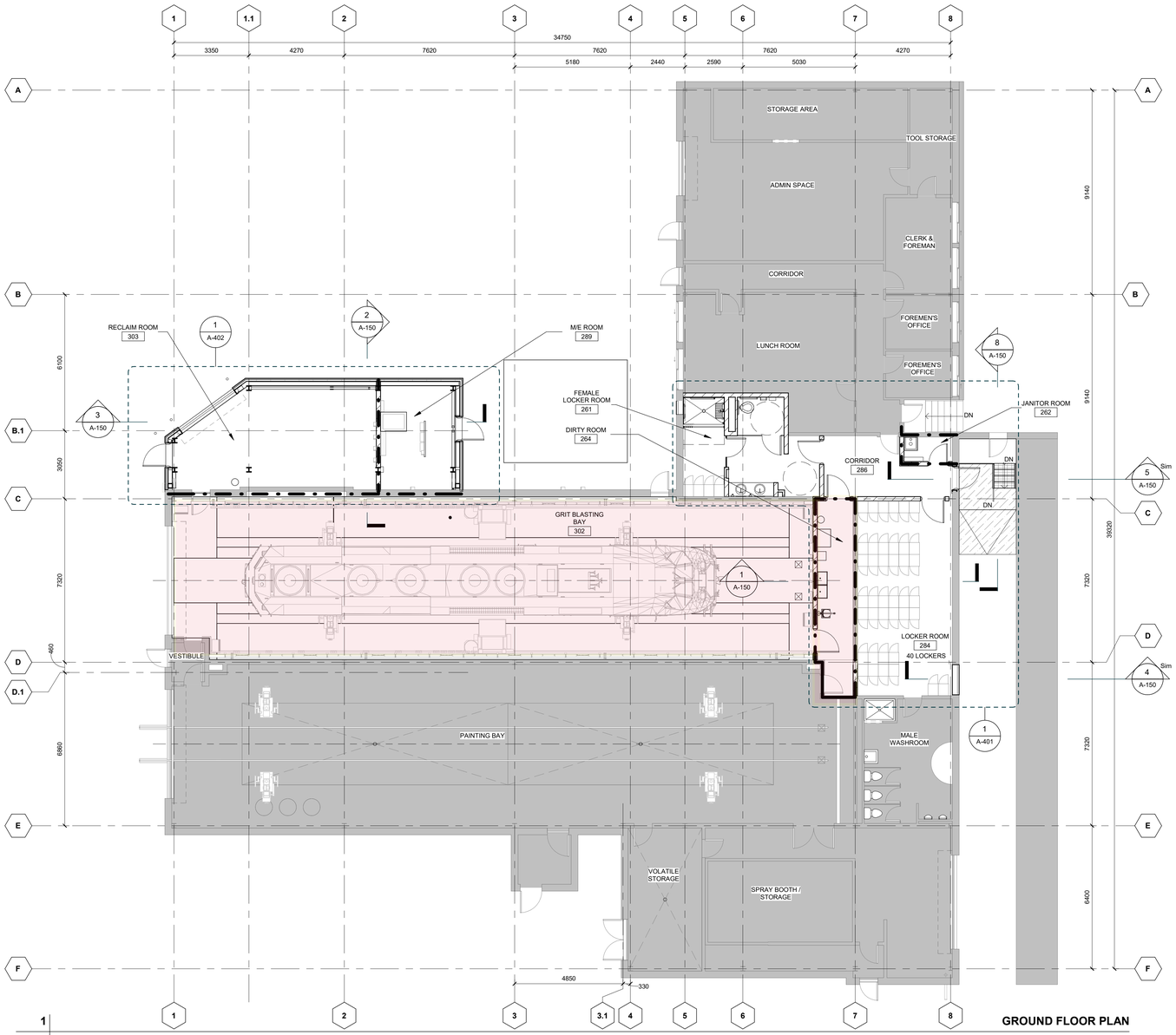
ACT-1 — ACT-1 ACOUSTIC CEILING TILE ASSEMBLY
- 610mm x 610mm ACOUSTIC CEILING TILE IN EXPOSED T-BAR SUSPENSION SYSTEM AT 2600mm ABOVE FINISH FLOOR

GYP-1 — GYP-1 SUSPENDED GYPSUM CEILING ASSEMBLY
- 41mm CARRYING CHANNELS @ 1200mm O/C
- 13mm METAL STRAPPING @ 410mm O/C
- 16mm GYPSUM BOARD AT 2600mm ABOVE FINISH FLOOR

REFLECTED CEILING LEGEND

LIGHTING FIXTURES
- REFER TO ELECTRICAL DWGS.

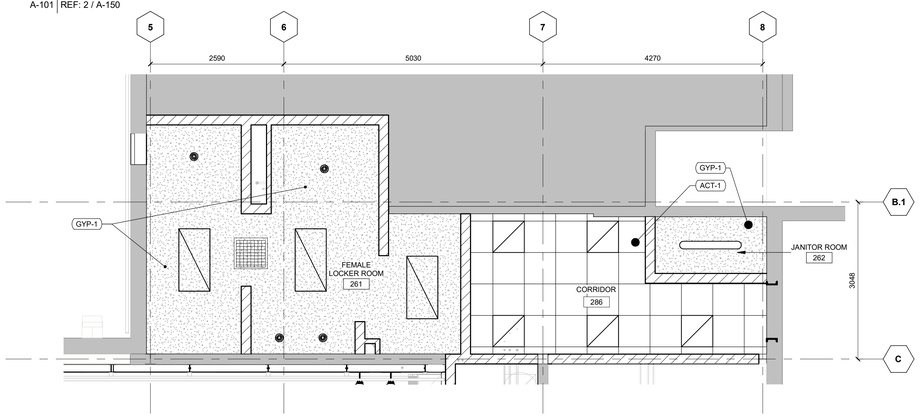
EXHAUST GRILLE
- REFER TO MECHANICAL DWGS.



1 GROUND FLOOR PLAN

A-101 | REF: 2 / A-150

Scale: 1 : 100



2 PARTIAL GROUND FLOOR REFLECTED CEILING PLAN

A-101 | REF: 2 / A-150

Scale: 1 : 50

AECOM

PROJECT

BLAST BAY UPGRADE
915/916 McINTYRE ST. E, NORTH BAY, ON

CLIENT

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REGISTRATION

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KEY PLAN

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ISSUE/REVISION

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3	ISSUED FOR TENDER	29/09/2023
2	ISSUED FOR 100% CLIENT REVIEW	21/07/2023
1	ISSUED FOR 60% CLIENT REVIEW	31/03/2023

PROJECT NUMBER

60678205

SHEET TITLE

GROUND FLOOR PLAN & PARTIAL RCP

SHEET NUMBER

A-101

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C
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A

KEYNOTES

01 HOLLOW METAL DOOR & FRAME ASSEMBLY
02 SINK - REFER TO MECHANICAL DRAWINGS & SPECIFICATIONS
03 SURFACE MOUNTED SOAP DISPENSER
04 MIRROR
05 SURFACE MOUNTED PAPER TOWEL DISPENSER AND DISPOSAL
06 TOILET - REFER TO MECHANICAL DRAWINGS & SPECIFICATIONS
07 TOILET PAPER HOLDER (TYP OF 1 IN EACH STALL)
08 TOILET STALL
09 ROLL-IN SHOWER STALL - REFER TO MECHANICAL DRAWINGS & SPECIFICATIONS
10 SHS - SHOWER FOLDING SEAT
11 SHOWER CONTROL - REFER TO MECHANICAL DRAWINGS AND SPECIFICATIONS
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15 GB4 - L SHAPED 760mm x 760mm LONG 38mm DIA. GRAB BAR
16 SHOWER CURTAIN AND ROD
17 COUNTERTOP
18 METAL CLADDING INFILL PANELS. COLOUR AND PROFILE TO MATCH EXISTING PANELS
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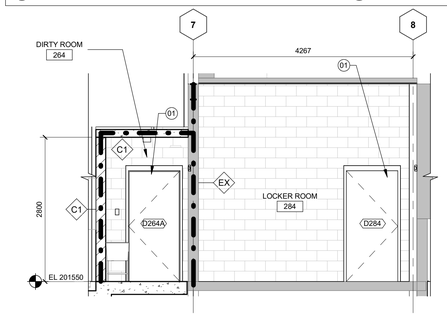
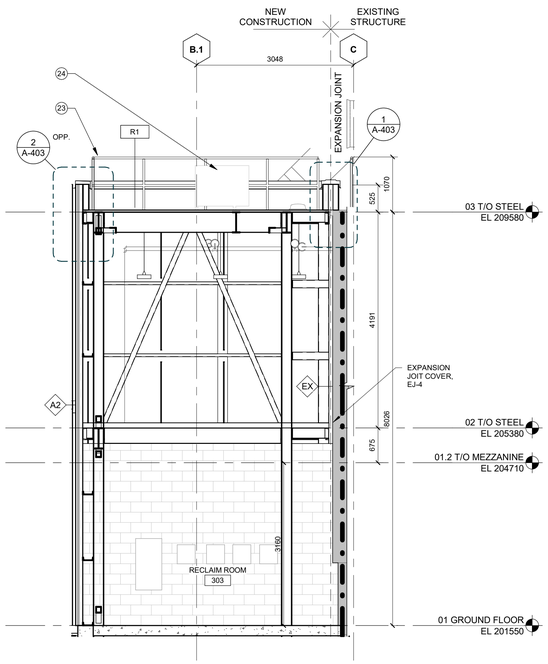
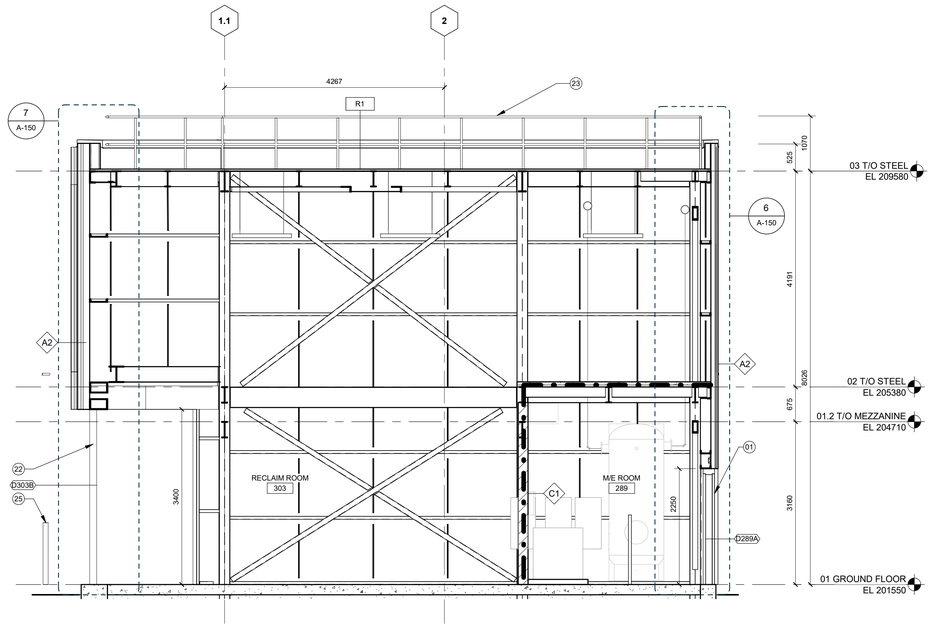
20 CH1 - COAT HOOK
21 SOILED COVERALL STORAGE BIN (NOT IN CONTRACT)
22 INSULATED THERMALLY BROKEN HOLLOW METAL DOOR AND FRAME ASSEMBLY
23 GALVANIZED STEEL GUARDRAIL ASSEMBLY
24 MECHANICAL EQUIPMENT, REFER TO MECHNICAL DWGS.
25 GALVANIZED STEEL BOLLARD ASSEMBLY, REFER TO STRUCTURAL DWGS.
26 LIGHT FIXTURE, REFER TO ELEC. DWGS.
27 PRIVACY PARTITION C/W DOOR
28 600mm X 600mm WIDE ACCESS HATCH, AT 150mm F.F
29 S.S. WALL MOUNTED MASK HOOK, TOTAL OF 24 HOOKS
30 EMERGENCY SHOWER & EYE WASH REFER TO MECHANICAL DWGS
31 WASTE BIN (NOT IN CONTRACT)
32 PERSONAL CLEANING VACUUM STATION
33 EYE WASH - REFER TO MECHANICAL DWGS
34 JANITOR SHELF
35 FEMININE NAPKIN DISPOSAL
36 SCUPPER



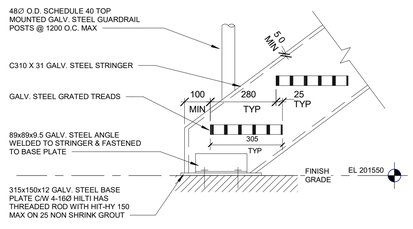




1 SECTION 1
A-150 | REF: 1 / A-101 Scale: 1 : 50

2 SECTION 2
A-150 | REF: 1 / A-101 Scale: 1 : 50

3 SECTION 3
A-150 | REF: 1 / A-101 Scale: 1 : 50



9 STAIR DETAIL
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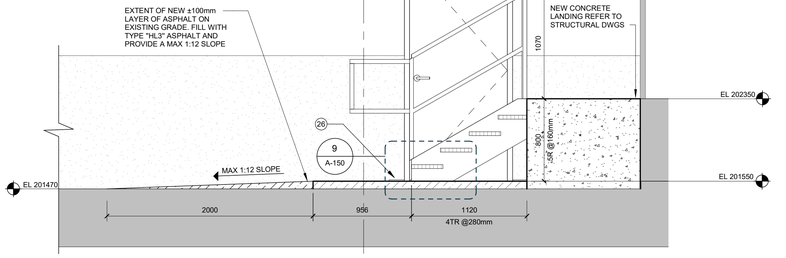
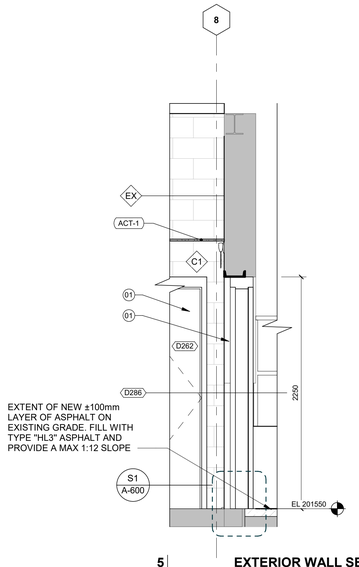


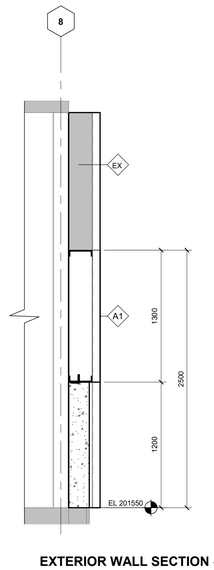
8 STEEL STAIR SECTION
A-150 | REF: 1 / A-101 Scale: 1 : 25

7 WALL SECTION 2
A-150 | REF: 3 / A-150 Scale: 1 : 25

6 WALL SECTION 1
A-150 | REF: 3 / A-150 Scale: 1 : 25



5 EXTERIOR WALL SECTION - ENTRANCE DOOR
A-150 | REF: 1 / A-101 Scale: 1 : 25



4 EXTERIOR WALL SECTION - EAST LOCKER ROOM
A-150 | REF: 1 / A-101 Scale: 1 : 25

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PROJECT

BLAST BAY UPGRADE
915/916 McINTYRE ST. E, NORTH BAY, ON

CLIENT

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REGISTRATION

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KEY PLAN

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ISSUE/REVISION

No.	DESCRIPTION	DATE
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1	ISSUED FOR 60% CLIENT REVIEW	31/03/2023

PROJECT NUMBER

60678205

SHEET TITLE

BUILDING & WALL SECTIONS

SHEET NUMBER

A-150

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KEYNOTES

01 HOLLOW METAL DOOR & FRAME ASSEMBLY
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04 MIRROR
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19 RELOCATED LOCKERS
20 CH1 - COAT HOOK AT 1100mm FF
21 SOILED COVERALL STORAGE BIN (NOT IN CONTRACT)
22 INSULATED THERMALLY BROKEN HOLLOW METAL DOOR AND FRAME ASSEMBLY
23 GALVANIZED STEEL GUARDRAIL ASSEMBLY
24 MECHANICAL EQUIPMENT, REFER TO MECHNICAL DWGS.
25 GALVANIZED STEEL BOLLARD ASSEMBLY, REFER TO STRUCTURAL DWGS.
26 ACTIVATOR- WAVE HAND DOOR SWITCH
27 PRIVACY PARTITION C/W DOOR
28 600mm X 600mm WIDE ACCESS HATCH, AT 150mm F.F
29 S.S. WALL MOUNTED MASK HOOK, TOTAL OF 24 HOOKS
30 EMERGENCY SHOWER & EYE WASH REFER TO MECHANICAL DWGS
31 WASTE BIN (NOT IN CONTRACT)
32 PERSONAL CLEANING VACUUM STATION
33 EYE WASH - REFER TO MECHANICAL DWGS
34 JANITOR SHELF
35 FEMININE NAPKIN DISPOSAL
36 SCUPPER

WALL TYPES

A1 — A1 EXTERIOR WALL ASSEMBLY
- 38mm PREFINISHED STEEL CLADDING
- Z-GIRTS @ 400 O/C
- 25mm AIR SPACE
- 75mm SPRAY APPLIED FOAM INSULATION
- 190mm CONCRETE BLOCK W/ HORIZONTAL TRUSS REINFORCING EVERY SECOND COURCE

A2 — A2 EXTERIOR WALL ASSEMBLY
- 38mm PREFINISHED STEEL CLADDING
- Z-GIRTS @ 400 O/C
- 25mm AIR SPACE
- 75mm SPRAY APPLIED FOAM INSULATION
- PREFINISHED 22ga STEEL LINER PANEL

C1 — C1 INTERIOR WALL ASSEMBLY
- 190mm CONCRETE BLOCK
- HORIZONTAL TRUSS REINFORCING EVERY SECOND COURCE
- BULLNOSE ON EXPOSED CORNERS

C2 — C2 INTERIOR WALL ASSEMBLY
- 90mm CONCRETE BLOCK
- HORIZONTAL TRUSS REINFORCING EVERY SECOND COURCE
- BULLNOSE ON EXPOSED CORNERS

EX — EX EXISTING WALL TO REMAIN

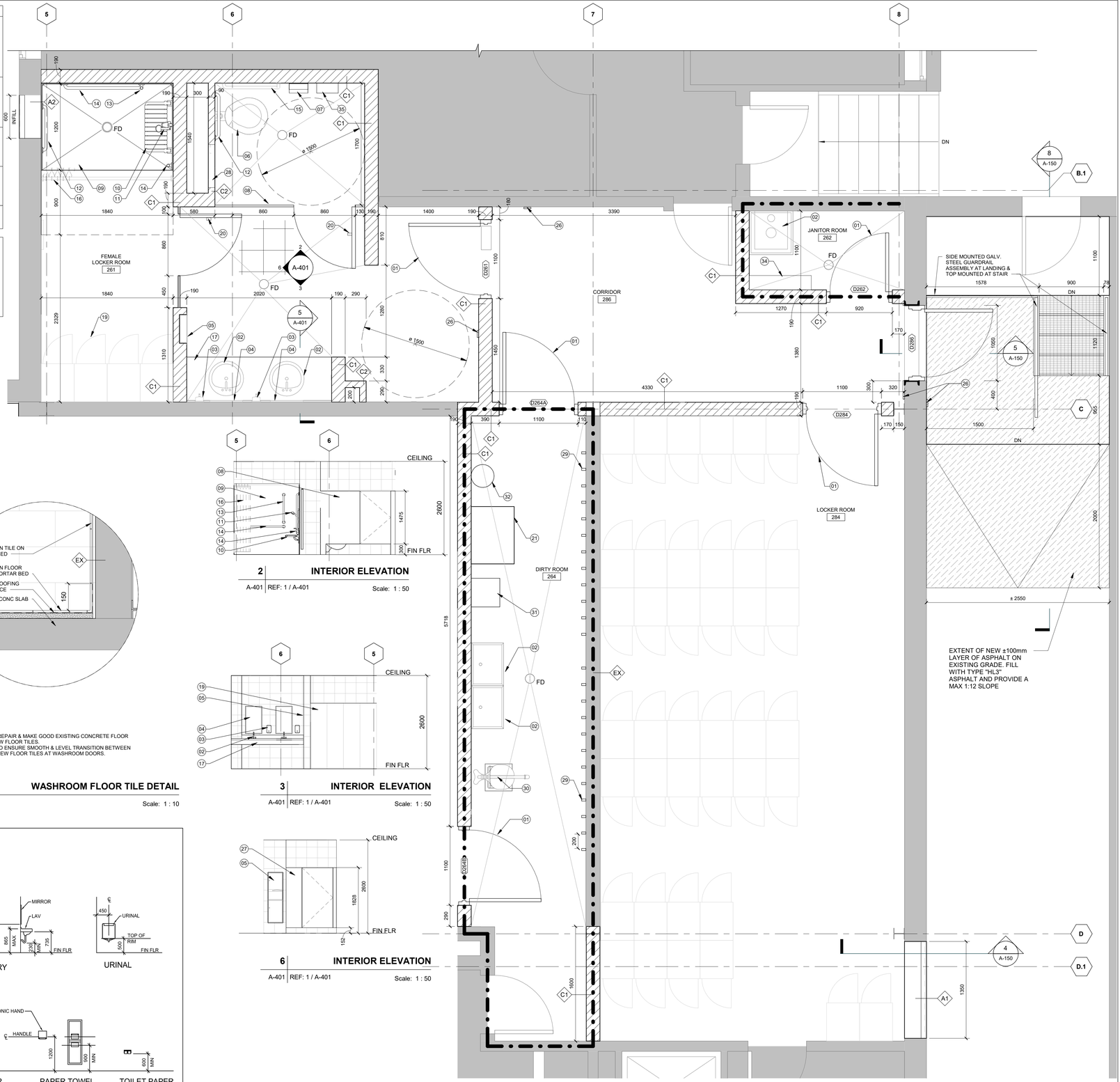
LEGEND

DENOTES AREAS NOT IN CONTRACT

FIRE SAFETY LEGEND

PATH OF TRAVEL

1 HOUR FIRE RESISTANCE RATING



1 ENLARGED PARTIAL FLOOR PLAN

A-401 | REF: 1 / A-101 | Scale: 1 : 25

2 INTERIOR ELEVATION

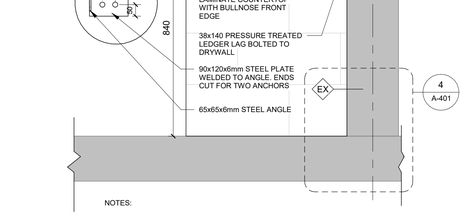
A-401 | REF: 1 / A-401 | Scale: 1 : 50

3 INTERIOR ELEVATION

A-401 | REF: 1 / A-401 | Scale: 1 : 50

6 INTERIOR ELEVATION

A-401 | REF: 1 / A-401 | Scale: 1 : 50

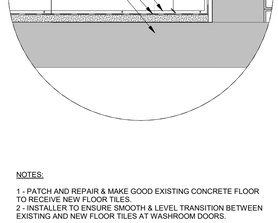


NOTES:

1- PROVIDE WOOD BLOCKING TO SUPPORT ANY LEDGE, RAILS, MIRRORS, VANITIES AND OTHER WASHROOM FIXTURES.

5 WASHROOM VANITY COUNTER DETAIL

A-401 | REF: 1 / A-401 | Scale: 1 : 10



NOTES:

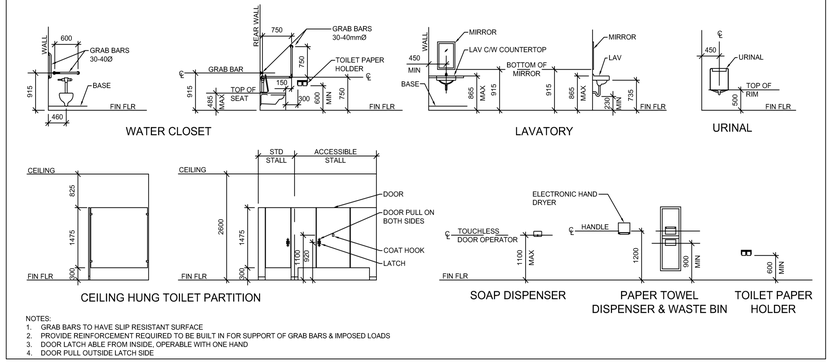
1 - PATCH AND REPAIR & MAKE GOOD EXISTING CONCRETE FLOOR TO RECEIVE NEW FLOOR TILES.
2 - INSTALLER TO ENSURE SMOOTH & LEVEL TRANSITION BETWEEN EXISTING AND NEW FLOOR TILES AT WASHROOM DOORS.

4 WASHROOM FLOOR TILE DETAIL

A-401 | Scale: 1 : 10

OBC FIXTURE HEIGHTS AND CLEARANCES

OBC REFERENCE A-3.8.3.11.(1)



NOTES:
1. GRAB BARS TO HAVE SLIP RESISTANT SURFACE
2. PROVIDE REINFORCEMENT REQUIRED TO BE BUILT IN FOR SUPPORT OF GRAB BARS & IMPOSED LOADS
3. DOOR LATCH ABLE FROM INSIDE, OPERABLE WITH ONE HAND
4. DOOR PULL OUTSIDE LATCH SIDE

AECOM

PROJECT

BLAST BAY UPGRADE
915/916 McINTYRE ST. E, NORTH BAY, ON

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REGISTRATION

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INTERIM

KEY PLAN

0 1000 2000 3000 5000mm

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PROJECT NUMBER

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SHEET TITLE

ENLARGED PARTIAL FLOOR PLAN & DETAILS

SHEET NUMBER

A-401

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CHECKED: Checker
DESIGNER: Designer
PROJECT MANAGEMENT INITIALS:
SCRIPT: RM_PROJECT DELIVERY AGENT - ENLARGED PLANS & 3-4 - ENLARGED PARTIAL FLOOR PLAN & DETAILS
Last Plotted: 2024-03-05 10:01:19 AM
Filename: BIM 360://BP-AMER(CAN) 60678205 - ONTC Grt Blast Bay/60678205 - ONTC Grt Blast Bay_R20-ACM-R20-GRTBLAST-AE.rvt
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PROJECT MANAGEMENT INITIALS: C | DESIGNER: Designer | CHECKED: Checker | APPROVED: Approver | ISO B1 707 x 1000mm
Last Plotted: 2024-03-05 10:01:21 AM
Filename: BIM 360://BP-AMER(CAN) 60678205 - ONTC Grit Blast Bay/60678205-ACM-R20-GRITBLAST-AE.rvt

KEYNOTES

01 HOLLOW METAL DOOR & FRAME ASSEMBLY
02 SINK - REFER TO MECHANICAL DRAWINGS & SPECIFICATIONS
03 SURFACE MOUNTED SOAP DISPENSER
04 MIRROR
05 SURFACE MOUNTED PAPER TOWEL DISPENSER AND DISPOSAL
06 TOILET - REFER TO MECHANICAL DRAWINGS & SPECIFICATIONS
07 TOILET PAPER HOLDER (TYP OF 1 IN EACH STALL)
08 TOILET PARTITION C/W DOOR
09 ROLL-IN SHOWER STALL - REFER TO MECHANICAL DRAWINGS & SPECIFICATIONS
10 SHS - SHOWER FOLDING SEAT
11 SHOWER CONTROL - REFER TO MECHANICAL DRAWINGS AND SPECIFICATIONS
12 GB1 - 610mm LONG 38mm DIA. GRAB BAR
13 GB2 - 765mm LONG 38mm DIA. GRAB BAR
14 GB3 - 1067mm LONG 38mm DIA. GRAB BAR
15 GB4 - L SHAPED 760mm x 760mm LONG 38mm DIA. GRAB BAR
16 SHOWER CURTAIN AND ROD
17 COUNTERTOP
18 METAL CLADDING INFILL PANELS. COLOUR AND PROFILE TO MATCH EXISTING PANELS
19 RELOCATED LOCKERS
20 CH1 - COAT HOOK AT 1100mm FF
21 SOILED COVERALL STORAGE BIN (NOT IN CONTRACT)
22 INSULATED THERMALLY BROKEN HOLLOW METAL DOOR AND FRAME ASSEMBLY
23 GALVANIZED STEEL GUARDRAIL ASSEMBLY
24 MECHANICAL EQUIPMENT, REFER TO MECHNICAL DWGS.
25 GALVANIZED STEEL BOLLARD ASSEMBLY, REFER TO STRUCTURAL DWGS.
26 ACTIVATOR- WAVE HAND DOOR SWITCH
27 PRIVACY PARTITION C/W DOOR
28 600mm X 600mm WIDE ACCESS HATCH, AT 150mm F.F
29 S.S. WALL MOUNTED MASK HOOK, TOTAL OF 24 HOOKS
30 EMERGENCY SHOWER & EYE WASH REFER TO MECHANICAL DWGS
31 WASTE BIN (NOT IN CONTRACT)
32 PERSONAL CLEANING VACUUM STATION
33 EYE WASH - REFER TO MECHANICAL DWGS
34 JANITOR SHELF
35 FEMININE NAPKIN DISPOSAL
36 SCUPPER

WALL TYPES

A1 — A1 EXTERIOR WALL ASSEMBLY
- 38mm PREFINISHED STEEL CLADDING
- Z-GIRTS @ 400 O/C
- 25mm AIR SPACE
- 75mm SPRAY APPLIED FOAM INSULATION
- 190mm CONCRETE BLOCK W/ HORIZONTAL TRUSS REINFORCING EVERY SECOND COURCE

A2 — A2 EXTERIOR WALL ASSEMBLY
- 38mm PREFINISHED STEEL CLADDING
- Z-GIRTS @ 400 O/C
- 25mm AIR SPACE
- 75mm SPRAY APPLIED FOAM INSULATION
- PREFINISHED 22ga STEEL LINER PANEL

C1 — C1 INTERIOR WALL ASSEMBLY
- 190mm CONCRETE BLOCK
- HORIZONTAL TRUSS REINFORCING EVERY SECOND COURCE
- BULLNOSE ON EXPOSED CORNERS

C2 — C2 INTERIOR WALL ASSEMBLY
- 90mm CONCRETE BLOCK
- HORIZONTAL TRUSS REINFORCING EVERY SECOND COURCE
- BULLNOSE ON EXPOSED CORNERS

EX — EX EXISTING WALL TO REMAIN

ROOF TYPES

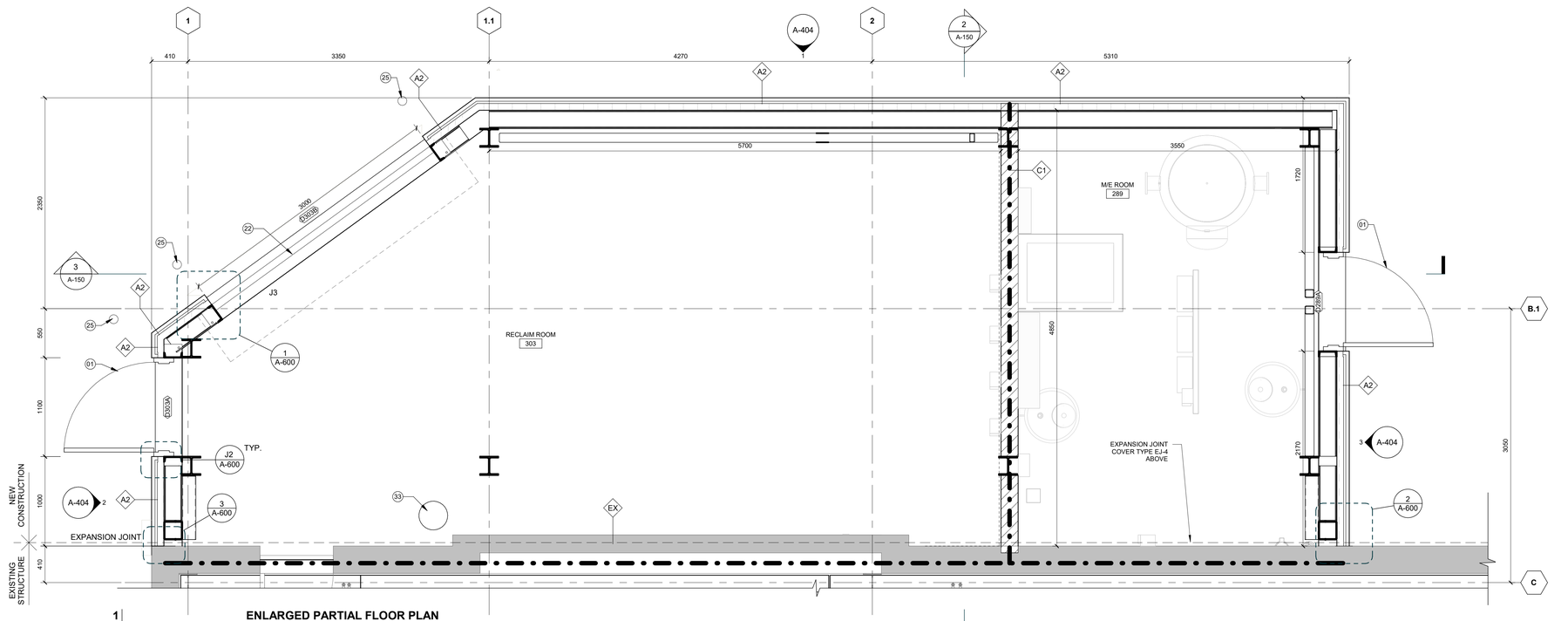
R1 — ROOF ASSEMBLY
2 PLY MODIFIED BITUMEN MEMBRANE
12mm SHEATHING
TAPERED INSULATION
2 LAYERS OF 50mm BASE INSULATION
VAPOUR RETARDER
PROTICTION BOARD
38mm STEEL DECK- REFER TO STRUCT DWGS

LEGEND

DENOTES AREAS NOT IN CONTRACT

FIRE SAFETY LEGEND

PATH OF TRAVEL
1 HOUR FIRE RESISTANCE RATING



1 ENLARGED PARTIAL FLOOR PLAN
A-402 | REF: 1 / A-101 | Scale: 1 : 25

4 ENLARGED PARTIAL ROOF PLAN
A-402 | Scale: 1 : 25

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PROJECT

BLAST BAY UPGRADE
915/916 McINTYRE ST. E, NORTH BAY, ON

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REGISTRATION

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KEY PLAN

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ISSUE/REVISION

No.	DESCRIPTION	DATE
4	ISSUED FOR BUDGET - VALUE ENG	05/03/2024
3	ISSUED FOR TENDER	29/09/2023
2	ISSUED FOR 100% CLIENT REVIEW	21/07/2023
1	ISSUED FOR 60% CLIENT REVIEW	31/03/2023

PROJECT NUMBER

60678205

SHEET TITLE

ENLARGED PARTIAL FLOOR PLAN & PARTIAL ROOF PLAN

SHEET NUMBER

A-402

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PROJECT MANAGEMENT INITIALS: DESIGNER: Designer CHECKED: Checker APPROVED: Approver ISO B1 707 x 1000mm
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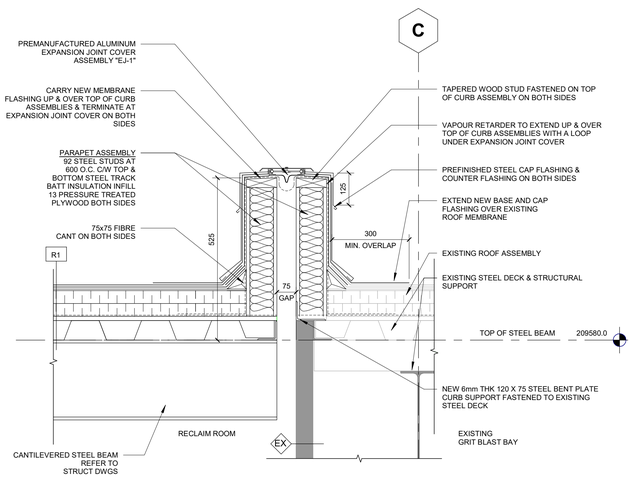
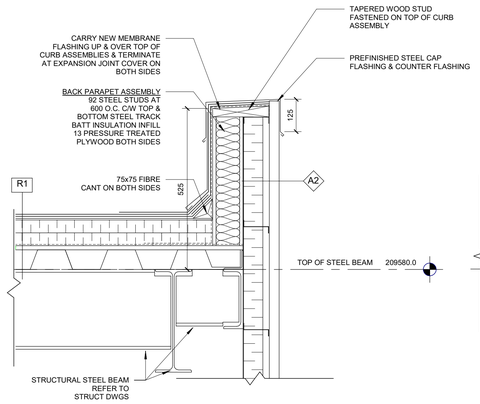
Filename: BIM 360:/BP-AMER(CAN) 60678205 - ONTC Grit Blast Bay/60678205-ACM-R20-GRITBLAST-AE.rvt
DRFT: RA - PRODUCT TEAM: HENRY AEVAR - ENLARGED PLANS-A-400 ROOF DETAILS

NOTES

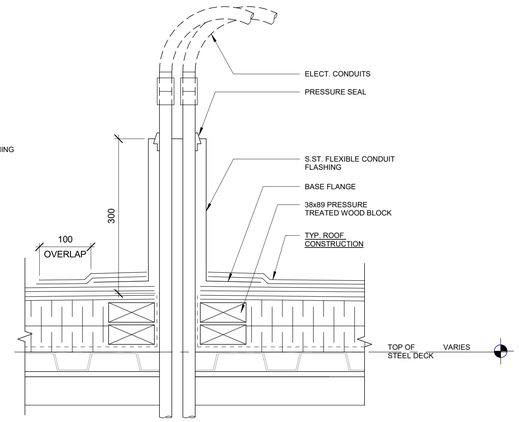
1. TYPE 2 FLASHING FOR 2 OR LESS CONDUIT/PIPE PENETRATIONS SERVICING THE SAME EQUIPMENT - REFER TO SPECIFICATIONS
2. TYPE 3 FLASHING FOR 3 OR MORE CONDUIT/PIPE PENETRATIONS SERVICING THE SAME EQUIPMENT - REFER TO SPECIFICATIONS



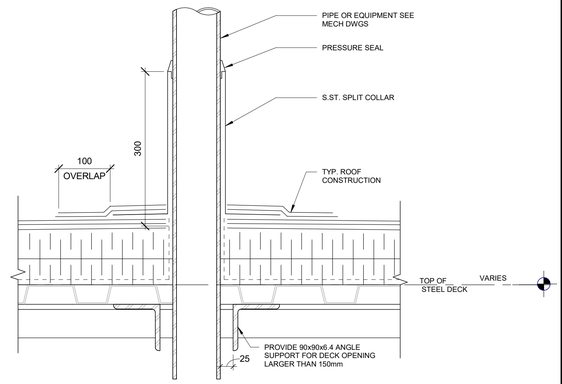
1 EXPANSION JOINT DETAIL AT ROOF PARAPET
A-403 | REF: 2 / A-150 — Scale: 1 : 10



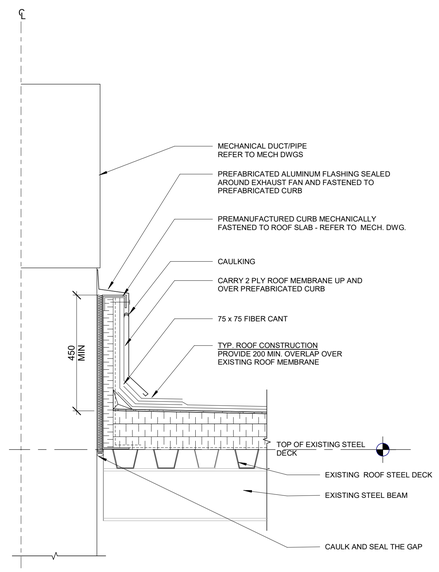
2 TYPICAL ROOF PARAPET DETAIL
A-403 | REF: 2 / A-150 — Scale: 1 : 10



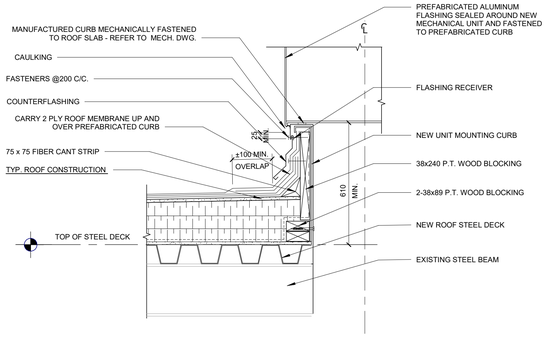
3 ROOF PENETRATION DETAIL
A-403 — Scale: 1 : 5



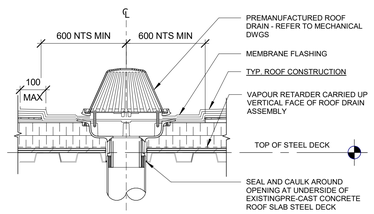
4 ROOF PENETRATION DETAIL
A-403 — Scale: 1 : 5



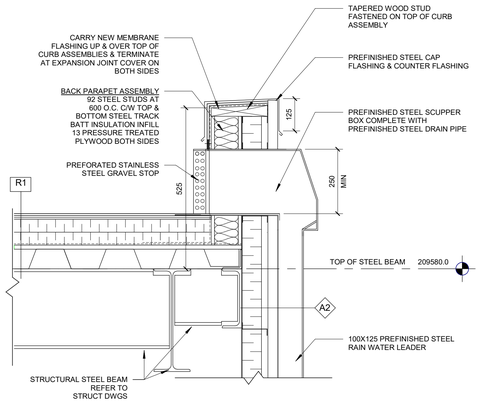
5 PREMANUFACTURED MECH CURB AT EXISTING ROOF
A-403 — Scale: 1 : 10



6 ROOF CURB DETAIL-MECH. UNITS
A-403 — Scale: 1 : 10



7 ROOF DEPRESSION - ROOF DRAIN
A-403 — Scale: 1 : 10



8 TYPICAL SCUPPER DETAIL
A-403 | REF: 1 / A-402 — Scale: 1 : 10

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PROJECT

BLAST BAY UPGRADE
915/916 McINTYRE ST. E, NORTH BAY, ON

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KEY PLAN

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1	ISSUED FOR 60% CLIENT REVIEW	31/03/2023

PROJECT NUMBER

60678205

SHEET TITLE

ROOF DETAILS

SHEET NUMBER

A-403

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ISO B1 707 x 1000mm
APPROVED: Approver
CHECKED: Checker
DESIGNER: Designer
PROJECT MANAGEMENT INITIALS:

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02 SINK - REFER TO MECHANICAL DRAWINGS & SPECIFICATIONS	20 CH1 - COAT HOOK
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07 TOILET PAPER HOLDER (TYP OF 1 IN EACH STALL)	25 GALVANIZED STEEL BOLLARD ASSEMBLY, REFER TO STRUCTURAL DWGS.
08 TOILET STALL	26 LIGHT FIXTURE, REFER TO ELEC. DWGS.
09 ROLL-IN SHOWER STALL - REFER TO MECHANICAL DRAWINGS & SPECIFICATIONS	27 PRIVACY PARTITION C/W DOOR
10 SHS - SHOWER FOLDING SEAT	28 600mm X 600mm WIDE ACCESS HATCH, AT 150mm F.F
11 SHOWER CONTROL - REFER TO MECHANICAL DRAWINGS AND SPECIFICATIONS	29 S.S. WALL MOUNTED MASK HOOK, TOTAL OF 24 HOOKS
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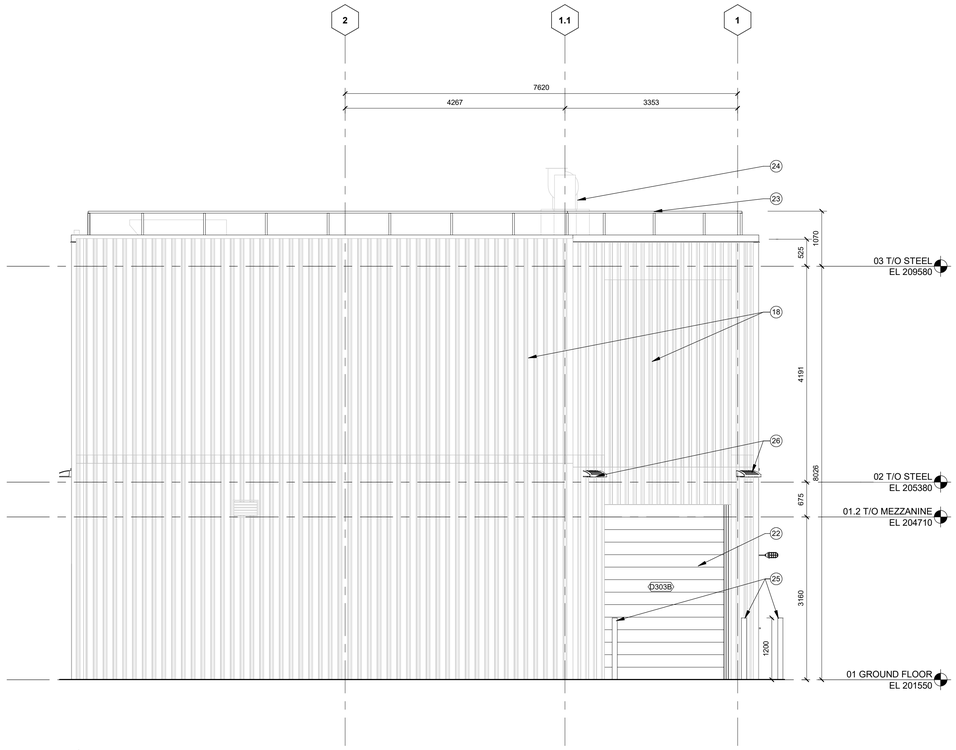
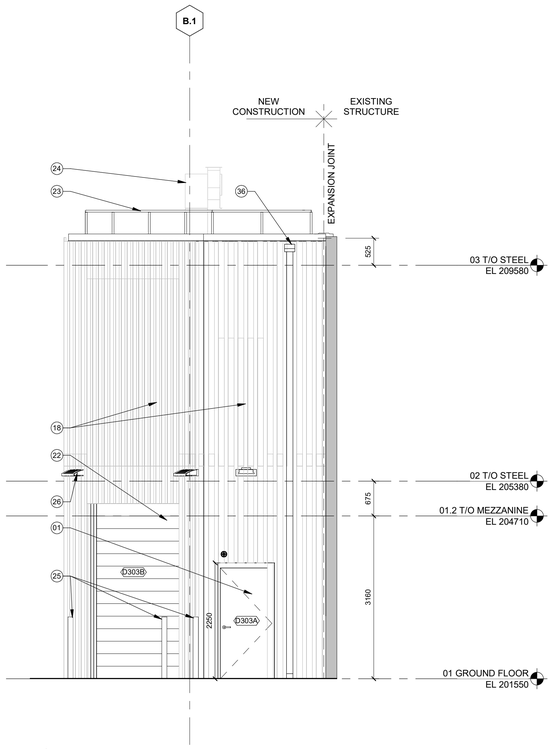


1 NORTH ELEVATION

A-404 | REF: 1 / A-402

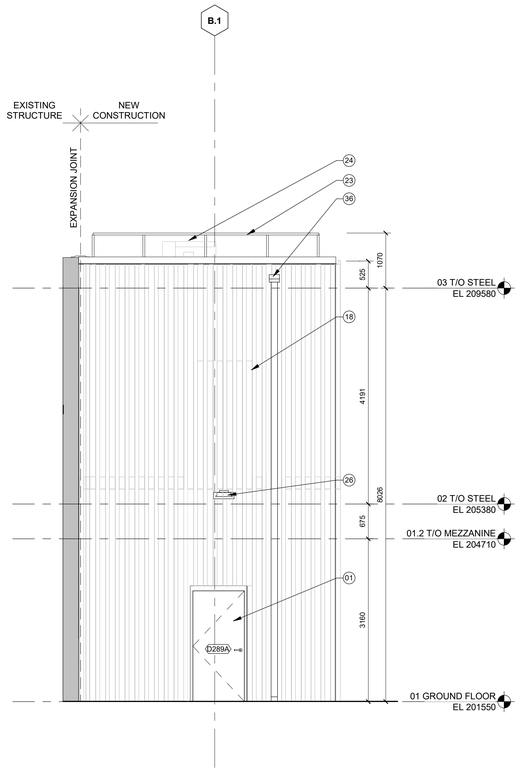
Scale: 1 : 50



2 WEST ELEVATION

A-404 | REF: 1 / A-402

Scale: 1 : 50



3 EAST ELEVATION

A-404 | REF: 1 / A-402

Scale: 1 : 50

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REGISTRATION

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KEY PLAN

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PROJECT NUMBER

60678205

SHEET TITLE

EXTERIOR ELEVATIONS

SHEET NUMBER

A-404

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ROOM FINISH SCHEDULE

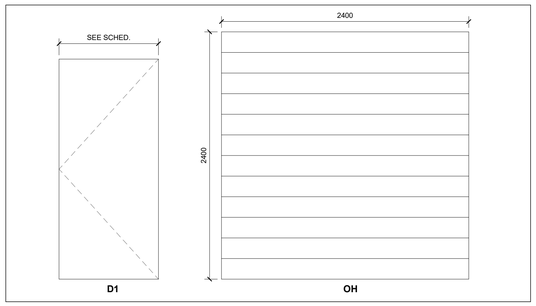
ROOM NO.	ROOM NAME	FLOOR		NORTH WALL		SOUTH WALL		EAST WALL		WEST WALL		CEILING		HEIGHT	COMMENTS
		MAT.	FIN.	MAT.	FIN.	MAT.	FIN.	MAT.	FIN.	MAT.	FIN.	MAT.	FIN.		
261	FEMALE LOCKER ROOM	CONC	PORCELAIN TILE	CONC BLK	PORCELAIN TILE	EXISTING	PORCELAIN TILE	CONC BLK	PORCELAIN TILE	EXISTING	PORCELAIN TILE	GYP BD	PAINTED	2600	
262	JANITOR ROOM	CONC	PORCELAIN TILE	EXISTING	PORCELAIN TILE	CONC BLK	PORCELAIN TILE	EXISTING	PORCELAIN TILE	CONC BLK	PORCELAIN TILE	GYP BD	PAINTED	2600	1HR FIRE RATED CEILING
264	DIRTY ROOM	CONC	EPOXY	CONC BLK	PAINTED	EXISTING	PAINTED	EXISTING	PAINTED	CONC BLK	PORCELAIN TILE,UP TO 1600 AFF.	CONC	PAINTED	2600	1HR FIRE RATED CEILING
284	LOCKER ROOM	CONC	EXISTING TO REMAIN	CONC BLK	PAINTED	EXISTING	PAINTED	EXISTING TO REMAIN	PAINTED	EXISTING	PAINTED	EXISTING	-	-	
286	CORRIDOR	CONC	EPOXY	EXISTING	PAINTED	CONC BLK	PAINTED	EXISTING	PAINTED	CONC BLK	PAINTED	ACT	-	2600	
289	M/E ROOM	CONC	EPOXY	STEEL	-	EXISTING	PAINTED	STEEL	-	EXISTING	-	STEEL	IC	3800	1HR FIRE RATED CEILING, ALL EXPOSED STRUCT STEEL MEMBERS TO RECIEVE A COATING OF INTUMESCENT FIREPROOFING
303	RECLAIM ROOM	CONC	EPOXY	STEEL	-	EXISTING	PAINTED	STEEL	-	STEEL/MASONRY	-/ PAINTED	EXP.	-	8000	ONLY MASONRY TO BE PAINTED

ABBREVIATIONS

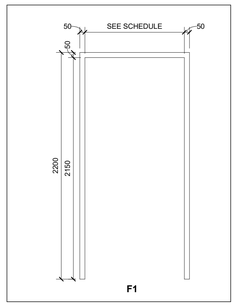
CONC - CONCRTE
CONC BLK - CONCRETE BLOCK
GALV. STL. - GALVANIZED STEEL
HM - HOLLOW METAL
ACT - ACOUSTIC CEILING TILE
GYP BD - GYPSUM BOARD CEILING
PREFIN- PREFINISHED
IC - INTUMESCENT COATING

DOOR AND HARDWARE SCHEDULE

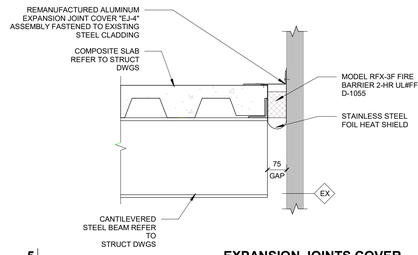
DOOR NO.	FROM	TO ROOM	DOOR SIZE (W X H)	DOOR DATA										HARDWARE GROUP	NOTES
				DOOR					FRAME						
				FIRE RATING	DOOR TYPE	MATERIAL	FINISH	GLASS	FRAME TYPE	MATERIAL	FINISH	HEAD TYPE	JAMB TYPE		
D261	CORRIDOR	FEMALE LOCKER ROOM	1000 X 2150	-	D1	HM	PAINTED	-	F1	HM	PAINTED	H1	J1	1	ACTIVATOR - WAVE HAND, BOTH SIDES OF THE DOOR
D262	CORRIDOR	JANITOR ROOM	820 X 2150	3/4	D1	HM	PAINTED	-	F1	HM	PAINTED	H1	J1	2	
D264A	CORRIDOR	DIRTY ROOM	1000 X 2150	3/4	D1	HM	PAINTED	-	F1	HM	PAINTED	H1	J1	3	
D264B	GRIT BLASTING BAY	DIRTY ROOM	1000 X 2150	3/4	D1	HM	PAINTED	-	F1	HM	PAINTED	H1	J1	3	
D284	CORRIDOR	LOCKER ROOM	1000 X 2150	-	D1	HM	PAINTED	-	F1	HM	PAINTED	H1	J1	4	
D286	EXTERIOR	CORRIDOR	950 X 2150	-	D1	HM	PAINTED	-	F1	HM	PAINTED	H2	J2	5	ACTIVATOR - WAVE HAND, BOTH SIDES OF THE DOOR
D289A	M/E ROOM	EXTERIOR	1000 X 2150	-	D1	HM	PAINTED	-	F1	HM	PAINTED	H2	J2	6	
D289D	FEMALE LOCKER ROOM	FEMALE LOCKER ROOM	860 X 1480				GALV								
D289E	FEMALE LOCKER ROOM	FEMALE LOCKER ROOM	860 X 1680												
D303A	EXTERIOR	RECLAIM ROOM	1000 X 2150	-	D1	HM	PAINTED	-	F1	HM	PAINTED	H2	J2	6	
D303B	EXTERIOR	RECLAIM ROOM	3000 X 3400	-	OH	GALV. STEEL	PREFIN	-	-	GALV. STEEL	PREFIN	H3	J3	7	REFER TO SPECIFICATION FOR OVERHEAD DOOR AND OPERATOR



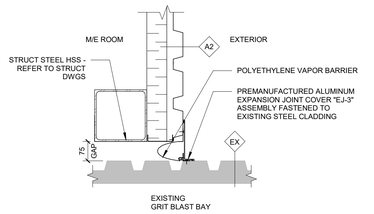
DOOR TYPE



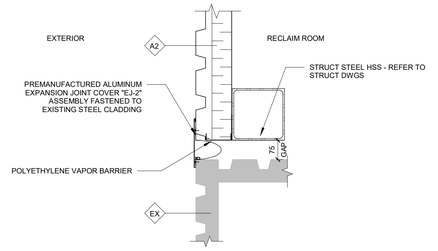
FRAME TYPE



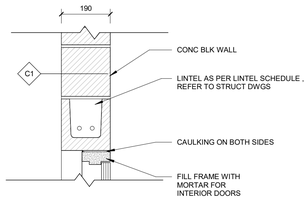
5 | A-600 — EXPANSION JOINTS COVER
Scale: 1 : 10



2 | A-600 | REF: 1 / A-402 — EXPANSION JOINT COVER PLAN DETAIL
Scale: 1 : 10



3 | A-600 | REF: 1 / A-402 — EXPANSION JOINT COVER PLAN DETAIL
Scale: 1 : 10



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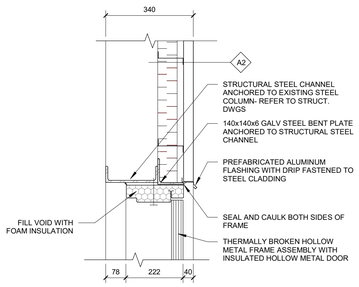
HEAD DETAIL



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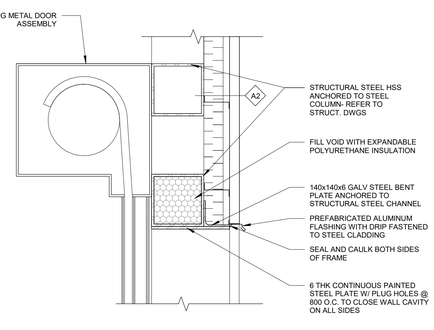
HEAD DETAIL



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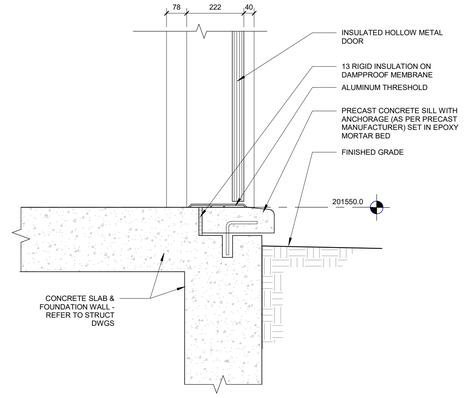
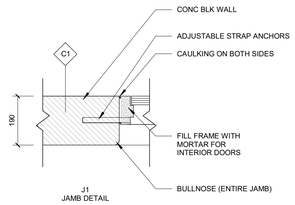
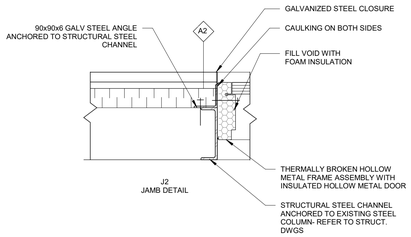
HEAD DETAIL



S1
OVERHEAD DOOR SILL DETAIL



J1
JAMB DETAIL



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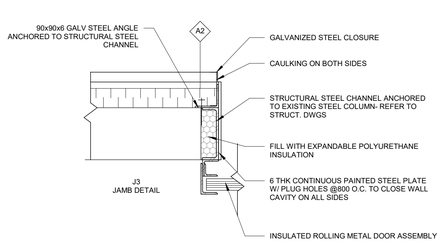
JAMB DETAIL



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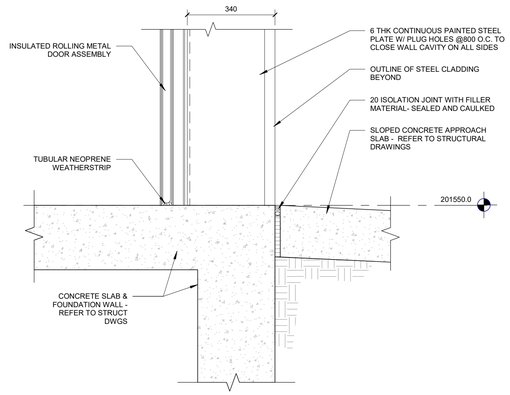
JAMB DETAIL



S2
OVERHEAD DOOR SILL DETAIL

1 | A-600 | REF: 5 / A-150 — TYPICAL DOOR DETAILS
Scale: 1 : 10

AECOM

PROJECT
BLAST BAY UPGRADE
915/916 McINTYRE ST. E, NORTH BAY, ON

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REGISTRATION
INTERIM
INTERIM

KEY PLAN

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ISSUE/REVISION

No.	DESCRIPTION	DATE
4	ISSUED FOR BUDGET - VALUE ENG	05/03/2024
3	ISSUED FOR TENDER	29/09/2023
2	ISSUED FOR 100% CLIENT REVIEW	21/07/2023
1	ISSUED FOR 60% CLIENT REVIEW	31/03/2023

PROJECT NUMBER
60678205

SHEET TITLE
SCHEDULES & DETAILS

SHEET NUMBER
A-600

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APPROVED: Approver
CHECKED: Checker
DESIGNER: Designer
PROJECT MANAGEMENT INITIALS:
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Last Plotted: 2024-03-05 10:01:26 AM
Filename: BIM 360:/BP-AMER(CAN) 60678205 - CNTC Grit Blast Bay/60678205-ACM-R20-GRITBLAST-ALE.rvt
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APPROVED: Approver
CHECKED: Checker
DESIGNER: Designer
PROJECT MANAGEMENT INITIALS:

LEGEND

DENOTES AREAS NOT IN CONTRACT

DENOTES EXTENT OF DEMOLITION

DEMOLITION NOTES

1. THIS FACILITY IS TO REMAIN IN FULL OPERATION FOR THE DURATION OF THE WORK. DEMOLITION WORK SHALL NOT INTERFERE WITH OPERATIONS AND IS TO BE SCHEDULED WITH THE FACILITY OPERATOR BEFORE STARTING WORK. CONTRACTOR SHALL VISIT THE SITE AND OBTAIN ALL BASE BUILDING INFORMATION AS TO EXISTING CONDITIONS AFFECTING THEIR WORK. BEFORE PROCEEDING WITH ANY WORK, OBTAIN ALL APPROVALS AND VERIFY THE LOCATION AND SIZE OF ALL EXISTING SERVICES.
2. REMOVE ITEMS AND DISPOSE OF THEM OFFSITE IN ACCORDANCE WITH THE REGULATIONS, UNLESS NOTED ON THE DEMOLITION DOCUMENTS TO BE SALVAGED OR RETURNED. SEPARATE ALL MATERIALS ON SITE AS PER APPLICABLE ONTARIO REGULATIONS.
3. PROTECT ALL STRUCTURAL MEMBERS TO REMAIN, SHORE AND BRACE AS REQUIRED.
4. ALL DEMOLITION DRAWINGS SHALL BE READ IN CONJUNCTION WITH STRUCTURAL, MECHANICAL AND ELECTRICAL CONSTRUCTION DRAWINGS.
5. DIMENSIONS GIVEN ON THESE DRAWINGS ARE APPROXIMATIONS ONLY. CONTRACTOR TO VERIFY ALL DIMENSIONS ON SITE BEFORE STARTING WORK. DO NOT USE SCALE TO GENERATE DIMENSIONS FROM THESE DRAWINGS
6. PROVIDE DUST CONTROL SYSTEM DURING DEMOLITION AND TO ALL WORK THAT PRODUCE DUST
7. PROTECT ALL EXISTING EQUIPMENT FROM DUST, DEBRIS AND DAMAGE DURING DEMOLITION.
8. PROVIDE FIRE WATCH FOR DURATION OF PERIODS WHEN FIRE ALARM SYSTEMS ARE NOT OPERATIONAL DUE TO CONTRACTED WORK.
9. PROTECT ALL EXISTING FIRE DETECTION EQUIPMENT THAT MAY BE AFFECTED BY DEMOLITION WORK
10. ENSURE THAT ALL REPAIRS TO EXISTING SURFACES AS A RESULT OF DEMOLITION ARE MADE GOOD.
11. EXISTING FACILITY CONTAINS DESIGNATED SUBSTANCES. THE CONTRACTOR SHALL BE RESPONSIBLE FOR HAZARDOUS MATERIAL ABATEMENT. REFER TO CONTRACT SPECIFICATIONS AND DESIGNATED SUBSTANCE SURVEY REPORT IN THE APPENDICES FOR MORE DETAILS.

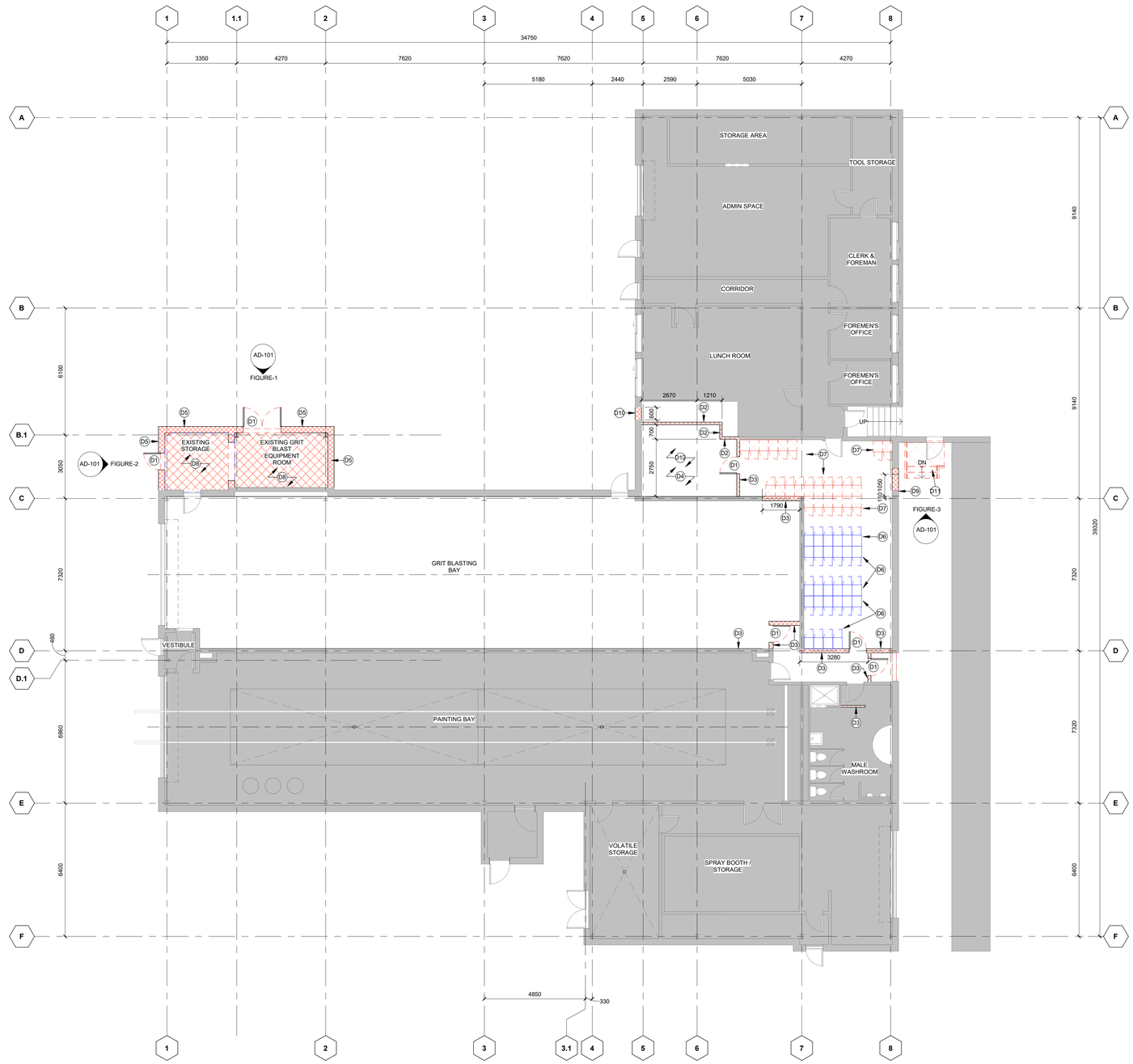
DEMOLITION KEYNOTES

- D1 REMOVE AND DISPOSE OF EXISTING HOLLOW METAL DOOR & FRAME ASSEMBLY
- D2 REMOVE AND DISPOSE OF EXISTING DRYWALL ASSEMBLY
- D3 REMOVE AND DISPOSE OF EXISTING MASONRY WALL
- D4 REMOVE AND DISPOSE OF EXISTING SUSPENDED CEILING ASSEMBLY
- D5 REMOVE AND DISPOSE OF EXISTING EXTERIOR WALL ASSEMBLY
- D6 EXISTING LOCKER UNITS TO REMAIN
- D7 REMOVE AND SALVAGE EXISTING LOCKER UNITS FOR REINSTALLATION ELSEWHERE IN THE ROOM
- D8 REMOVE AND DISPOSE OF EXISITNG ROOF ASSEMBLY INCLUDING ROOF SUPPORTS FOR EXISTING STORAGE
- D9 SAW CUT OPENING IN EXISTING WALL ASSEMBLY AND MAKE GOOD TO RECIEVE NEW DOOR AND FRAME ASSEMBLY
- D10 REMOVE EXISTING MECHANICAL AIR CONDITION UNIT, OPENING TO BE FILLED WITH NEW WALL ASSEMBLY
- D11 REMOVE EXISTING STAIR AND GUARDRAILS
- D12 REMOVE AND DISPOSE OF EXISTING FLOORING AND MAKE GOOD TO RECIEVE NEW FLOOR TILES

FIGURE-1

FIGURE-2

FIGURE-3



1 GROUND FLOOR DEMOLITION

AD101 | REF: 2 / A-150

Scale: 1 : 100

AECOM

PROJECT

BLAST BAY UPGRADE
915/916 McINTYRE ST. E, NORTH BAY, ON

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REGISTRATION

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INTERIM

KEY PLAN

0 2 4 6 10m

ISSUE/REVISION

No.	DESCRIPTION	DATE
4	ISSUED FOR BUDGET - VALUE ENG	05/03/2024
3	ISSUED FOR TENDER	29/09/2023
2	ISSUED FOR 100% CLIENT REVIEW	21/07/2023
1	ISSUED FOR 60% CLIENT REVIEW	31/03/2023

PROJECT NUMBER

60678205

SHEET TITLE

GROUND FLOOR DEMOLITION PLAN

SHEET NUMBER

AD101

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SCOPE OF DEMOLITION AD101 DEMOLITION PLANS AD101 GROUND FLOOR DEMOLITION PLAN
Last Plotted: 2024-03-05 10:01:29 AM
Filename: BIM 360://BP-AMER(CAN) 60678205 - ONTC Grit Blast Bay/60678205-ACM-R20-GRITBLAST-AE.rvt
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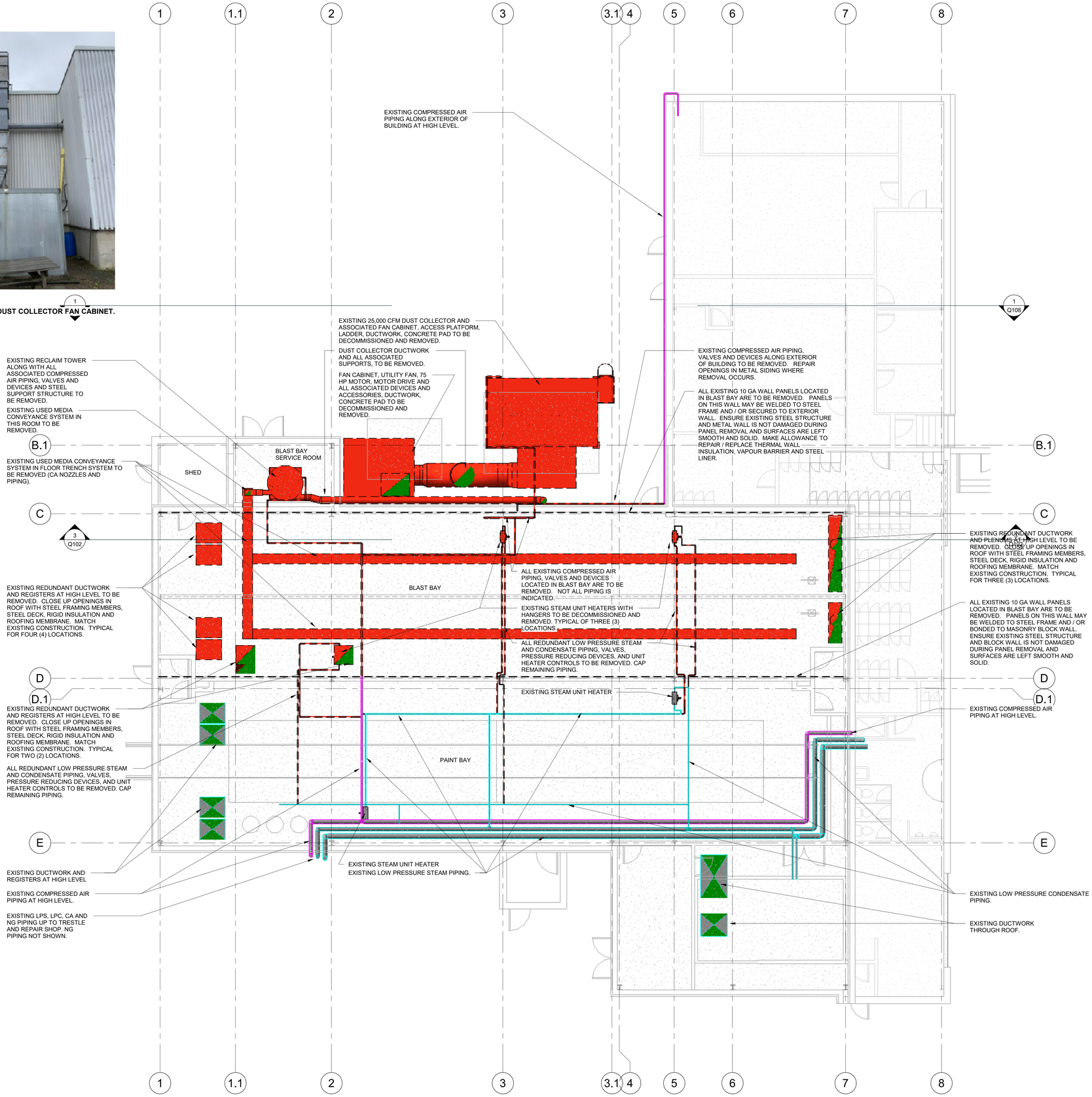
PHOTO A - EXISTING DUST COLLECTOR.

PHOTO B - EXISTING DUST COLLECTOR FAN CABINET.

PHOTO C - EXISTING BLAST BAY EXTERIOR WALL - ALONG GRID 'C'.

PHOTO D - EXISTING BLAST BAY INTERIOR WALL ALONG GRID 'D'.



1
Q001 | REF: 1 / Q110

GROUND FLOOR PLAN - PROCESS

Scale: 1 : 75

PROJECT MANAGEMENT INITIALS:
DESIGNER: Designer
CHECKED: Checker
APPROVED: Approver
ISO B1 707 x 1000mm

Last Plotted: 2024-02-28 2:33:50 PM
Filename: BIM 360://BP-AMER(CAN) 60678205 - ONTC Grit Blast Bay/60678205-ACM-R20-GRITBLAST-Q.rvt

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915/916 McINTYRE ST. E, NORTH BAY, ON

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KEY PLAN

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ISSUE/REVISION

No.	DESCRIPTION	DATE
5	ISSUED FOR BUDGET - VALUE ENG	
4	ISSUED FOR TENDER	2023/09/29

PROJECT NUMBER

60678205

SHEET TITLE

DEMOLITION GROUND FLOOR PLAN - PROCESS

SHEET NUMBER

Q001

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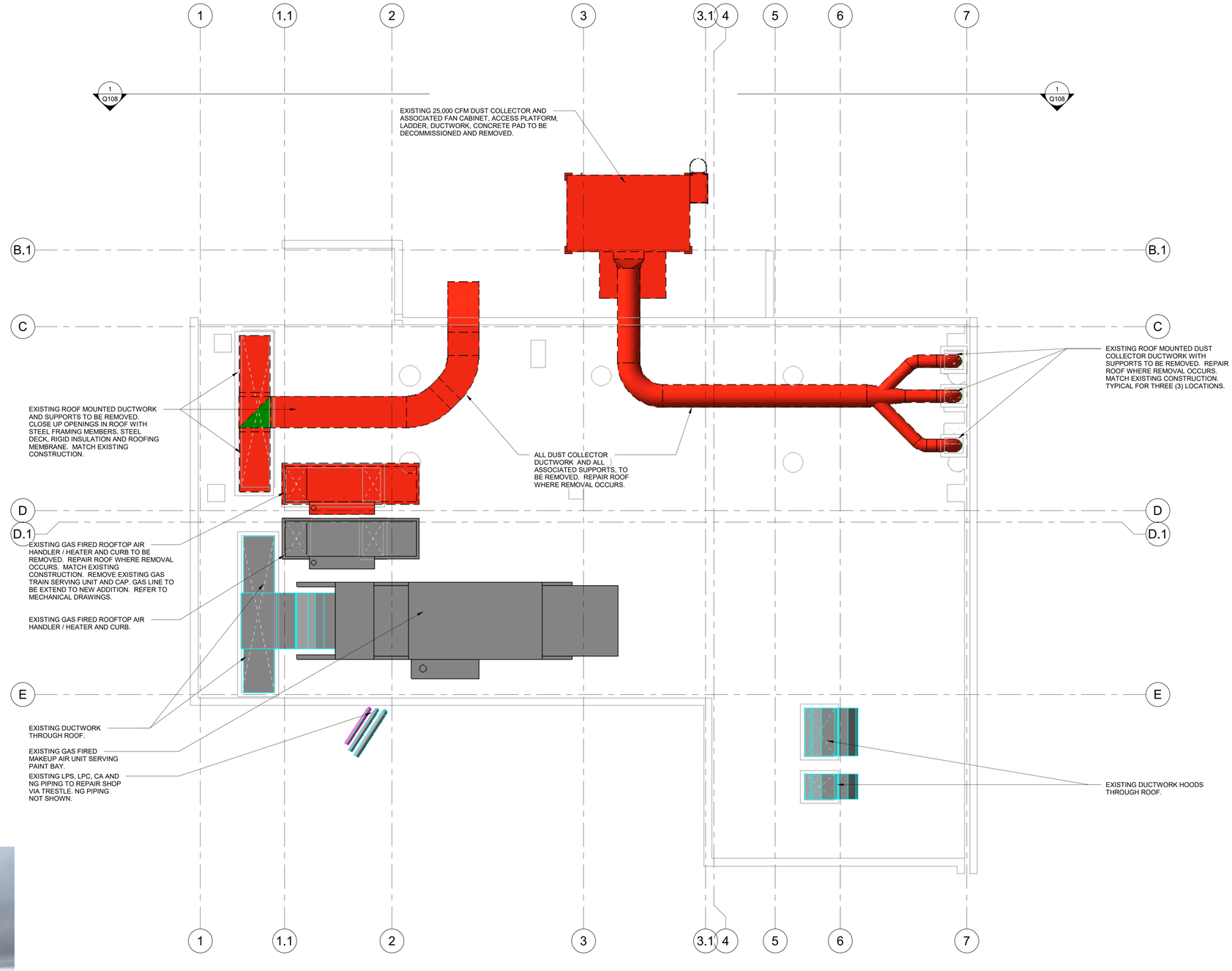
ISO B1 707 x 1000mm
APPROVED: Approver
CHECKED: Checker
DESIGNER: Designer
PROJECT MANAGEMENT INITIALS:

PHOTO E - EXISTING DUST COLLECTOR (HIGH LEVEL).

PHOTO F - EXISTING DUST COLLECTOR DUCTWORK AND GAS FIRED ROOFTOP AIR HANDLER / HEATER.

PHOTO G - EXISTING DUST COLLECTOR DUCTWORK.



1 | **HIGH ROOF LEVEL PLAN - PROCESS DEMO**

Q002 | REF: 1 / Q108 | NTS

AECOM

PROJECT

BLAST BAY UPGRADE
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REGISTRATION

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INTERIM

KEY PLAN

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ISSUE/REVISION

No.	DESCRIPTION	DATE
5	ISSUED FOR BUDGET - VALUE ENG	
4	ISSUED FOR TENDER	2023/09/29

PROJECT NUMBER

60678205

SHEET TITLE

DEMOLITION ROOF PLAN - PROCESS

SHEET NUMBER

Q002

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ISO B1 707 x 1000mm
APPROVED: Approver
CHECKED: Checker
DESIGNER: Designer
PROJECT MANAGEMENT INITIALS:

EXISTING DUCTWORK THROUGH ROOF.

EXISTING LOW PRESSURE CONDENSATE PIPING.

ALL DUST COLLECTOR DUCTWORK AND ALL ASSOCIATED SUPPORTS, TO BE REMOVED. REPAIR ROOF WHERE REMOVAL OCCURS.

EXISTING REDUNDANT DUCTWORK AND PLENUMS AT HIGH LEVEL TO BE REMOVED. CLOSE UP OPENINGS IN ROOF WITH STEEL FRAMING MEMBERS, STEEL DECK, RIGID INSULATION AND ROOFING MEMBRANE. MATCH EXISTING CONSTRUCTION. TYPICAL FOR THREE (3) LOCATIONS.

EXISTING LOW PRESSURE STEAM PIPING.

EXISTING STEAM UNIT HEATER

ALL REDUNDANT LOW PRESSURE STEAM AND CONDENSATE PIPING, VALVES, PRESSURE REDUCING DEVICES, AND UNIT HEATER CONTROLS TO BE REMOVED. CAP REMAINING PIPING.

EXISTING STEAM UNIT HEATERS WITH HANGERS TO BE DECOMMISSIONED AND REMOVED. TYPICAL OF THREE (3) LOCATIONS.

EXISTING 25,000 CFM DUST COLLECTOR AND ASSOCIATED FAN CABINET, ACCESS PLATFORM, LADDER, DUCTWORK, CONCRETE PAD TO BE DECOMMISSIONED AND REMOVED.

ALL EXISTING 10 GA WALL PANELS LOCATED IN BLAST BAY ARE TO BE REMOVED. PANELS ON THIS WALL MAY BE WELDED TO STEEL FRAME AND / OR SECURED TO EXTERIOR WALL. ENSURE EXISTING STEEL STRUCTURE AND METAL WALL IS NOT DAMAGED DURING PANEL REMOVAL AND SURFACES ARE LEFT SMOOTH AND SOLID. MAKE ALLOWANCE TO REPAIR / REPLACE THERMAL WALL INSULATION, VAPOUR BARRIER AND STEEL LINER.

EXISTING COMPRESSED AIR PIPING ALONG EXTERIOR OF BUILDING AT HIGH LEVEL.

EXISTING COMPRESSED AIR PIPING, VALVES AND DEVICES ALONG EXTERIOR OF BUILDING TO BE REMOVED. REPAIR OPENINGS IN METAL SIDING WHERE REMOVAL OCCURS.

DUST COLLECTOR DUCTWORK AND ALL ASSOCIATED SUPPORTS, TO BE REMOVED.

FAN CABINET, UTILITY FAN, 75 HP MOTOR, MOTOR DRIVE AND ALL ASSOCIATED DEVICES AND ACCESSORIES, DUCTWORK, CONCRETE PAD TO BE DECOMMISSIONED AND REMOVED.

EXISTING RECLAIM TOWER ALONG WITH ALL ASSOCIATED COMPRESSED AIR PIPING, VALVES AND DEVICES AND STEEL SUPPORT STRUCTURE TO BE REMOVED.

EXISTING USED MEDIA CONVEYANCE SYSTEM IN BLAST BAY SERVICE ROOM TO BE REMOVED.

EXISTING COMPRESSED AIR PIPING AT HIGH LEVEL.

EXISTING GAS FIRED MAKEUP AIR UNIT SERVING PAINT BAY.

EXISTING STEAM UNIT HEATER

EXISTING GAS FIRED ROOFTOP AIR HANDLER / HEATER AND CURB.

EXISTING LPS, LPC, CA AND NG PIPING TO REPAIR SHOP VIA TRESTLE. NG PIPING NOT SHOWN.

EXISTING GAS FIRED ROOFTOP AIR HANDLER / HEATER AND CURB TO BE REMOVED. REPAIR ROOF WHERE REMOVAL OCCURS. MATCH EXISTING CONSTRUCTION. REMOVE EXISTING GAS TRAIN SERVING UNIT AND CAP. GAS LINE TO BE EXTEND TO NEW ADDITION. REFER TO MECHANICAL DRAWINGS.

EXISTING DUCTWORK AND REGISTERS AT HIGH LEVEL

EXISTING COMPRESSED AIR PIPING AT HIGH LEVEL.

ALL EXISTING 10 GA WALL PANELS LOCATED IN BLAST BAY ARE TO BE REMOVED. PANELS ON THIS WALL MAY BE WELDED TO STEEL FRAME AND / OR BONDED TO MASONRY BLOCK WALL. ENSURE EXISTING STEEL STRUCTURE AND BLOCK WALL IS NOT DAMAGED DURING PANEL REMOVAL AND SURFACES ARE LEFT SMOOTH AND SOLID.

EXISTING REDUNDANT DUCTWORK AND REGISTERS AT HIGH LEVEL TO BE REMOVED. CLOSE UP OPENINGS IN ROOF WITH STEEL FRAMING MEMBERS, STEEL DECK, RIGID INSULATION AND ROOFING MEMBRANE. MATCH EXISTING CONSTRUCTION. TYPICAL FOR FOUR (4) LOCATIONS.

ALL EXISTING COMPRESSED AIR PIPING, VALVES AND DEVICES LOCATED IN BLAST BAY ARE TO BE REMOVED. NOT ALL PIPING IS INDICATED.

EXISTING USED MEDIA CONVEYANCE SYSTEM IN FLOOR TRENCH SYSTEM TO BE REMOVED (CA NOZZLES AND PIPING).

1 ISOMETRIC VIEW - OVERALL BUILDING DEMOLITION - PROCESS

Q003 NTS

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AECOM

PROJECT

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915/916 McINTYRE ST. E, NORTH BAY, ON

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KEY PLAN

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ISSUE/REVISION

No.	DESCRIPTION	DATE
5	ISSUED FOR BUDGET - VALUE ENG	
4	ISSUED FOR TENDER	2023/09/29

PROJECT NUMBER

60678205

SHEET TITLE

DEMOLITION ISOMETRIC VIEW - PROCESS

SHEET NUMBER

Q003

Last Plotted: 2024-02-28 2:33:55 PM
Filename: BIM 360://BP-AMER[CAN] 60678205 - ONTC Grt Blast Bay/60678205-ACM-R20-GRTBLAST-Q.rvt
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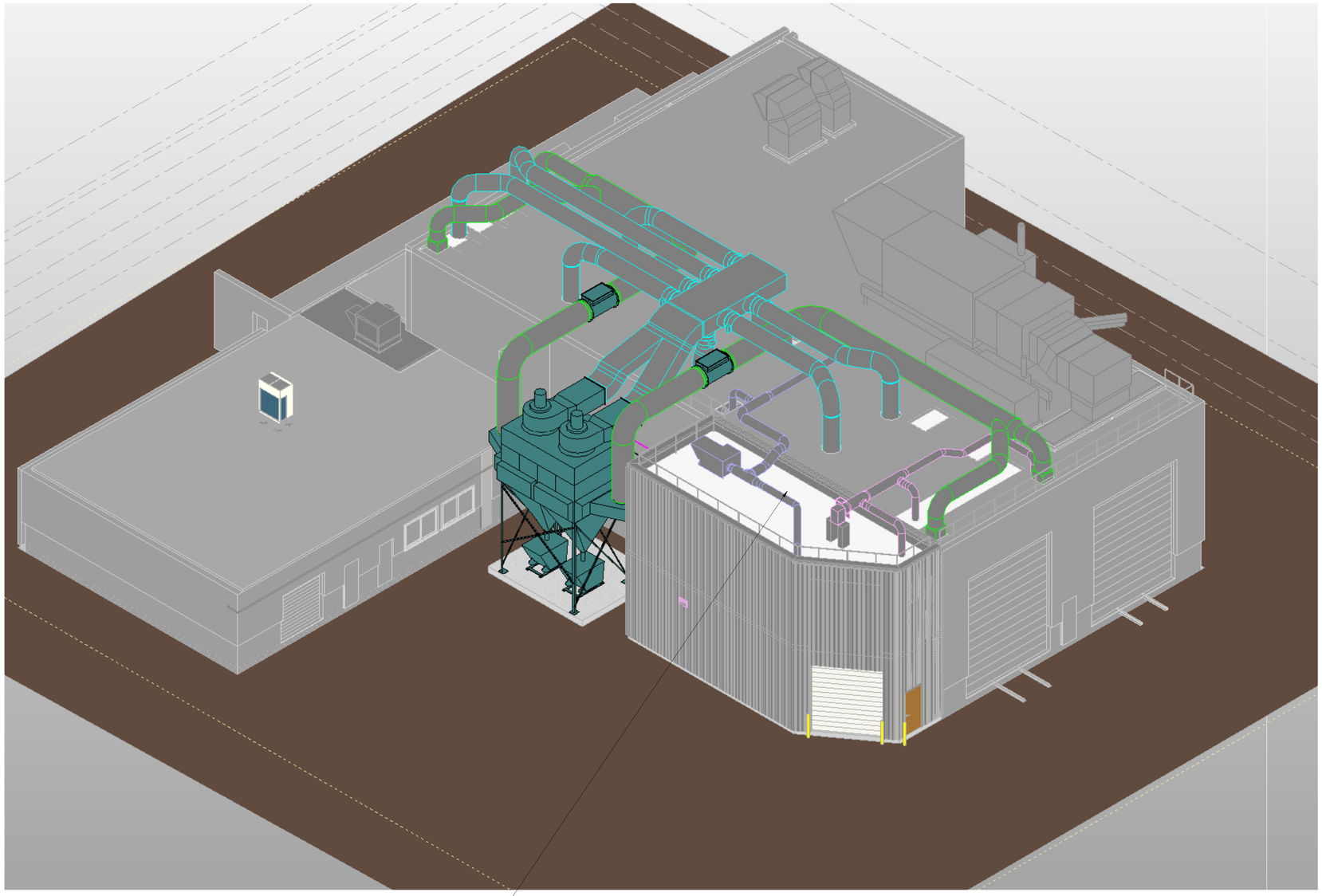
PROJECT MANAGEMENT INITIALS:



REFER TO MECHANICAL DRAWINGS FOR
HRV-01 AND ASSOCIATED DUCTWORK

1 | Q100 — ISOMETRIC VIEW - BLAST AND PAINT BAY BUILDING — NTS

PROCESS DRAWING LIST

SHEET NUMBER	SHEET NAME
Q001	DEMOLITION GROUND FLOOR PLAN - PROCESS
Q002	DEMOLITION ROOF PLAN - PROCESS
Q003	DEMOLITION ISOMETRIC VIEW - PROCESS
Q100	BUILDING ISOMETRIC - PROCESS
Q101	FOUNDATION PLAN - PROCESS
Q102	LOW LEVEL GROUND FLOOR PLAN - PROCESS
Q103	HIGH LEVEL GROUND FLOOR PLAN - PROCESS
Q104	CEILING LEVEL PLAN - PROCESS
Q105	HIGH ROOF PLAN - PROCESS
Q106	RECLAIM AND M /E ROOM
Q107	REFLECTED CEILING PLAN
Q108	BUILDING SECTIONS - PROCESS
Q109	BUILDING SECTIONS - PROCESS
Q110	BUILDING SECTIONS - PROCESS
Q111	ISOMETRIC VIEW - BLAST BAY AND ADDITION - PROCESS
Q112	ISOMETRIC VIEWS
Q113	3-AXIS MAN LIFT
Q114	CEILING AND WALL PANEL GENERAL ARRANGEMENT
Q115	PROCESS DESIGN NOTES AND SCHEMATICS
Q116	PROCESS SCHEDULES AND SCHEMATICS

NOTE:
THE LOCOMOTIVE AND BI-LEVEL COACH REVIT FAMILIES WERE OBTAINED FROM METROLINKS AND REPRESENT REAL OPERATING RAIL EQUIPMENT, HOWEVER, METROLINKS AND/OR AECOM CAN NOT BE HELD LIABLE FOR DIMENSIONAL OR COMPONENT INACCURACIES.

THE LOCOMOTIVE TRUCKS WITH TRACTION MOTORS AND THE COACH WHEEL BOGIE ASSEMBLIES ARE NOT TYPICALLY RAISED DURING THE JACKING PROCESS AS INDICATED HERE AND THROUGHOUT THESE DOCUMENTS.

ELECTRIC SCREW TYPE LIFTING JACKS ARE USED TO RAISE AND LOWER THE LOCOMOTIVE OR ROLLING STOCK. IF BODIES ARE LEFT IN RAISED POSITION, STEEL JACK STANDS CAN BE UTILIZED TO ALLOW LIFTING JACKS TO BE REMOVED FROM BLASTING AREAS AND PROTECTED FROM BLAST DEBRIS. ALTERNATELY, THE LIFTING JACKS CAN BE LEFT IN PLACE AND LOCKED TO PREVENT MOVEMENT. THESE JACK STANDS ARE NOT INDICATED IN THESE DRAWINGS.

DURING BLASTING PROCEDURE, UNDERHUNG BRIDGE CRANE SHALL BE 'PARKED' AT END OF BLAST BAY NEAR GRIDLINE '7'.

AECOM

PROJECT

BLAST BAY UPGRADE
915/916 McINTYRE ST. E, NORTH BAY, ON

CLIENT

REGISTERED OWNER:
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3	ISSUED FOR 60% CLIENT REVIEW	2023/03/31
2	ISSUED FOR CLIENT REVIEW	2023/01/26
1	ISSUED FOR CLIENT REVIEW	2022/11/03

PROJECT NUMBER

60678205

SHEET TITLE

BUILDING ISOMETRIC - PROCESS

SHEET NUMBER

Q100

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CONSTRUCTION ISOMETRIC - PROCESS
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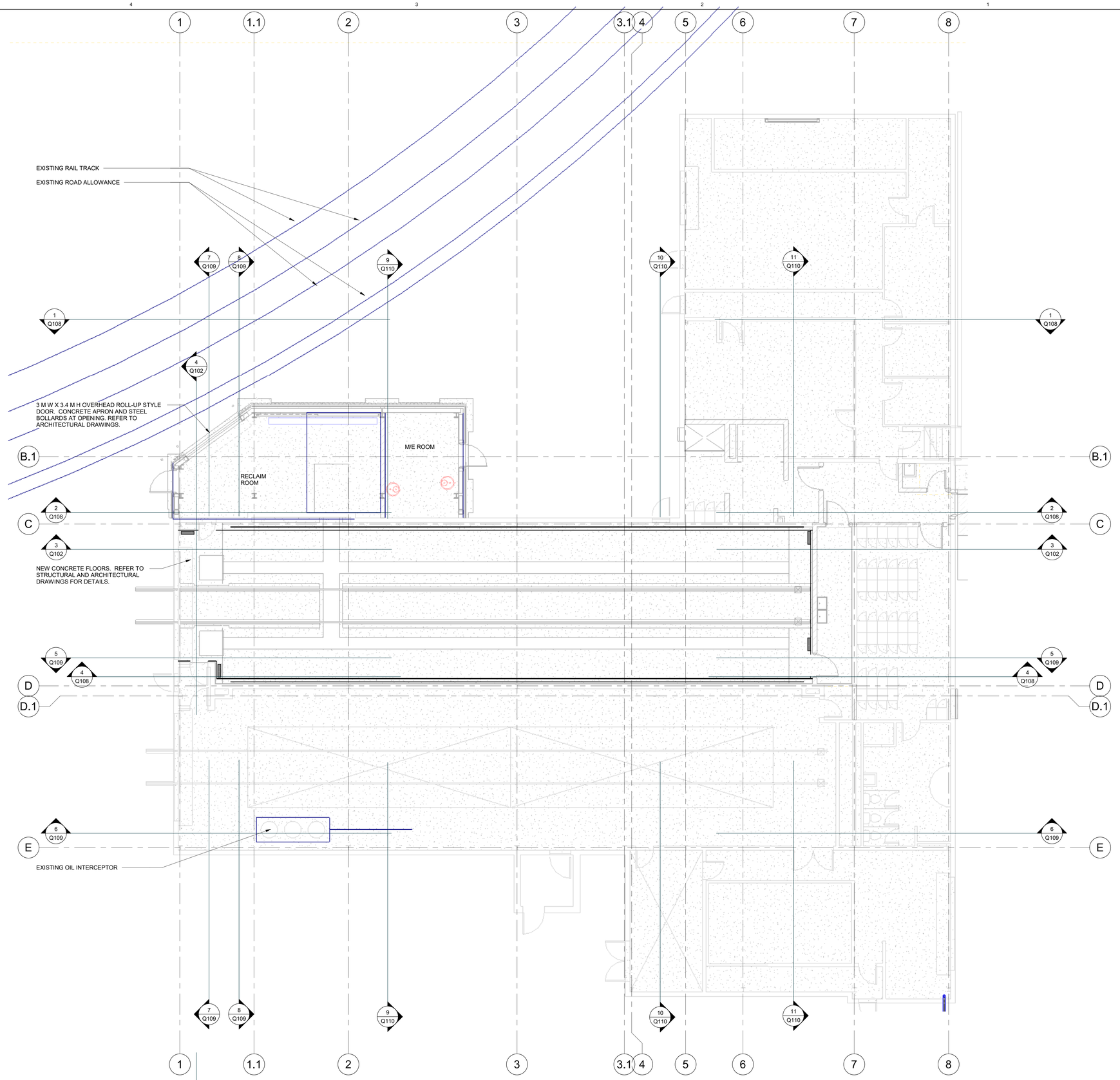

1 FOUNDATION PLAN - PROCESS
Q101 | REF: 1 / Q108
Scale: 1 : 75

AECOM

PROJECT

BLAST BAY UPGRADE
915/916 McINTYRE ST. E, NORTH BAY, ON

CLIENT

REGISTERED OWNER:
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2	ISSUED FOR CLIENT REVIEW	2023/01/26
1	ISSUED FOR CLIENT REVIEW	2022/11/03

PROJECT NUMBER

60678205

SHEET TITLE

FOUNDATION PLAN - PROCESS

SHEET NUMBER

Q101

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Q101 FOUNDATION PLAN - PROCESS
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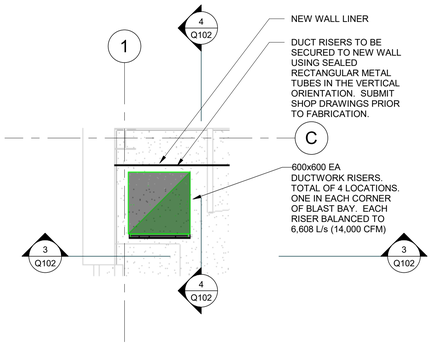
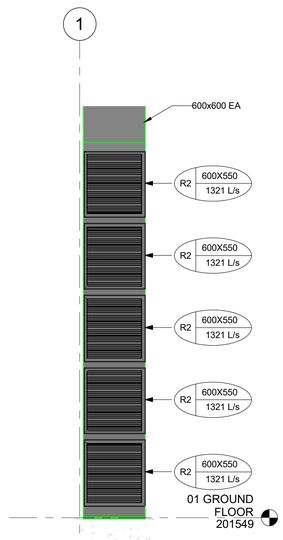


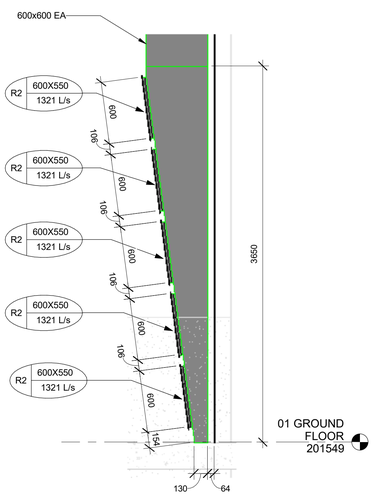
2 EXHAUST DUCT TAPERED RISER PLAN

Q102 | REF: 1 / Q102 | Scale: 1 : 25



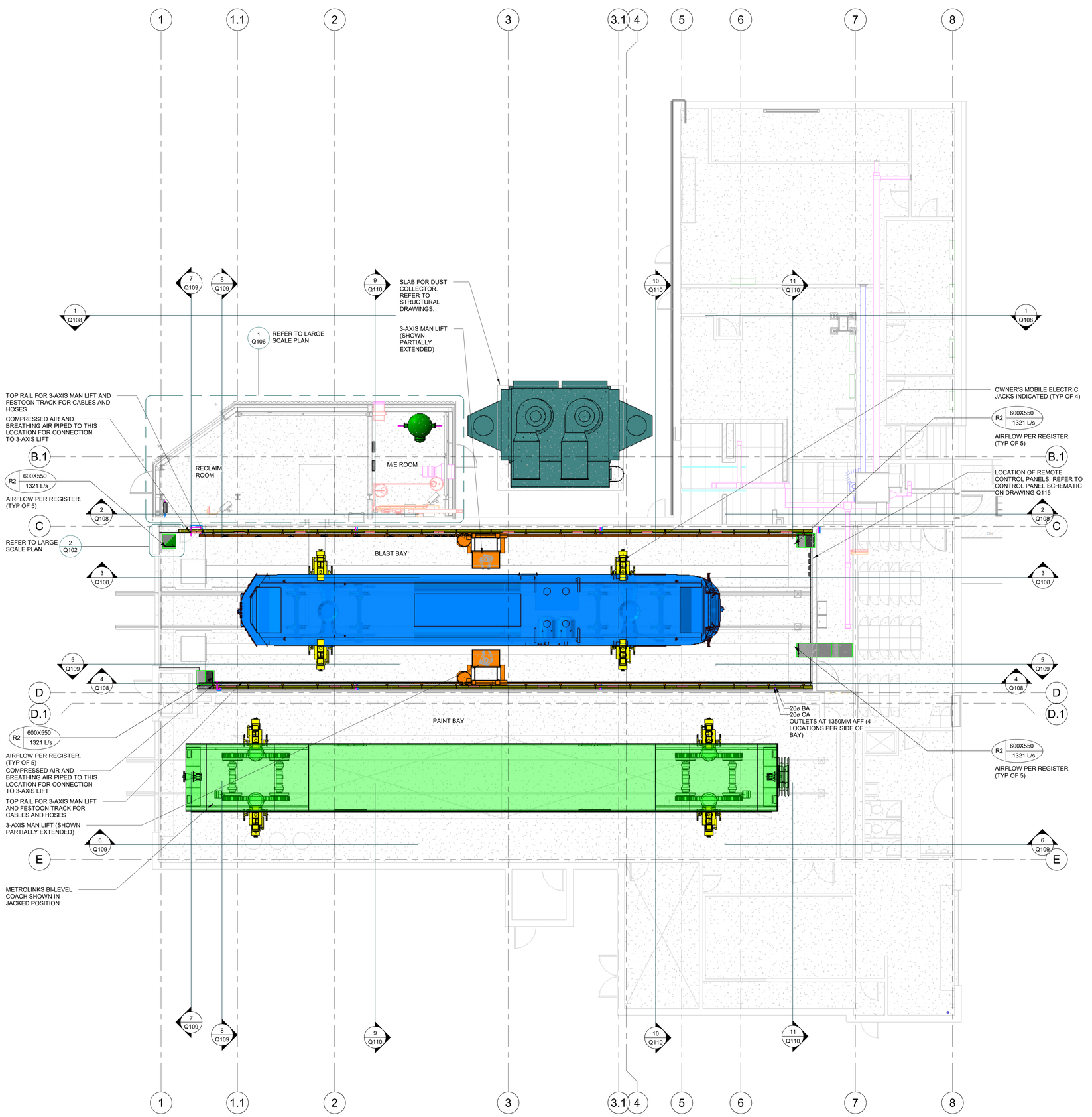
3 EXHAUST DUCT TAPERED RISER ELEVATION

Q102 | REF: 1 / Q001 | Scale: 1 : 25



4 EXHAUST DUCT TAPERED RISER ELEVATION

Q102 | REF: 1 / Q101 | Scale: 1 : 25



1 LOW LEVEL GROUND FLOOR PLAN - PROCESS

Q102 | REF: 1 / Q110 | Scale: 1 : 75

PROJECT

BLAST BAY UPGRADE
915/916 McINTYRE ST. E, NORTH BAY, ON

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3	ISSUED FOR 60% CLIENT REVIEW	2023/03/31
2	ISSUED FOR CLIENT REVIEW	2023/01/26
1	ISSUED FOR CLIENT REVIEW	2022/11/03

PROJECT NUMBER

60678205

SHEET TITLE

LOW LEVEL GROUND FLOOR PLAN - PROCESS

SHEET NUMBER

Q102

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OUTDOOR STORAGE GROUND FLOOR PLAN - PROCESS
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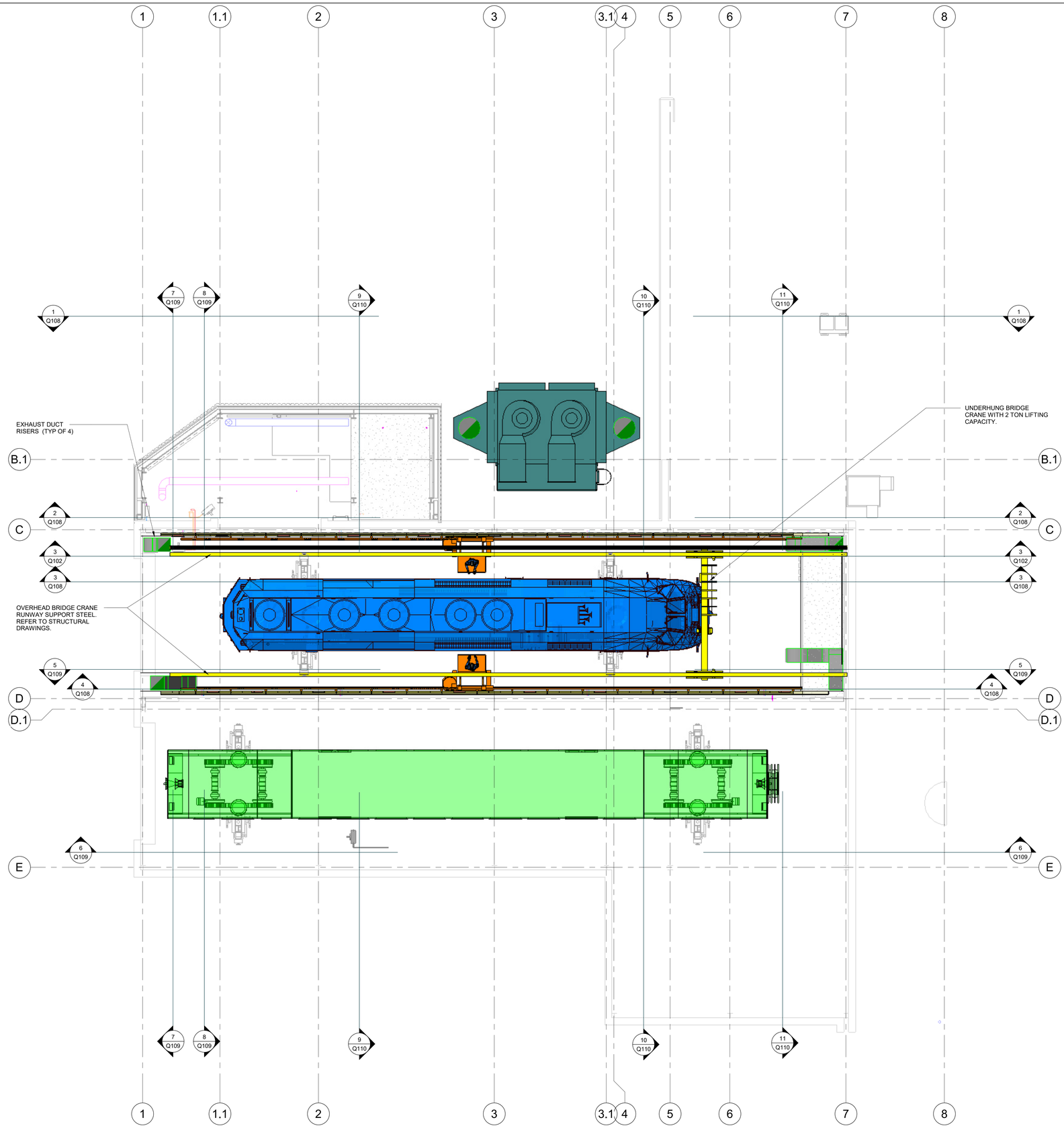

1

HIGH LEVEL GROUND FLOOR PLAN - PROCESS

Q103 | REF: 1 / Q110

Scale: 1 : 75

AECOM

PROJECT

BLAST BAY UPGRADE
915/916 McINTYRE ST. E, NORTH BAY, ON

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2	ISSUED FOR CLIENT REVIEW	2023/01/26
1	ISSUED FOR CLIENT REVIEW	2022/11/03

PROJECT NUMBER

60678205

SHEET TITLE

HIGH LEVEL GROUND FLOOR PLAN - PROCESS

SHEET NUMBER

Q103

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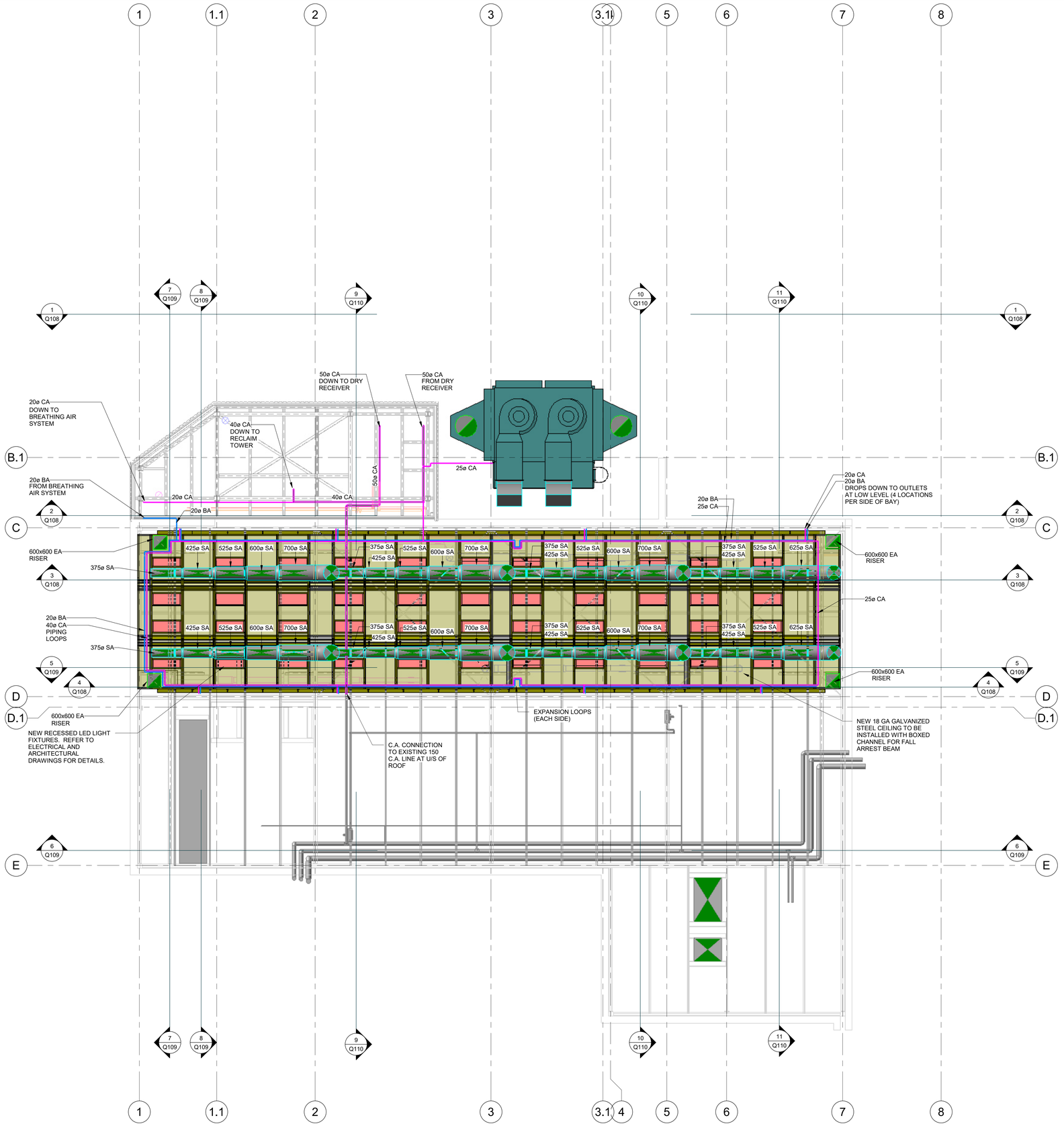
© TO HIGH LEVEL GROUND FLOOR PLAN - PROCESS



1 CEILING LEVEL PLAN - PROCESS

Q104 | REF: 1 / Q110

Scale: 1 : 75

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DRAWING LEVEL PLAN - PROCESS

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2	ISSUED FOR CLIENT REVIEW	2023/01/26

PROJECT NUMBER

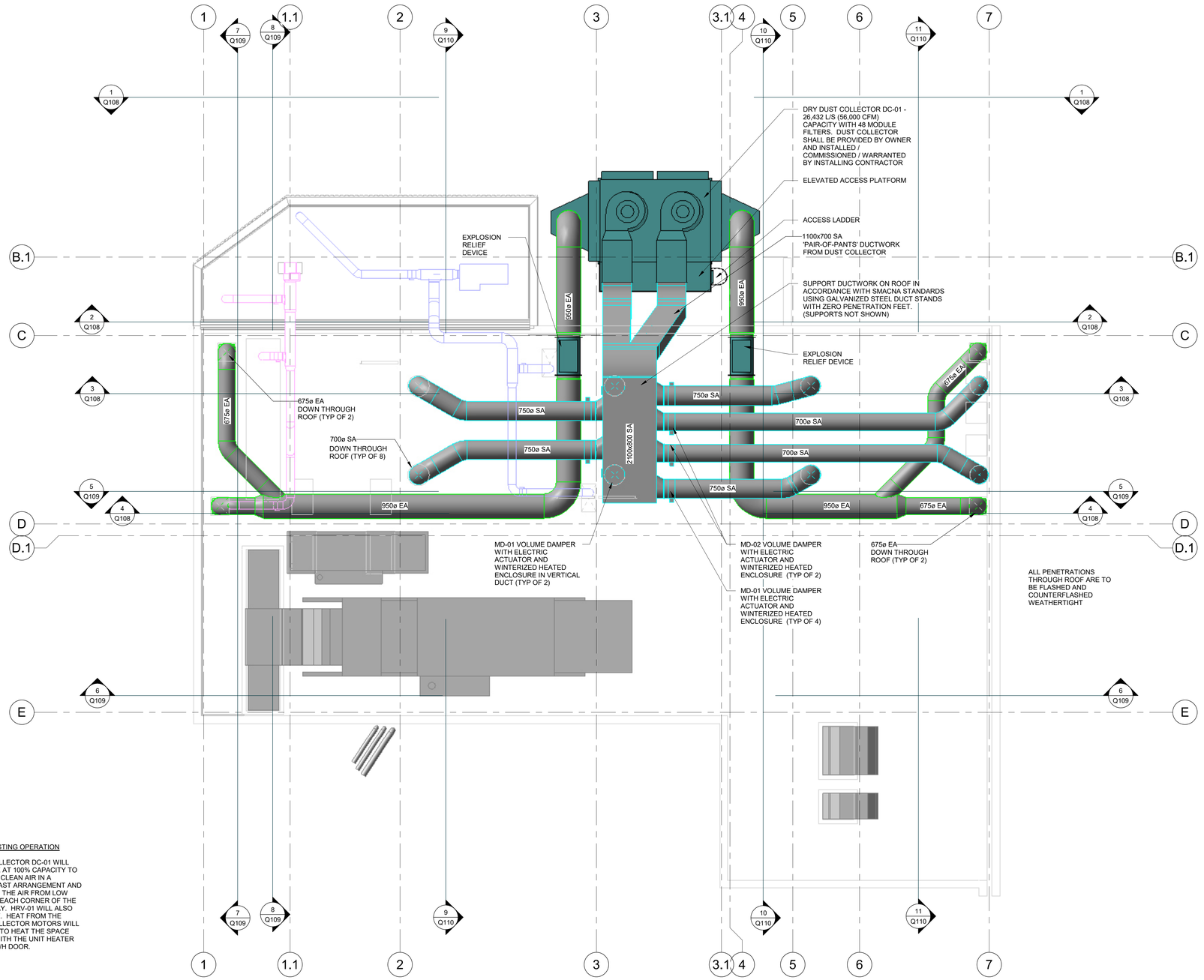
60678205

SHEET TITLE

CEILING LEVEL PLAN - PROCESS

SHEET NUMBER

Q104



DRY BLASTING OPERATION

DUST COLLECTOR DC-01 WILL OPERATE AT 100% CAPACITY TO PROVIDE CLEAN AIR IN A DOWNBLAST ARRANGEMENT AND EXHAUST THE AIR FROM LOW LEVEL IN EACH CORNER OF THE BLAST BAY. HRV-01 WILL ALSO OPERATE. HEAT FROM THE DUST COLLECTOR MOTORS WILL BE USED TO HEAT THE SPACE ALONG WITH THE UNIT HEATER AT THE O/H DOOR.

1 Q105 | REF: 1 / Q108

HIGH ROOF LEVEL PLAN - PROCESS

Scale: 1 : 75

PROJECT MANAGEMENT INITIALS: DESIGNER: CFL CHECKED: CC APPROVED: PDK ISO B1 707 x 1000mm

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ONE-HIGH ROOF PLAN - PROCESS

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PROJECT

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PROJECT NUMBER

60678205

SHEET TITLE

HIGH ROOF PLAN - PROCESS

SHEET NUMBER

Q105

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CHECKED: Checker
DESIGNER: Designer
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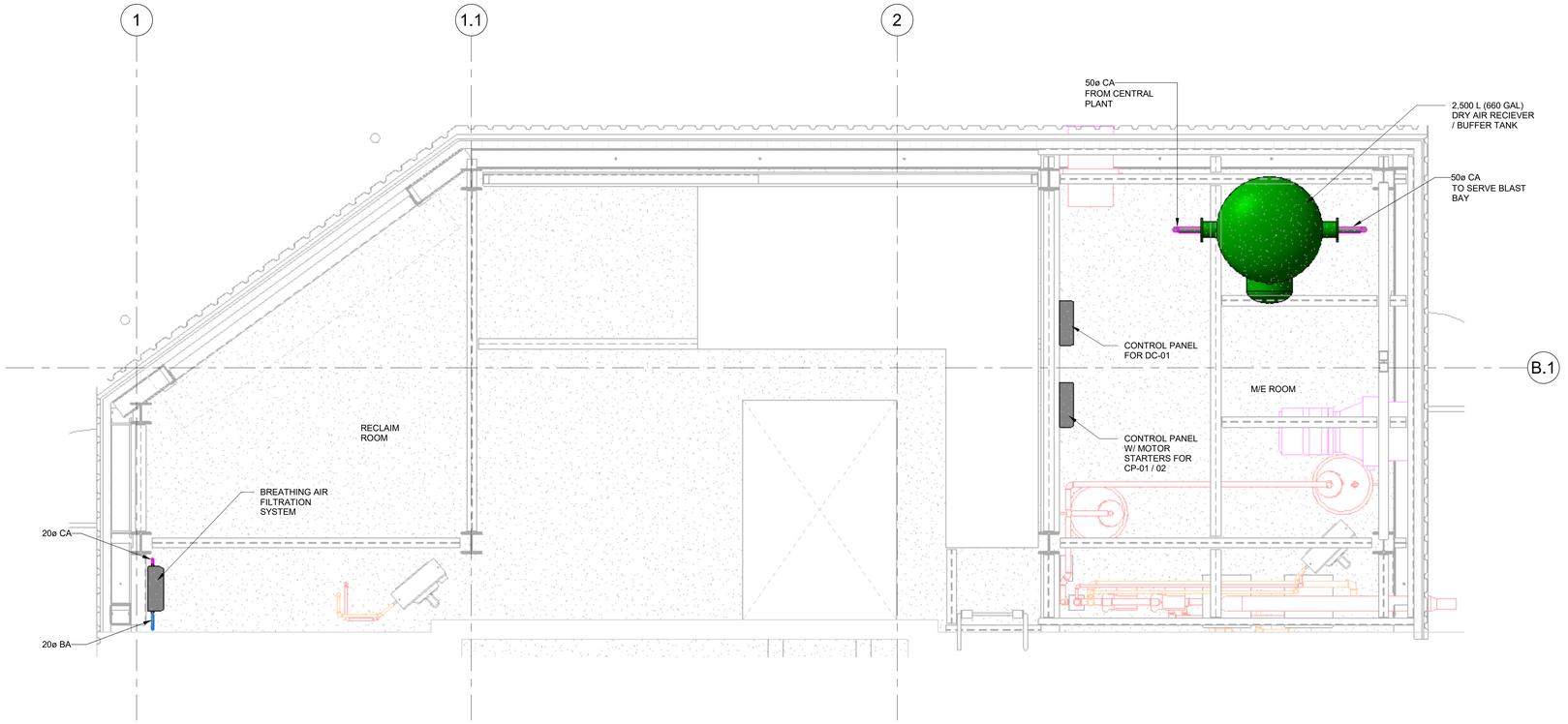

1 PARTIAL GROUND FLOOR PLAN - ADDITION - PROCESS

Q106 | REF: 1 / Q102

Scale: 1 : 25

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PROJECT

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CLIENT

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No.	DESCRIPTION	DATE
5	ISSUED FOR BUDGET - VALUE ENG	
4	ISSUED FOR TENDER	2023/09/29

PROJECT NUMBER

60678205

SHEET TITLE

RECLAIM AND M /E ROOM

SHEET NUMBER

Q106

Q106 RECLAIM AND M /E ROOM
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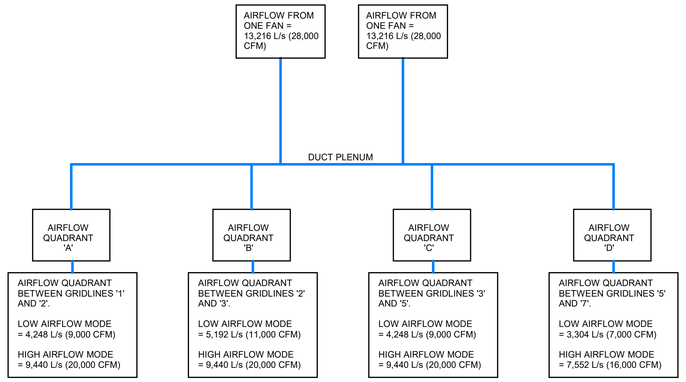


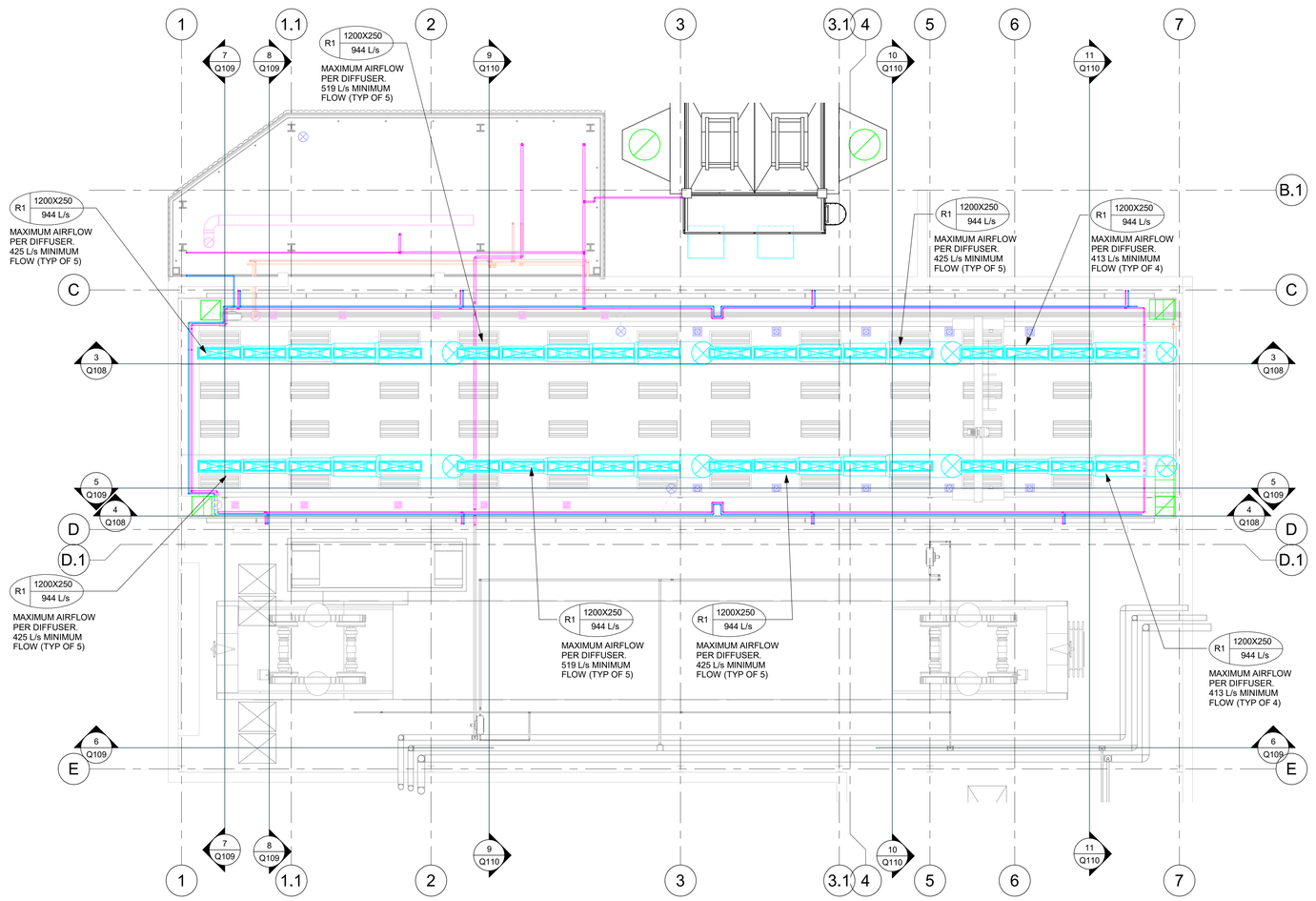
1) WHEN SELECTOR SWITCH IS PLACED IN 'WEST' POSITION AIRFLOW QUADRANTS 'A' AND 'B' SWITCH TO HIGH AIRFLOW MODE AND QUADRANTS 'C' AND 'D' SWITCH TO LOW AIRFLOW MODE = 26,432 L/s (56,000 CFM)

2) WHEN SELECTOR SWITCH IS PLACED IN 'MIDDLE' POSITION AIRFLOW QUADRANTS 'B' AND 'C' SWITCH TO HIGH AIRFLOW MODE AND QUADRANTS 'A' AND 'D' SWITCH TO LOW AIRFLOW MODE = 26,432 L/s (56,000 CFM)

3) WHEN SELECTOR SWITCH IS PLACED IN 'EAST' POSITION AIRFLOW QUADRANTS 'C' AND 'D' SWITCH TO HIGH AIRFLOW MODE AND QUADRANTS 'A' AND 'B' SWITCH TO LOW AIRFLOW MODE = 26,432 L/s (56,000 CFM)

2 Q107 — **AIRFLOW BLOCK DIAGRAM**

NTS



1 Q107 — **REFLECTED CEILING PLAN - PROCESS**

REF: 1 / Q108

Scale: 1 : 75

AECOM

PROJECT

BLAST BAY UPGRADE
915/916 McINTYRE ST. E, NORTH BAY, ON

CLIENT

REGISTERED OWNER:
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PROJECT NUMBER

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SHEET TITLE

REFLECTED CEILING PLAN

SHEET NUMBER

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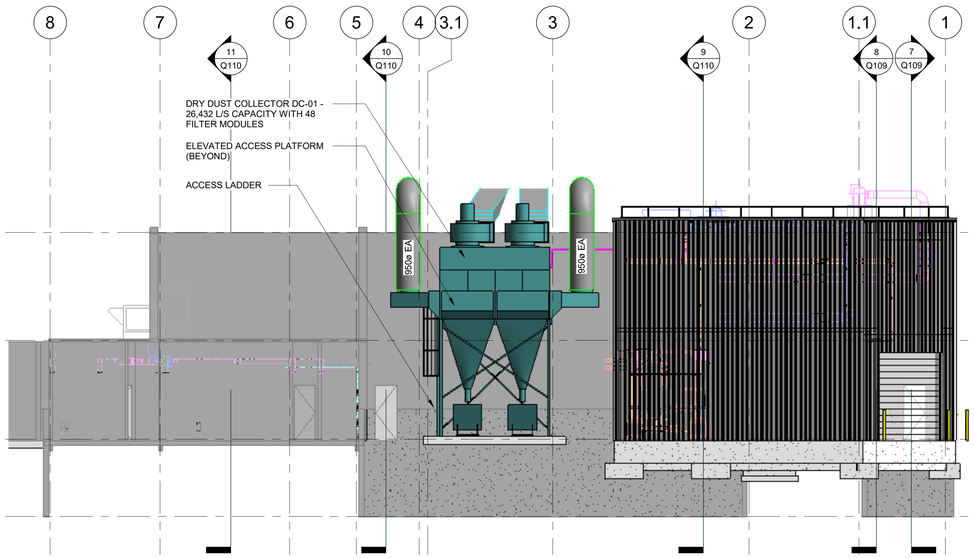

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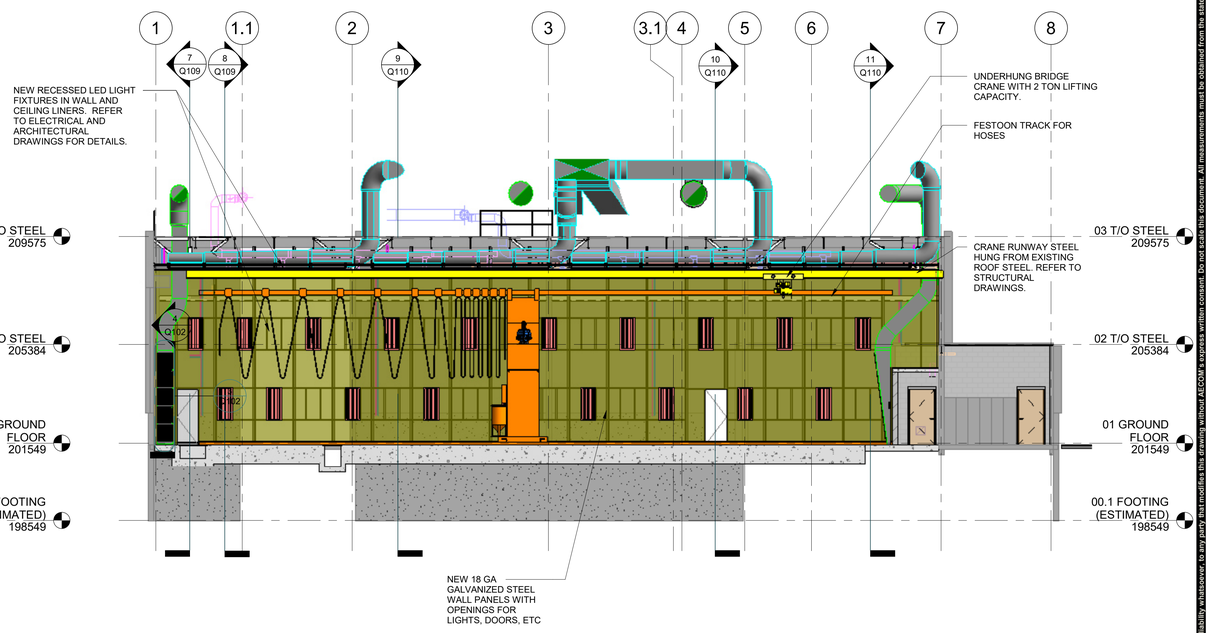

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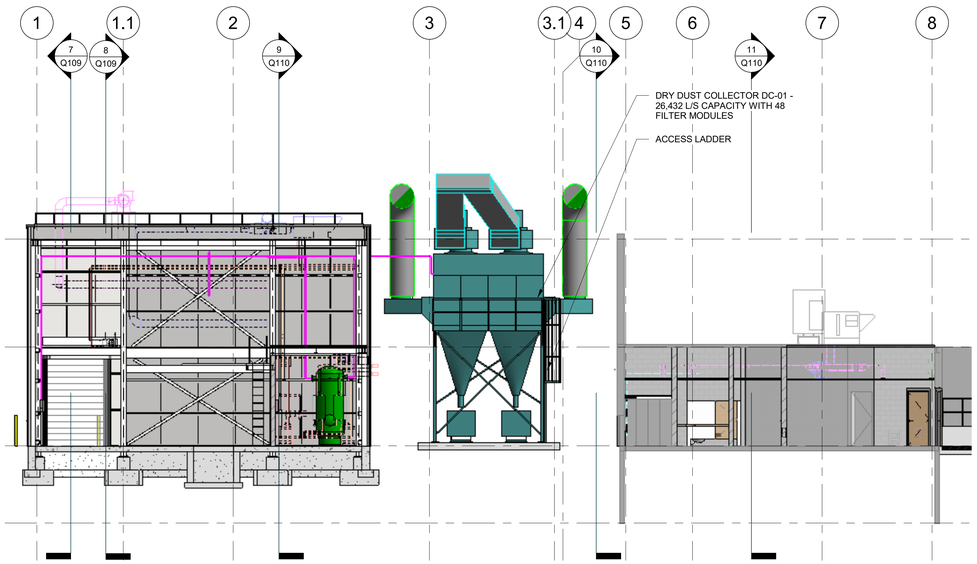

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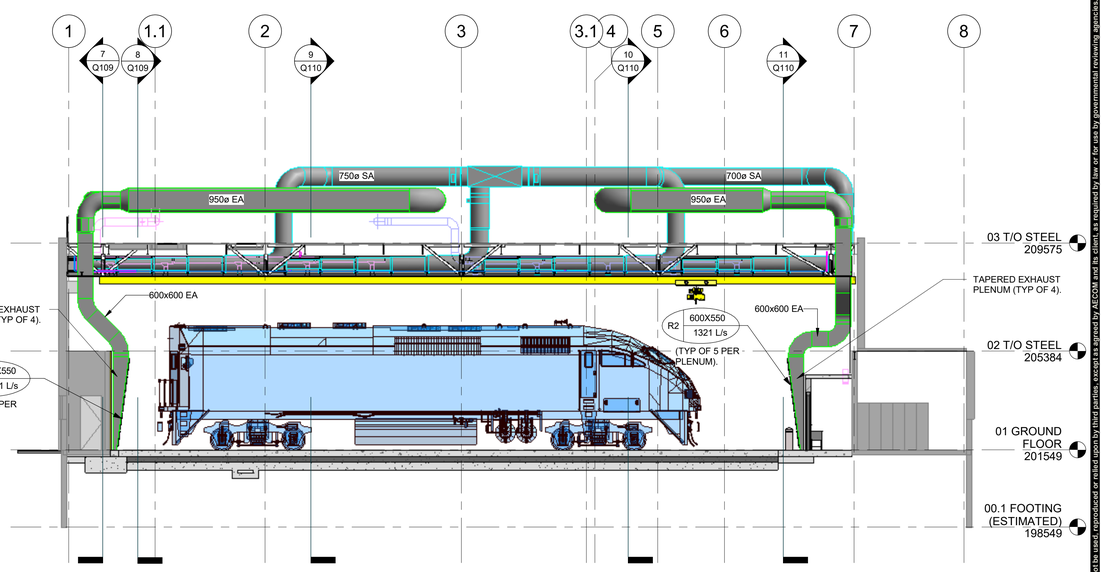

4 | BUILDING SECTION 4 - PROCESS

Q108 | REF: 1 / Q101 | Scale: 1 : 100

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PROJECT

BLAST BAY UPGRADE
915/916 McINTYRE ST. E, NORTH BAY, ON

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PROJECT NUMBER

60678205

SHEET TITLE

BUILDING SECTIONS - PROCESS

SHEET NUMBER

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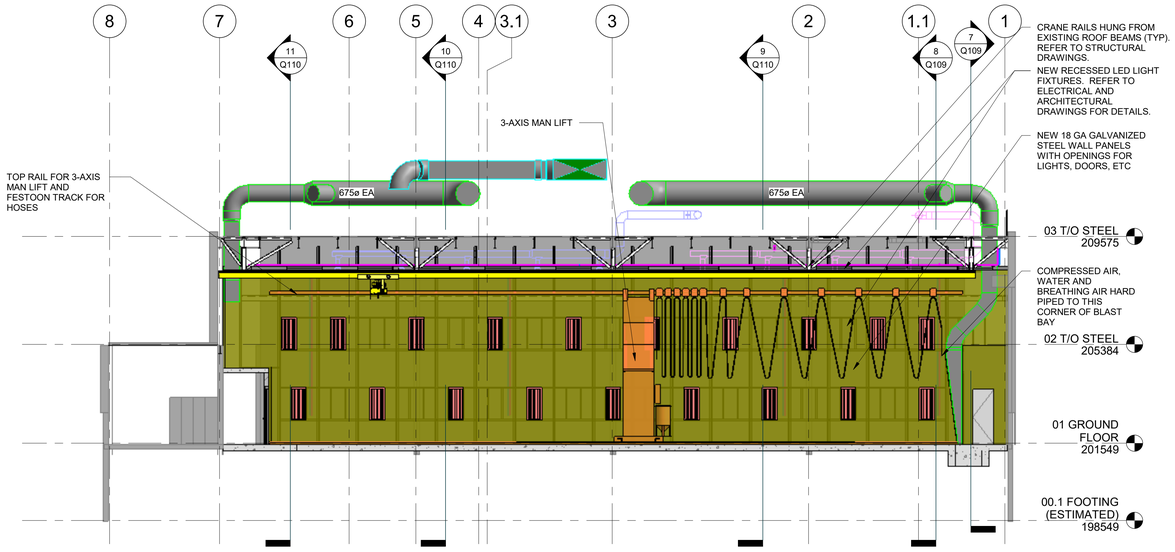

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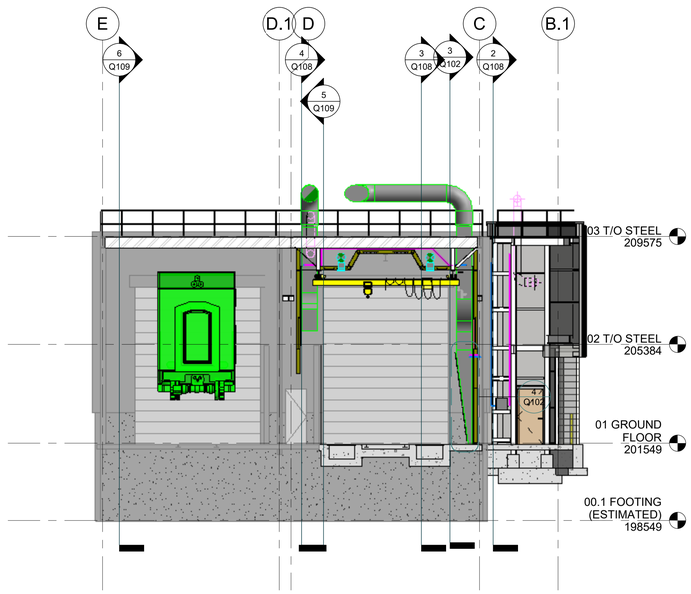

7 BUILDING SECTION 7 - PROCESS

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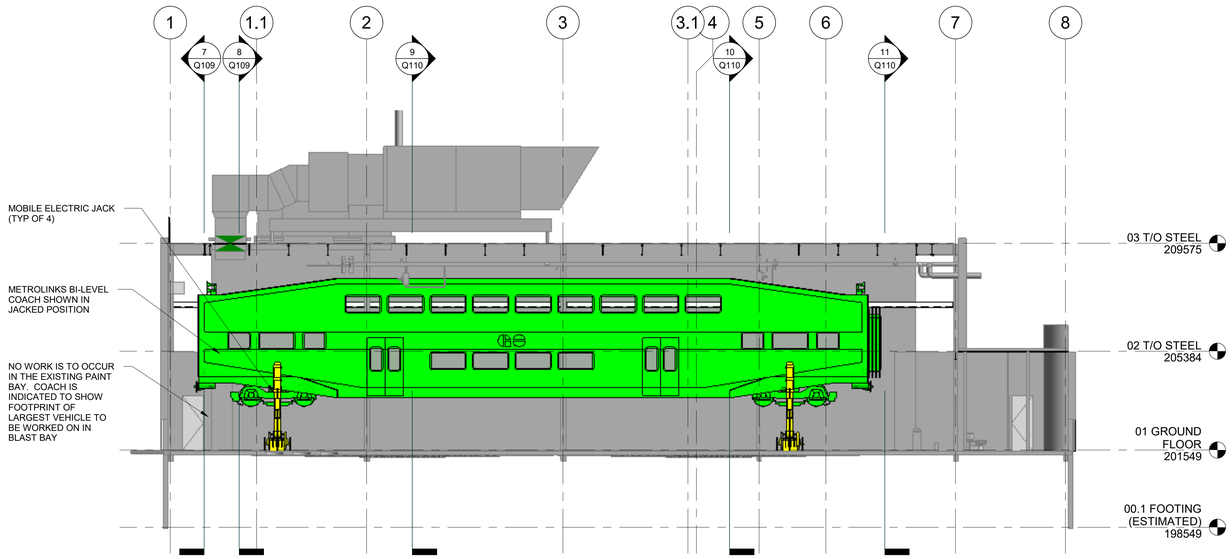

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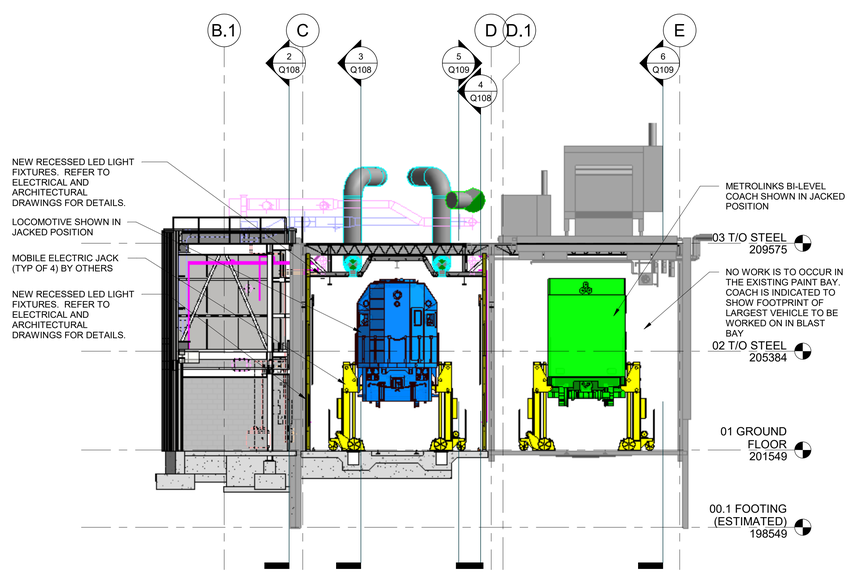

8 BUILDING SECTION 8 - PROCESS

Q109 | REF: 1 / Q101 Scale: 1 : 100

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BLAST BAY UPGRADE
915/916 McINTYRE ST. E, NORTH BAY, ON

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SHEET TITLE

BUILDING SECTIONS - PROCESS

SHEET NUMBER

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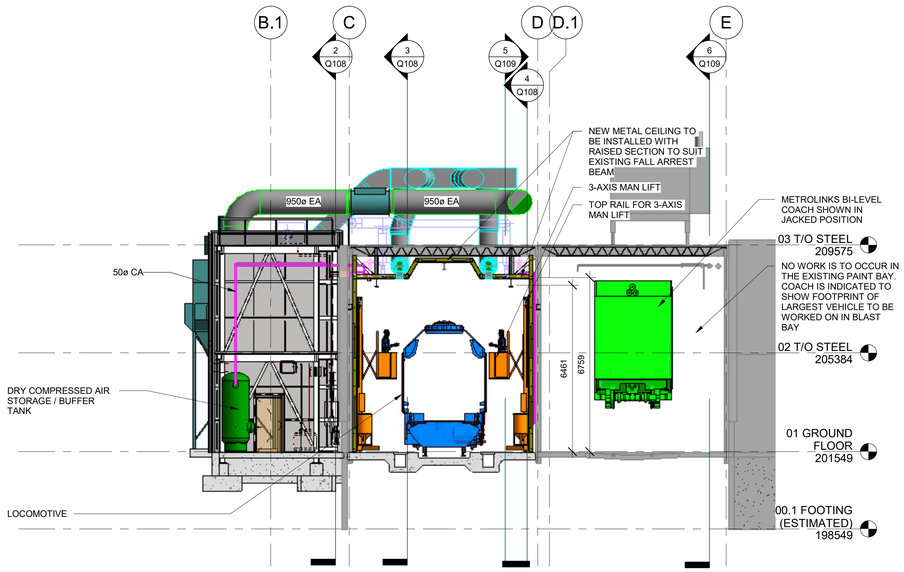

9 | **BUILDING SECTION 9 - PROCESS**

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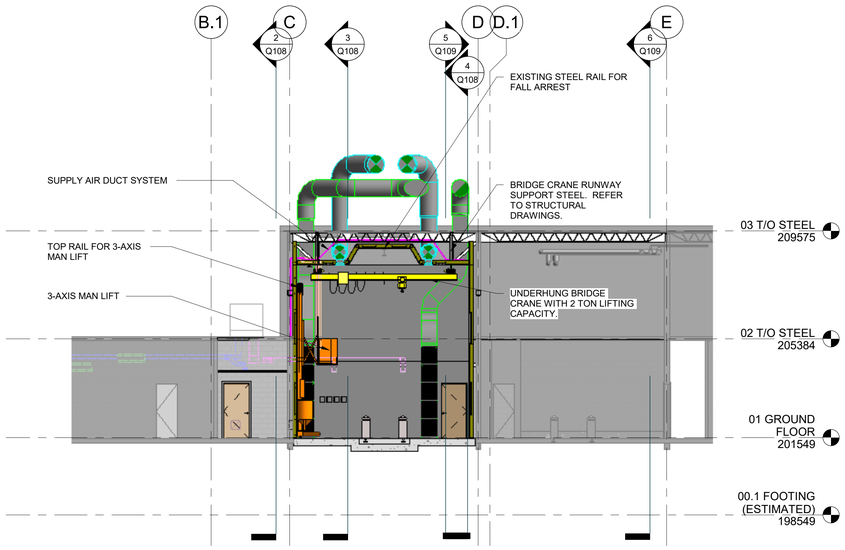

11 | **BUILDING SECTION 11 - PROCESS**

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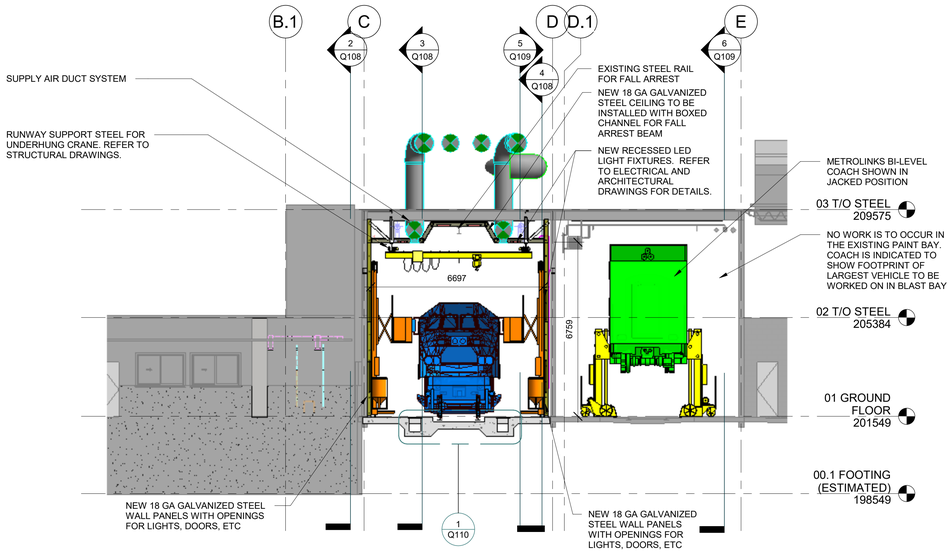

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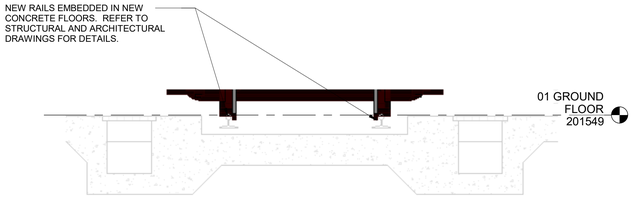

1 | **SLAB SECTION 1 - PROCESS**

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ORIGINAL DRAWING - PROCESS
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BUILDING SECTIONS - PROCESS

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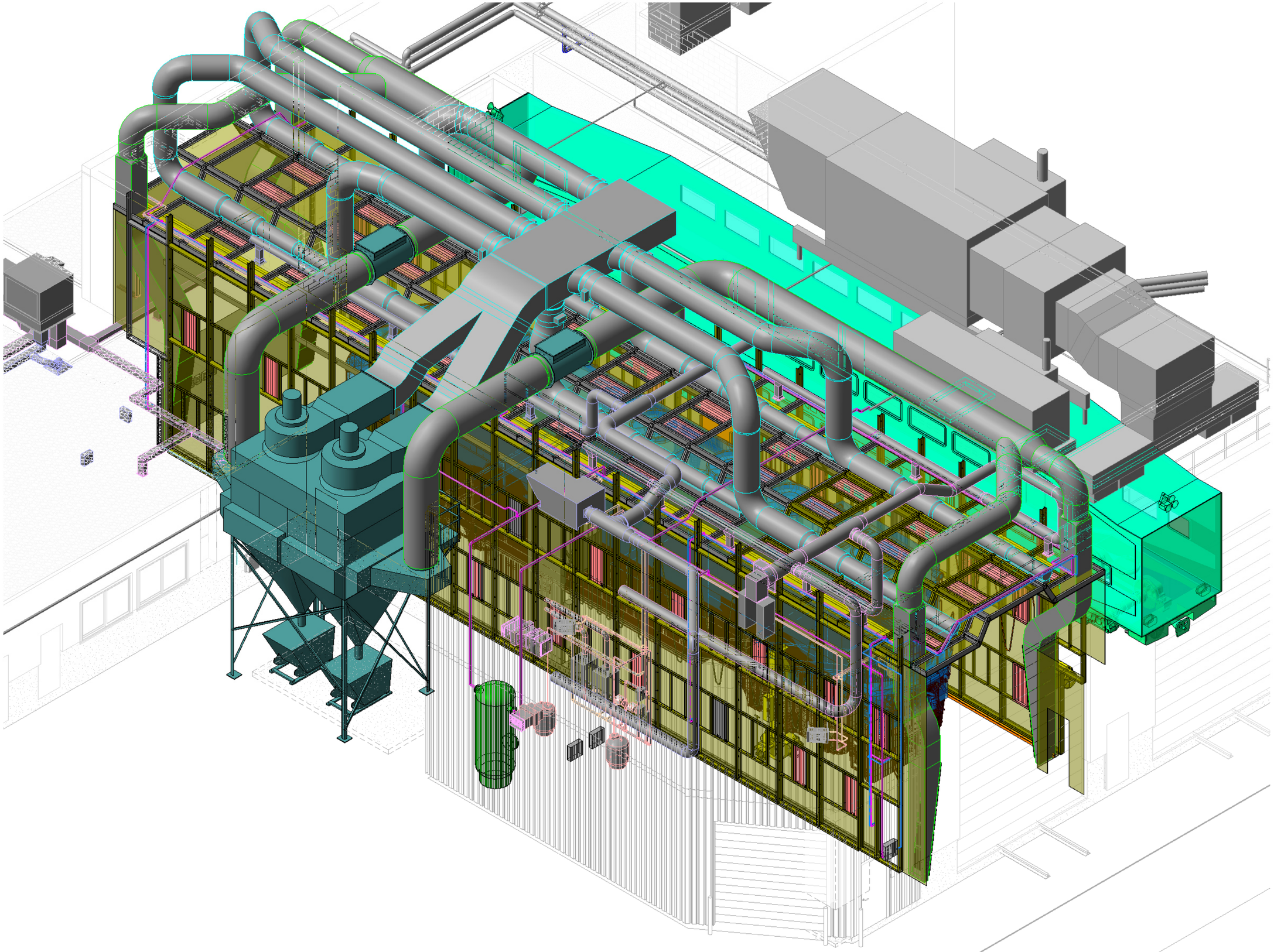

CITI ISOMETRIC VIEW - BLAST BAY AND ADDITION - PROCESS

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ISOMETRIC VIEW - BLAST BAY AND ADDITION - PROCESS

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ISOMETRIC VIEW - BLAST BAY AND ADDITION - PROCESS

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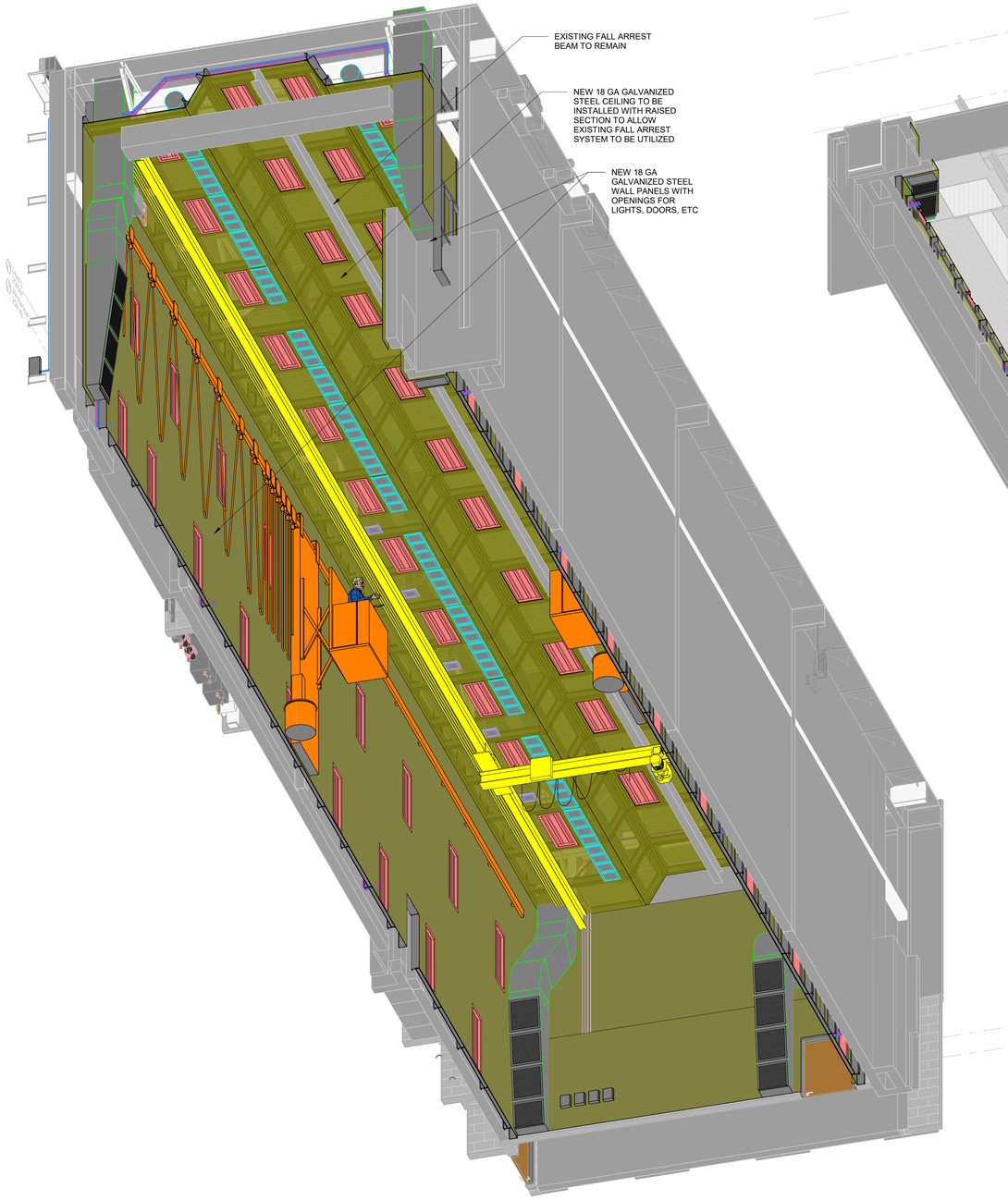
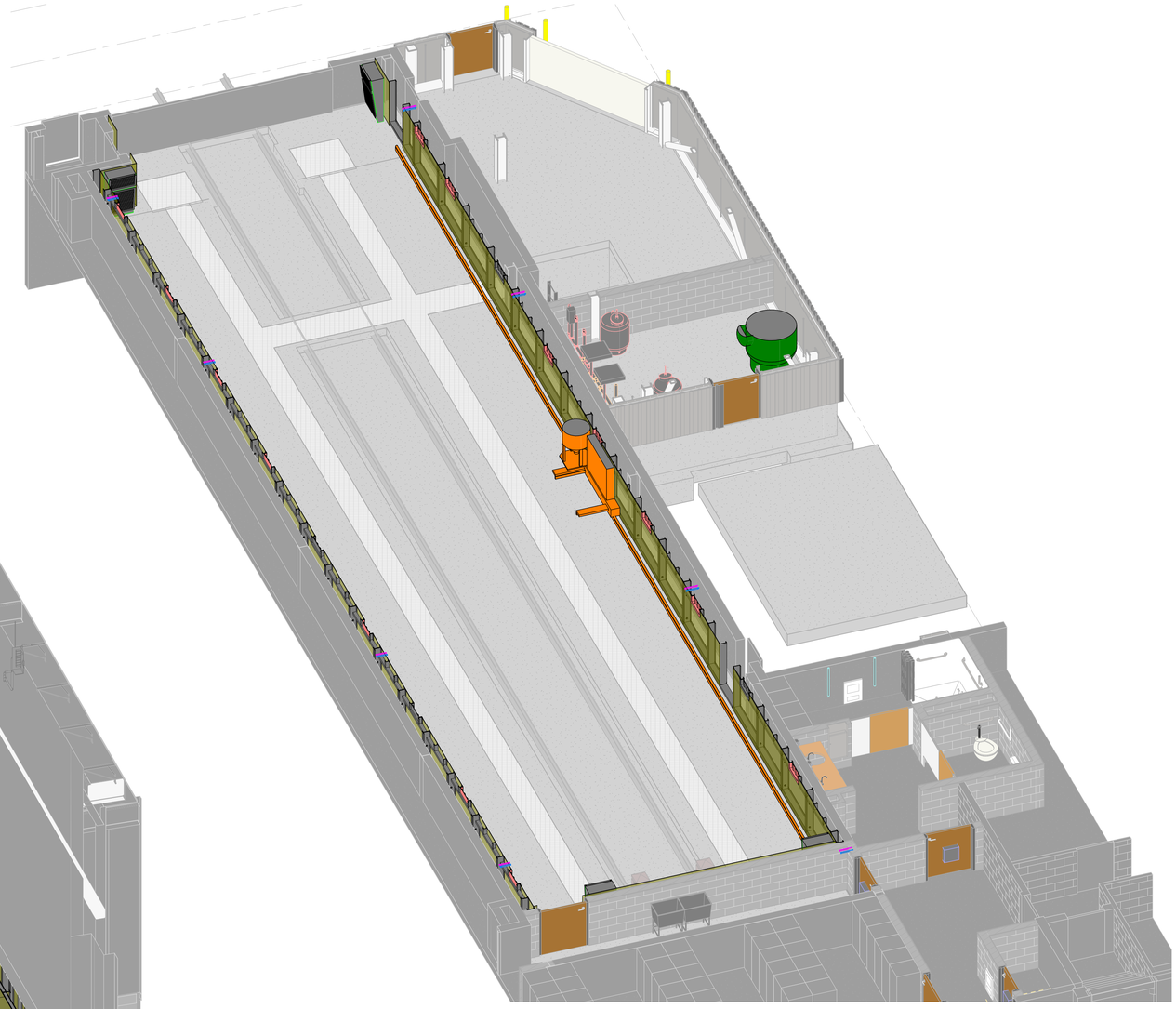


1 Q112 — **ISOMETRIC VIEW - BLAST BAY - LOOKING FROM BELOW** — NTS



2 Q112 — **ISOMETRIC VIEW - BLAST BAY - NEW TRENCHES** — NTS

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No.	DESCRIPTION	DATE
5	ISSUED FOR BUDGET - VALUE ENG	
4	ISSUED FOR TENDER	2023/09/29
3	ISSUED FOR 60% CLIENT REVIEW	2023/03/31

PROJECT NUMBER

60678205

SHEET TITLE

ISOMETRIC VIEWS

SHEET NUMBER

Q112

Q112-ISOMETRIC VIEWS
Last Plotted: 2024-02-28 2:35:06 PM
Filename: BIM 360://BP-AMER(CAN) 60678205 - ONTC Grit Blast Bay/60678205-ACM-R20-GRITBLAST-Q.rvt
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ISO B1 707 x 1000mm
APPROVED: Approver
CHECKED: Checker
DESIGNER: Designer
PROJECT MANAGEMENT INITIALS:

1 ISOMETRIC VIEW - BLAST BAY - NEW 3-AXIS MAN LIFTS

Q113 NTS

AECOM

PROJECT

BLAST BAY UPGRADE
915/916 McINTYRE ST. E, NORTH BAY, ON

CLIENT

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PROJECT NUMBER

60678205

SHEET TITLE

3-AXIS MAN LIFT

SHEET NUMBER

Q113

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Q113-3-AXIS MAN LIFT

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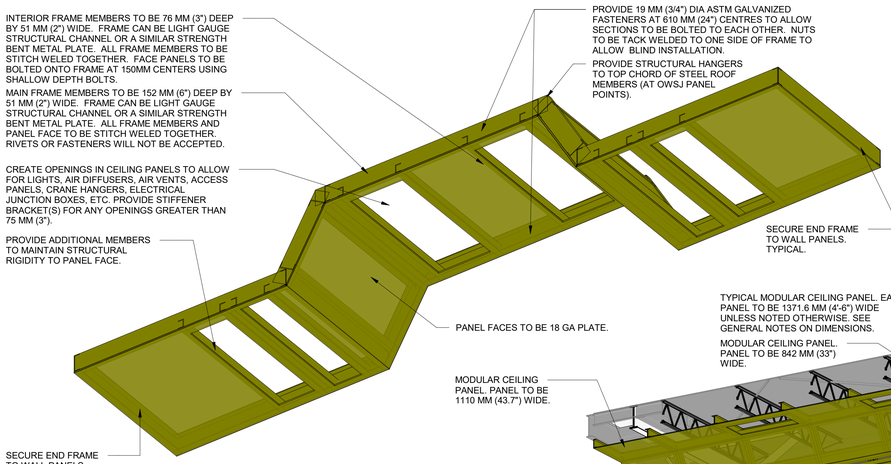
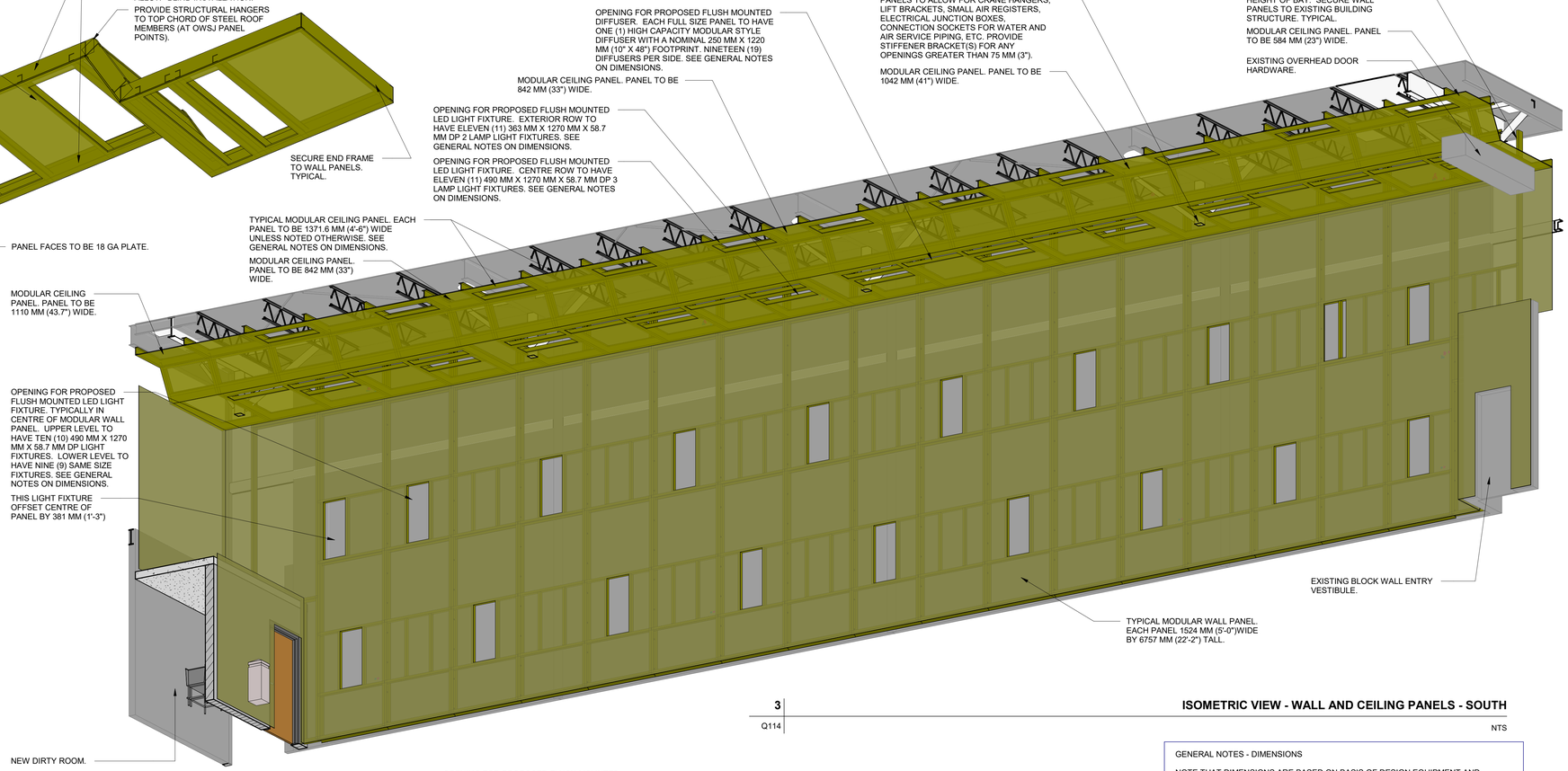
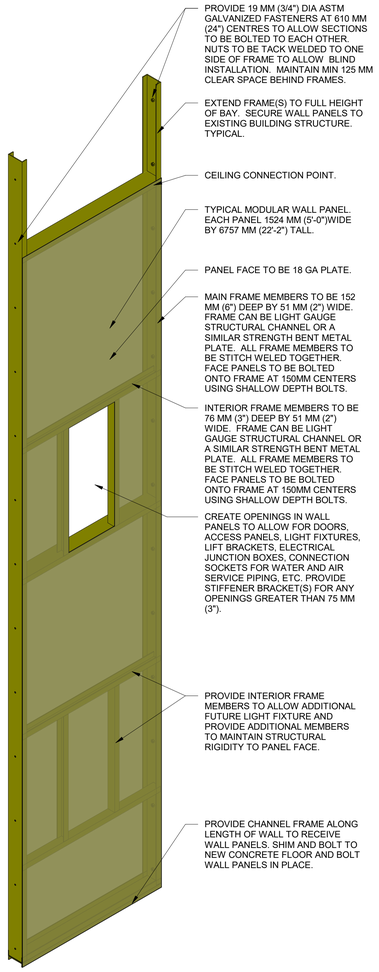
CHECKED: Checker
DESIGNER: Designer
PROJECT MANAGEMENT INITIALS:



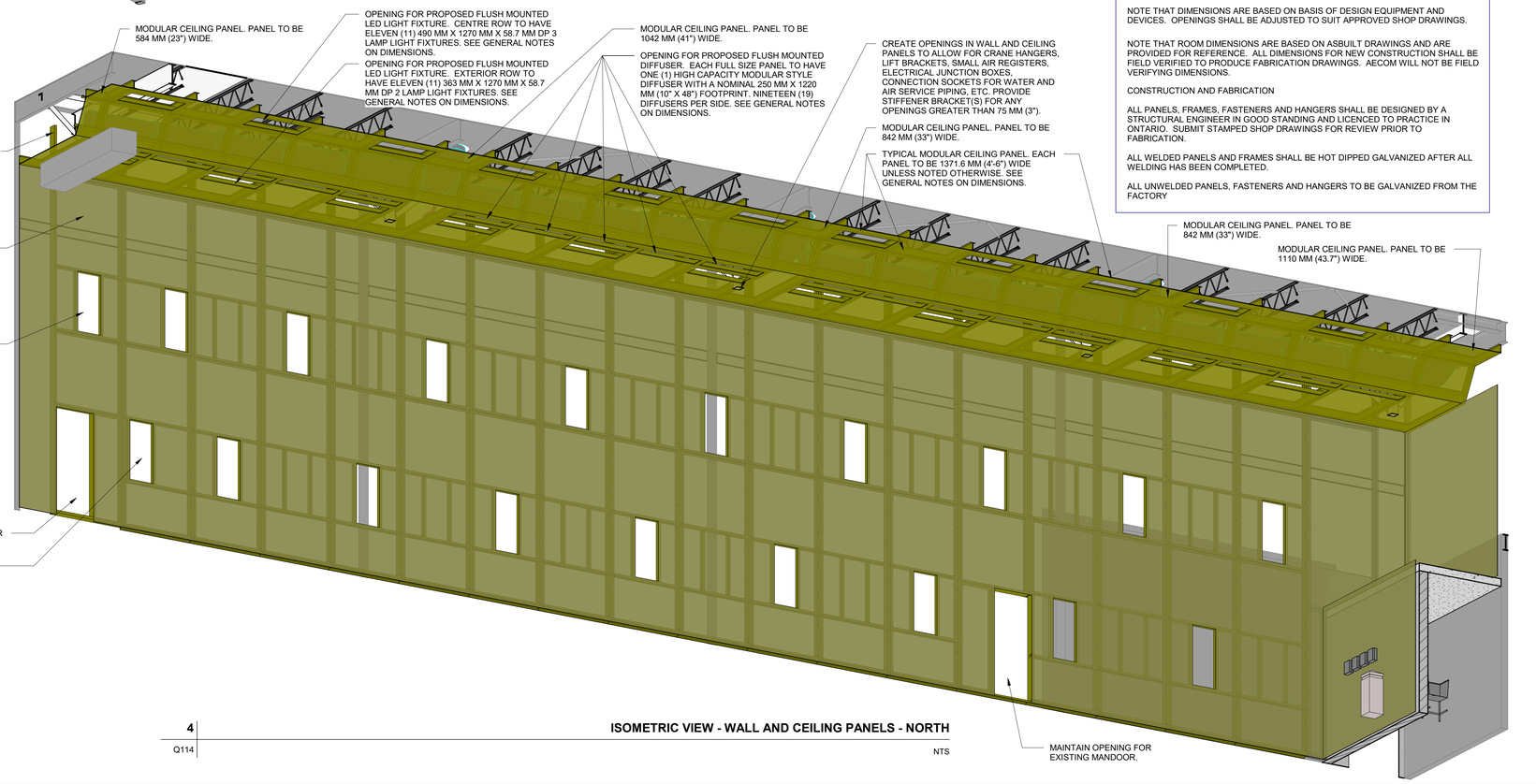
1 Q114 — **ISOMETRIC VIEW - TYPICAL CEILING PANEL** — NTS



3 Q114 — **ISOMETRIC VIEW - WALL AND CEILING PANELS - SOUTH** — NTS



2 Q114 — **ISOMETRIC VIEW - TYPICAL WALL PANEL** — NTS



4 Q114 — **ISOMETRIC VIEW - WALL AND CEILING PANELS - NORTH** — NTS

GENERAL NOTES - DIMENSIONS

NOTE THAT DIMENSIONS ARE BASED ON BASIS OF DESIGN EQUIPMENT AND DEVICES. OPENINGS SHALL BE ADJUSTED TO SUIT APPROVED SHOP DRAWINGS.

NOTE THAT ROOM DIMENSIONS ARE BASED ON ASBUILT DRAWINGS AND ARE PROVIDED FOR REFERENCE. ALL DIMENSIONS FOR NEW CONSTRUCTION SHALL BE FIELD VERIFIED TO PRODUCE FABRICATION DRAWINGS. AECOM WILL NOT BE FIELD VERIFYING DIMENSIONS.

CONSTRUCTION AND FABRICATION

ALL PANELS, FRAMES, FASTENERS AND HANGERS SHALL BE DESIGNED BY A STRUCTURAL ENGINEER IN GOOD STANDING AND LICENCED TO PRACTICE IN ONTARIO. SUBMIT STAMPED SHOP DRAWINGS FOR REVIEW PRIOR TO FABRICATION.

ALL WELDED PANELS AND FRAMES SHALL BE HOT DIPPED GALVANIZED AFTER ALL WELDING HAS BEEN COMPLETED.

ALL UNWELDED PANELS, FASTENERS AND HANGERS TO BE GALVANIZED FROM THE FACTORY

DO NOT SCALE DRAWING
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PROJECT

BLAST BAY UPGRADE
915/916 McINTYRE ST. E, NORTH BAY, ON

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PROJECT NUMBER

60678205

SHEET TITLE

CEILING AND WALL PANEL GENERAL ARRANGEMENT

SHEET NUMBER

Q114

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ISO B1 707 x 1000mm
APPROVED: Approver
CHECKED: Checker
DESIGNER: Designer
PROJECT MANAGEMENT INITIALS:

1. DESIGN NOTES

1. NORTH BAY CLIMATIC CONDITIONS
   1. EXTERIOR: JANUARY 1% DB: -30C
   2. EXTERIOR: JULY 2.5% DB/WB: 28C / 22C

1. INTERIOR SPACE DESIGN SET POINTS:
   1. WORK AREAS: DB: 18C
   2. PERSONNEL AREAS: HEATING: DB: 21C : COOLING: 23C

1. BLAST ROOM HVAC
   1. HEATING WILL BE PROVIDED PRIMARILY BY HYDRONIC UNIT HEATER(S), AND BY REHEAT COIL IN THE ROOF MOUNTED HEAT RECOVERY VENTILATOR (HRV)
   2. NO MECHANICAL COOLING
   3. FREE COOLING AS PROVIDED BY AIR MOVEMENT FROM HEAT RECOVERY VENTILATOR (HRV).
   4. GENERAL VENTILATION AVAILABLE FROM HEAT RECOVERY UNIT.
   5. RECIRCULATING FILTERING DUST COLLECTOR USED DURING DRY BLASTING
   6. HRV USED DURING WET BLASTING. HRV MAY ALSO BE USED FOR DRY BLASTING.

2 PROCESS KEY ASSUMPTIONS:

2.1 GENERAL
- .1 THE BLASTING PROCESS PERFORMED IN THE BLAST ROOM WILL USE BOTH DRY BLASTING AND WET (VAPOUR) BLASTING SYSTEMS.
  - .1 BLASTING IS CURRENTLY OPERATING APPROXIMATELY 12 HOURS PER DAY WITH TWO PERSONS BLASTING.
  - .2 DRY AND WET BLASTING WILL NOT OCCUR ON THE SAME DAY.
  - .3 THE MEDIA RECLAMATION WILL BE REQUIRED DURING BOTH WET AND DRY BLASTING OPERATIONS.
  - .4 OUTSIDE AND/OR RECIRCULATED FILTERED VENTILATION AIR WILL BE SUPPLIED FROM OVERHEAD, DOWNWARD ALONG THE LENGTH OF THE ESTIMATED BODY LINE OF TYPICAL RAIL VEHICLES.
  - .5 BYPRODUCT COLLECTION TRENCHES WITH TROUGHED AUGERS ARE LOCATED JUST OUTBOARD OF RAIL VEHICLE BODY LINE WILL COLLECT DIRECT DROP OUT PARTICLES AND LIQUID. PROCESS WILL STILL REQUIRE ONGOING SWEEPING / SQUEEGEEING TO TRENCHES.

2.2 PURIFIED BREATHING AIR (PBA) SYSTEM
- .1 FILTERING, NON-CATYLISING TYPE SYSTEM, WITH CONTINUOUS CARBON MONOXIDE MONITORING.
- .2 SUPPLIED FROM MAIN SITE COMPRESSED AIR SYSTEM.
  - .1 MAIN SITE COMPRESSED AIR SYSTEM NOT NORMALLY EXPOSED TO CARBON MONOXIDE (CO) CONTAMINATION AT COMPRESSOR AIR INTAKES, OR OTHERWISE, THUS NO CO CATYLISING REQUIRED.
- .3 DISTINCT PBA SYSTEM QUICK COUPLINGS TO PREVENT PBA END USER CONNECTION TO REGULAR COMPRESSED AIR AND VICE VERSA.
- .4 A MAXIMUM OF 3 PBA END USERS AT ANY TIME.
  - .1 USING FULL BLASTING HOODS
  - .2 ALLOWED MAXIMUM OF 15 CUBIC FEET PER MINUTE (6.5 LITRES PER SECOND) PER END USER.
- .5 CONTINUOUS INTEGRAL PBA VENDOR FILTRATION UNIT CARBON MONOXIDE MONITORING, WITH ADDITIONAL REMOTE ALARMING TO BE PROVIDED BY CONTRACTOR.
- .6 NO PBA HUMIDIFICATION PROVIDED IN THIS CONTRACT. ANY HUMIDIFICAITON REQUIREMENTS TO BE PROVIDED AT END USER HOOD CONNECTION BY ONTC AS REQUIRED ON INDIVIDUAL BASIS. NOT IN CONTRACT.

2.3 DRY ABRASIVE BLASTING. (EXISTING BLASTING EQUIPMENT)
- .1 COMPRESSED AIR DRIVEN, PORTABLE PRESSURE POT SYSTEMS.
  - .1 WILL BE MOUNTED ON THE BASE FRAME OF THE NEW 3 AXIS PERSONNEL LIFTS.
  - .2 BLASTING ABRASIVE (MEDIA) MAY INCLUDE BUT IS NOT LIMITED TO SILICONE DIOXIDE / ALUMINUM OXIDE BASED, AND NON FERRITE AND FERRITE BASED PRODUCTS.
  - .3 ASSUMED MEDIA MAXIMUM DENSITY: 150 LBS/CU.FT. (2400 KG/M3)
- .2 DRY BLASTING BY-PRODUCTS:
  - .1 MEDIA AND BY-PRODUCTS (REMOVED PARTICLES SUCH AS IRON BASED (RUST) PARTICLES, PAINTS, BODY FILLERS, ETC.)
    - .1 DROPPING OUT TO FLOOR AND AIRBORNE PARTICULATE
  - .2 ASSUMED MEDIA AND PARTICULATE MAXIMUM DENSITY: 150 LBS/CU.FT. (2400 KG/M3)
  - .3 ESTIMATED DRY BLASTING PRODUCT GENERATED:
    - .1 PARTICLES AND BY-PRODUCTS: 400 LBS/ HR. (185 KG/HR.)

2.7 COMPRESSED AIR SUPPLY
- .1 NEW DEMANDS IN THE BLAST ROOM AREA (AVERAGED VALUES):
  - .1 3-AXIS PERSONNEL LIFTS: 80 CFM EACH, WITH 80% SIMULTANEOUS USE FACTOR = 140 CFM
  - .2 DUST COLLECTOR FILTER: PLUSE OF LESS THAN 250 MILLISECONDS WITH EQUIVALENT RATE OF 25 CFM.
  - .3 PURIFIED BREATHING AIR SYSTEM: 50 CFM.
  - .4 MEDIA RECLAIM SYSTEM FILTER: PULSE OF LESS THAN 250 MILLISECONDS PULSE WITH EQUIVALENT FLOW RATE ESTIMATED AT 6 CFM.
- .2 ALL NEW DEMAND WILL BE ACCOMMODATED BY THE EXISTING CENTRALIZED COMPRESSED AIR SYSTEM, ABLE TO PROVIDE APPROXIMATELY 800 SCFM AFTER DESSICANT DRYER PURGE ALLOWANCE OF 180 SCFM.
- .3 EXISTING SYSTEM HAS DESSICANT AIR DRYER ABLE TO PROVIDE PRESSURE DEWPOINT TO AT LEAST -40C. THUS NO ADDITIONAL AIR DRYING REQUIRED FOR OUTSIDE AIR SUPPLIES.

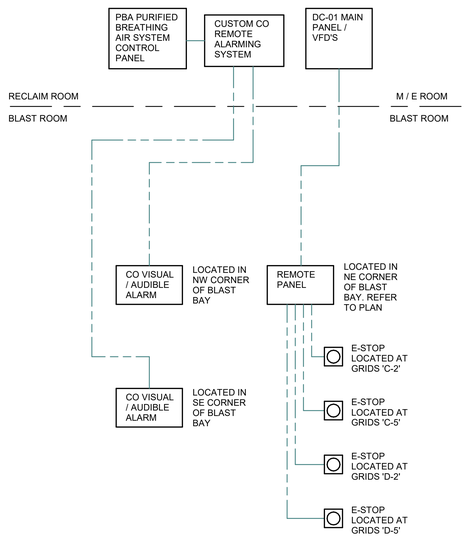
3 BLAST ROOM PROCESS EQUIPMENT AND VENTILATION CONTROL SEQUENCES

NOTE: THE FOLLOWING INFORMATION DOES NOT INCLUDE:
- THE OWNER SUPPLIER / EXISTING ECOQUIP VAPOR BLASTING AND DRY BLASTING EQUIPMENT OPERATION. REFER TO EXISTING VENDOR OPERATION AND MAINTENANCE (O&M) MANUAL.
- BLAST ROOM HEATING SYSTEM. REFER TO HVAC CONTROL SEQUENCE, PRODUCT SPECIFICATION SECTIONS, AND TO VENDOR OPERATION AND MAINTENANCE (O&M) MANUALS.

3.1 PURIFIED BREATHING AIR (PBA) SYSTEM
- .1 FILTRATION PANEL LOCATED IN RECLAIM ROOM
- .2 AIR SUPPLIED FROM GENERAL SHOP COMPRESSED AIR SYSTEM.
- .3 120 V ELECTRICAL POWER FOR INTEGRAL CARBON MONOXIDE (CO) MONITOR "ON"
- .4 COMPRESSED AIR SUPPLY VALVE TO PBA FILTRATION UNIT "OPEN".
- .5 VENDOR PACKAGE PROVIDES ONGOING AIR FILTRATION ACCORDING TO DOWNSTREAM DEMAND AND CONTINUOUSLY MONITORS FOR PRESENCE OF CARBON MONOXIDE IN THE PURIFIED AIR.
- .6 CARBON MONOXIDE DETECTED.
  - .1 LOCAL VENDOR PACKAGE SYSTEM ALARM AT PBA SYSTEM
  - .2 CONTRACTOR PROVIDED ADDITIONAL REMOTE VISUAL AND AUDIBLE ALARM AT TWO LOCATIONS BLAST ROOM. REFER TO SCHEMATICS.
- .7 ALSO REFER TO PRODUCT SPECIFICATION SECTION AND TO VENDOR OPERATION AND MAINTENANCE (O&M) MANUAL.

3.2 PERSONNEL LIFTS
- .1 3 AXIS WALL MOUNTED LIFTS, WITH PROVISION FOR ON-BOARD DRY BLAST POTS (MAXIMUM 20 INCH DIAMETER, 600 LB. WEIGHT).
- .2 POWERD BY ONTC MAIN COMPRESSED AIR SYSTEM.
- .3 FULL LENTH TRAVEL ON EACH SIDE OF BOOTH
- .4 ONTC FACILITY MAIN COMPRESSED AIR SYSTEM IN OPERATION.
- .5 LIFT SUPPLY COMPRESSED AIR SUPPLY VALVE OPEN
  - .1 PERSONNEL LIFTS OPERATIONAL USING VENDOR PROVIDED PNEUMATIC CONTROLS ON LIFT.
- .6 ALSO REFER TO PRODUCT SPECIFICATION SECTION AND TO VENDOR OPERATION AND MAINTENANCE (O&M) MANUAL.

3.3 BLAST ROOM DUST COLLECTION – FOR DRY BLASTING
- .1 EXTERIOR RECIRCULATING FILTERING DUST COLLECTOR.
  - .1 OPERATE ONLY WHEN DRY BLASTING. DO NOT USE DURING ACTIVE VAPOUR (WET) BLASTING.
  - .2 ROOM VENTILATION (OUTSIDE AIR) MAY BE PROVIDED BY OPERATING THE SEPARATE HRV DURING DRY BLASTING.
  - .3 DUST COLLECTOR RETURNING AIR VOLUME IS CONSTANT BUT CAN BE DISTRIBUTED TO PROVIDE HIGHER VOLUMES IN SELECTED PORTION OF BLAST ROOM, (WEST / CENTER / EAST / ALL) BY DAMPERS CONTROLLED FROM DUST COLLECTOR CONTROLLER.
- .2 VENDOR CONTROL PACKAGE PROVIDES ALL SYSTEM CONTROL INCLUDING BUT NOT LIMITED TO:
  - .1 SUPPLY (RETURN) AIR DISTRIBUTION VOLUME CONTROL DAMPERS FOR SELECTED ROOM AREA. (WEST / CENTER / EAST / ALL)
    - .1 INCLUDING FAN SHUTDOWN AS APPROPRIATE FOR DAMPER ACTUATION PERIODS.
  - .2 DUST COLLECTION SYSTEM FANS
  - .3 FILTER BLOW DOWN AND MONITORING.
  - .4 EXPLOSION PROTECTION
  - .5 ALSO REFER TO PRODUCT SPECIFICATION SECTION AND TO VENDOR OPERATION AND MAINTENANCE (O&M) MANUAL.
  - .6 EMERGENCY STOP – IMMEDIATE SHUT DOWN OF SYSTEM OPERATION, EXCEPT FOR ANY COMPONENTS REQUIRED TO MAINTAIN SAFETY.
- .3 MAIN BREAKER IN ELECTRICAL ROOM "ON".
- .4 REMOTE DUST COLLECTOR CONTROL PANEL IN BLAST ROOM.
  - .1 DESIRED ACTIVE ROOM AREA SELECTED: (WEST / CENTER / EAST / ALL)
  - .2 SYSTEM ON / OFF-SHUTDOWN SWITCH TO "ON"
  - .3 VENDOR CONTROL ACTUATES APPROPRIATE SUPPLY AIR DAMPERS TO DISTRIBUTE AIR AS FOLLOWS:
    - .1 SELECTED ZONE: REFER TO AIRFLOW BLOCK DIAGRAM ON DRAWING Q107.
    - .2 ALL OTHER ZONES: REMAINDER OF RETURNING VOLUME DISTRIBUTED APPROXIMATELY EQUALLY.
    - .3 REFER TO SCHEMATIC DRAWING
  - .4 DUST COLLECTION SYSTEM FAN(S) ACTIVATES AND OPERATES ACCORDING TO VENDOR PACKAGE CONTROL SEQUENCES.
  - .5 ACTIVE BLASTING ZONE SELECTION MANUALLY CHANGED TO ANOTHER ZONE:
    - .1 DUST COLLECTOR AIRFLOW REDUCED OR STOPPED ACCORDING TO SYSTEM DESIGN.
    - .2 DUST COLLECTOR CONTROLLER REPOSITIONS DUCT DAMPERS TO SUIT.
    - .3 DUST COLLECTOR RESUMES FULL AIRFLOW.
  - .6 SYSTEM "OFF-SHUTDOWN" SELECTED
    - .1 SYSTEM CONTINUES TO OPERATE FOR PRESET AMOUNT OF TIME BEFORE SHUTTING DOWN.
      - .1 ADJUSTABLE FROM MAIN CONTROL PANEL ONLY (0 TO 120 MINUTES)
  - .7 EMERGENCY STOP – IMMEDIATE SHUT DOWN OF SYSTEM OPERATION, EXCEPT FOR ANY COMPONENTS REQUIRED TO MAINTAIN SAFETY.



1 Q115 — **CONTROL PANEL SCHEMATIC** — NTS

NOTE: ALL DEVICES INDICATED HERE IN SHALL BE PROVIDED BY THE INDIVIDUAL EQUIPMENT VENDORS AND INSTALLED BY THE ELECTRICAL CONTRACTOR UNLESS NOTED OTHERWISE.

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PROJECT

BLAST BAY UPGRADE
915/916 McINTYRE ST. E, NORTH BAY, ON

CLIENT

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REGISTRATION

INTERIM

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KEY PLAN

EXISTING BLAST BAY
EXISTING BLAST BAY
EXISTING BLAST BAY

ISO B1 707 x 1000mm
APPROVED: Approver
CHECKED: Checker
DESIGNER: Designer
PROJECT MANAGEMENT INITIALS:

INDUSTRIAL / PROCESS MOTORIZED DAMPER SCHEDULE

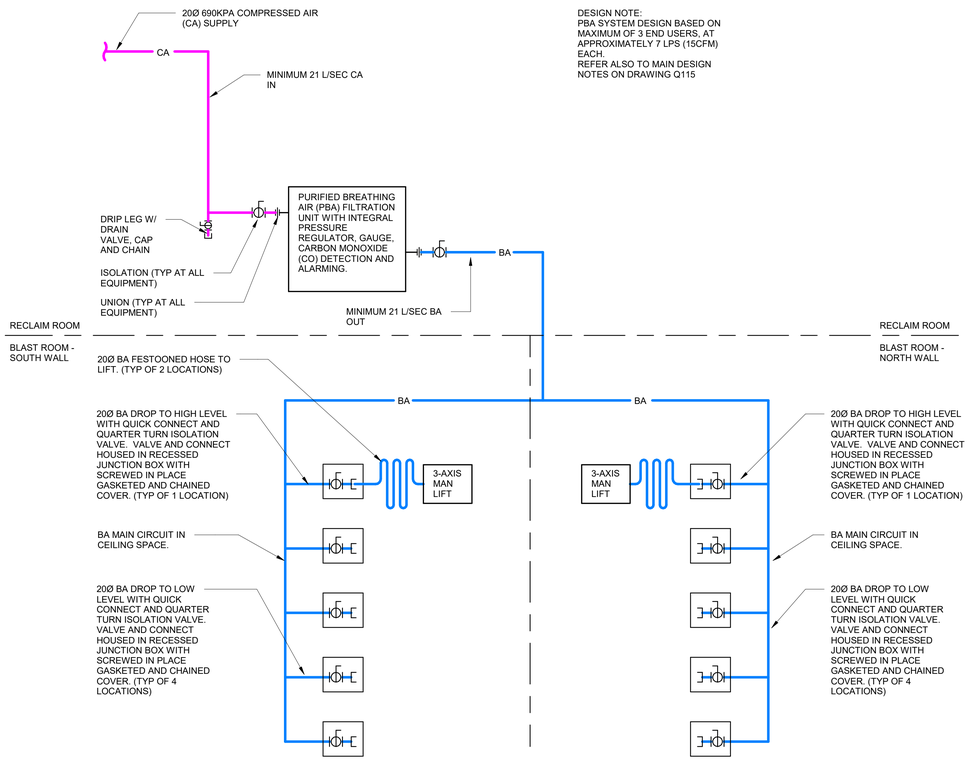
TAG	DESCRIPTION OR LOCATION	MANUFACTURER	MODEL	SIZE (MM)	BLADE ACTION	ACTION	FAIL POSITION	ACTUATOR	VOLTAGE	NOTES (SEE BELOW)
MD-01	SUPPLY AIR	GREENHECK	HCDR250	700	BUTTERFLY	2 POSITION	OPEN	BELIMO	24	1, 2, 3, 4
MD-02	SUPPLY AIR	GREENHECK	HCDR250	750	BUTTERFLY	2 POSITION	OPEN	BELIMO	24	1, 2, 3, 4

1. OR APPROVED EQUIVALENT PRODUCTS.
2. ELECTRICAL PRODUCTS TO BE CSA APPROVED, AND ALL PRODUCTS TO BE APPROVED FOR USE FROM -30C TO +40C.
3. DAMPER POSITION TO BE FIELD ADJUSTED TO PROVIDE 2 LEVELS OF AIRFLOW. WILL NOT COMPLETELY CLOSE OFF AIRFLOW.
4. DAMPER OPERATOR VOLTAGE TO BE COORDINATED WITH DUST COLLECTOR SUPPLIER.

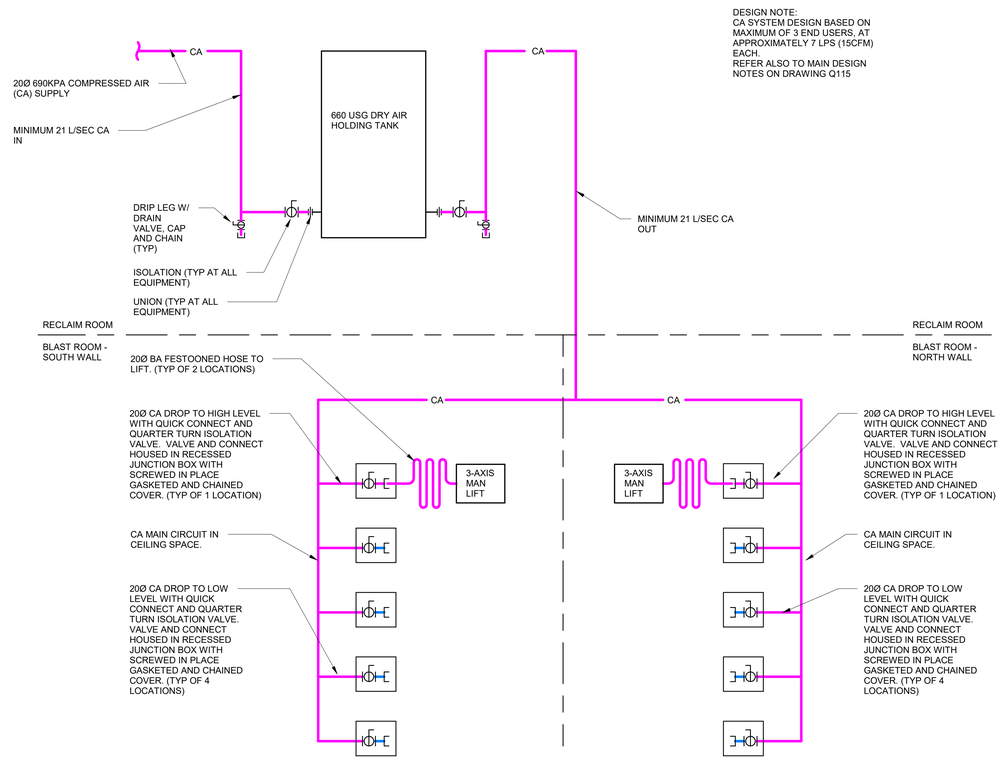
INDUSTRIAL / PROCESS GRILLE SCHEDULE

TAG	DESCRIPTION OR LOCATION	MANUFACTURER	MODEL	MOUNTING	TYPE / PATTERN	FACE SIZE (H X W) MM	FINISH			COMMENTS / ACCESSORIES
R1	DUST COLLECTOR RETURN AIR TO BLAST ROOM	EH PRICE	MIG - 4	FACE	MODULAR INDUSTRIAL GRILLE (MIG), 4 MODULES, DOUBLE DEFLECTION, ADJUSTABLE BLADES, WITH STEEL OPPOSED BLADE DAMPER	1200 X 250	B15 GREY			1, 2
R2	DUST COLLECTOR EXHAUST AIR FROM BLAST ROOM	EH PRICE	SERIES 95	FACE	HEAVY DUTY STEEL, 20MM BLADE SPACING, 0 DEGREE DEFLECTION, STEEL OPPOSED BLADE DAMPER	600 X 550	B15 GREY			1, 2

1. OR APPROVED EQUIVALENT PRODUCTS.
2. REFER TO DETAIL ON DRAWINGS. SUBMIT SHOP DRAWING FOR REVIEW.



1 Q116 — **BREATHING AIR SCHEMATIC** — NTS



2 Q116 — **COMPRESSED AIR SCHEMATIC** — NTS

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No.	DESCRIPTION	DATE
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4	ISSUED FOR TENDER	2023/09/29

PROJECT NUMBER

60678205

SHEET TITLE

PROCESS SCHEDULES AND SCHEMATICS

SHEET NUMBER

Q116

GRAPHICS, SCHEDULES AND SCHEMATICS

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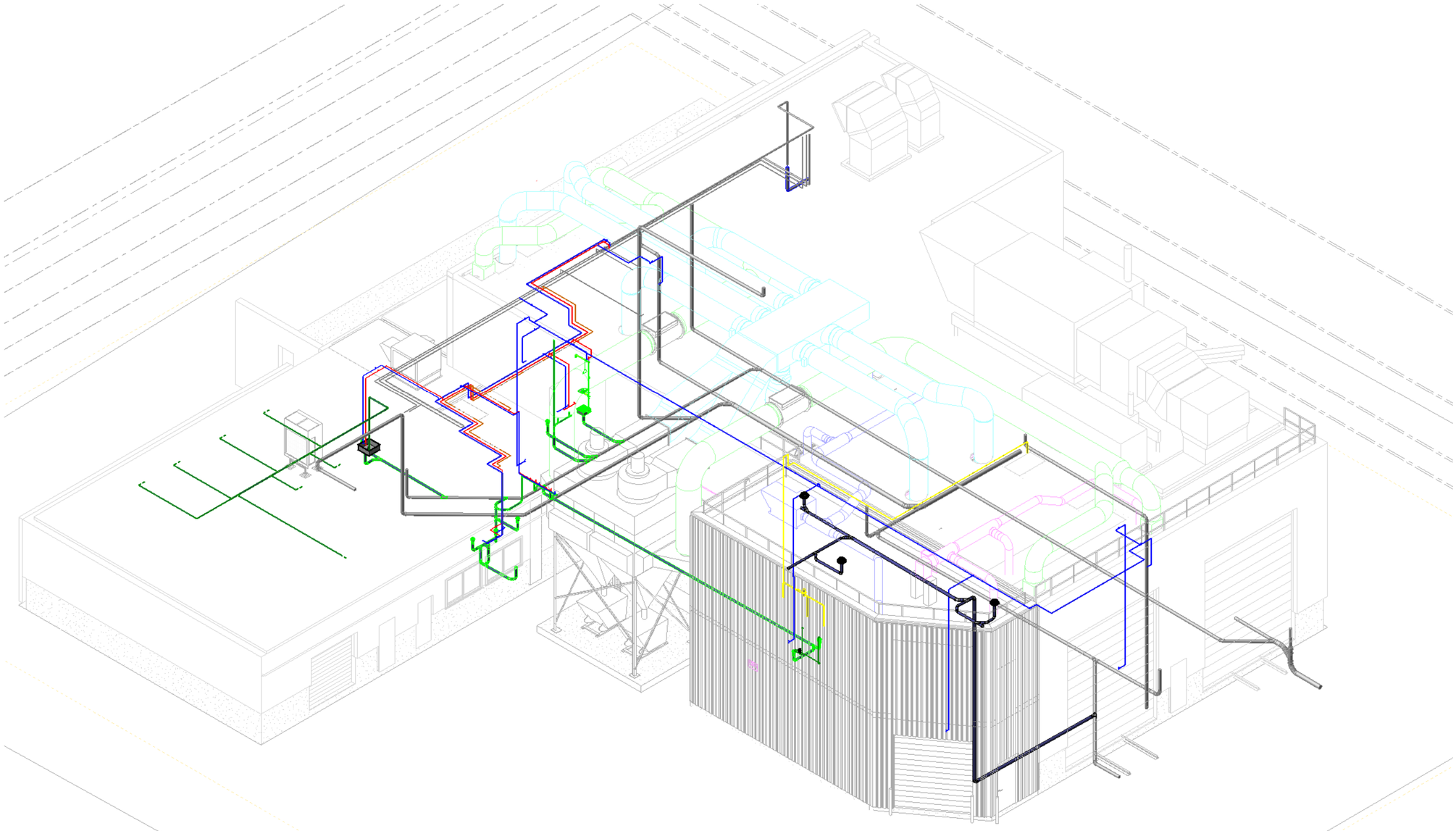

1 | P100

ISOMETRIC VIEW - OVERALL BUILDING - PLUMBING AND DRAINAGE

Scale:

PD DRAWING LIST

SHEET NUMBER	SHEET NAME
P100	ISOMETRIC VIEW - OVERALL BUILDING - PLUMBING AND DRAINAGE
P101	FOUNDATION PLAN - PD
P102	GROUND FLOOR PLAN - PD
P103	HIGH LEVEL PLAN - PD
P104	HIGH ROOF PLAN - PD
P105	BUILDING SECTIONS - PD
P106	BUILDING SECTIONS -PD
P107	BUILDING ISOMETRIC - PD
P108	PARTIAL GROUND FLOOR PLAN
P109	PARTIAL GROUND FLOOR PLAN

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PROJECT: GRIT BLAST UPGRADE - 915/916 McINTYRE ST. E, NORTH BAY, ON - ISOMETRIC VIEW - OVERALL BUILDING - PLUMBING AND DRAINAGE

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GRIT BLAST UPGRADE
915/916 McINTYRE ST. E, NORTH BAY, ON

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SHEET TITLE

ISOMETRIC VIEW - OVERALL BUILDING - PLUMBING AND DRAINAGE

SHEET NUMBER

P100

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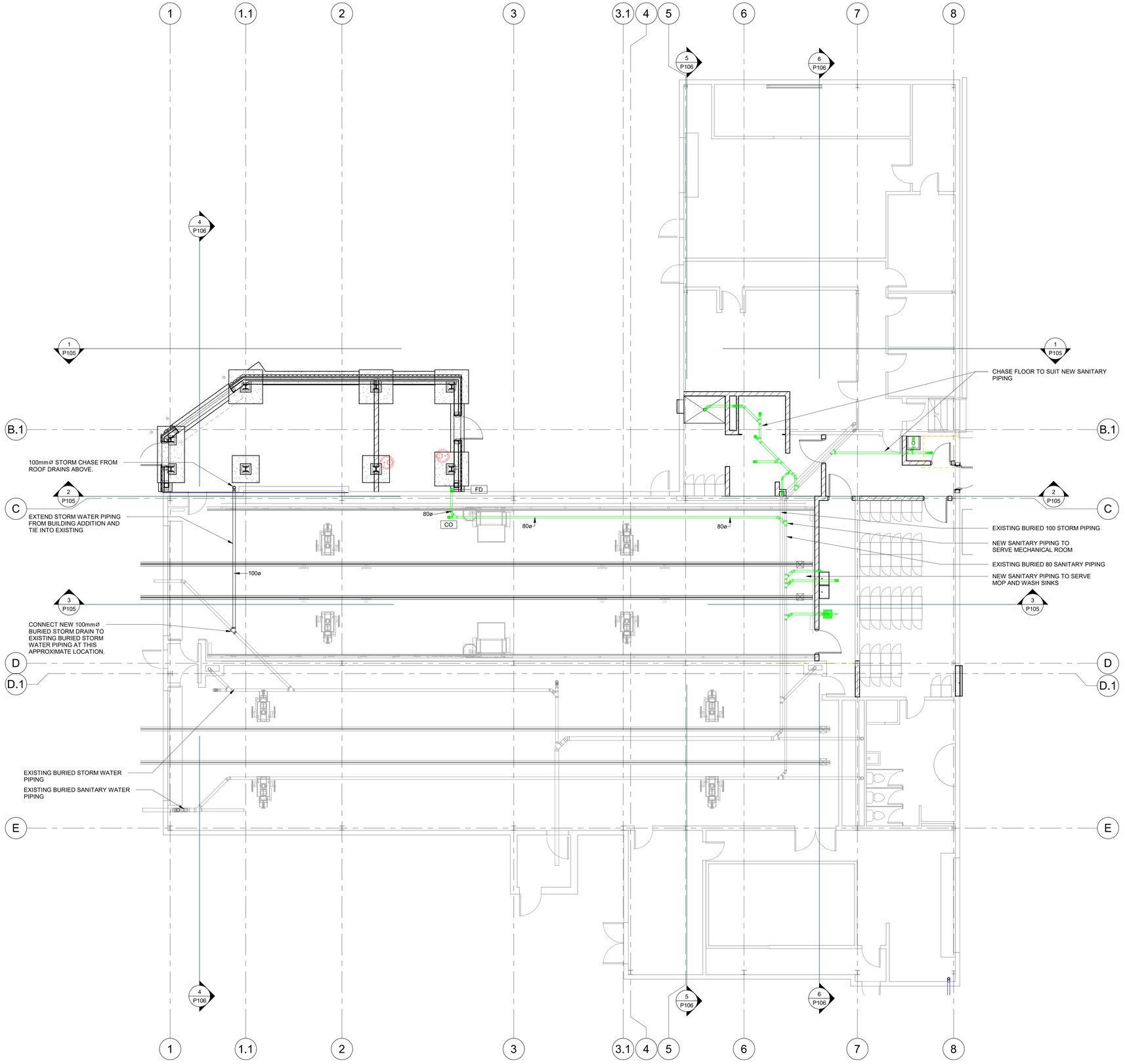

1 FOUNDATION PLAN - PD

P101 | REF: 1 / P105

Scale: 1 : 75

PRO-FOUNDATION PLAN - PD
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FOUNDATION PLAN - PD

SHEET NUMBER

P101

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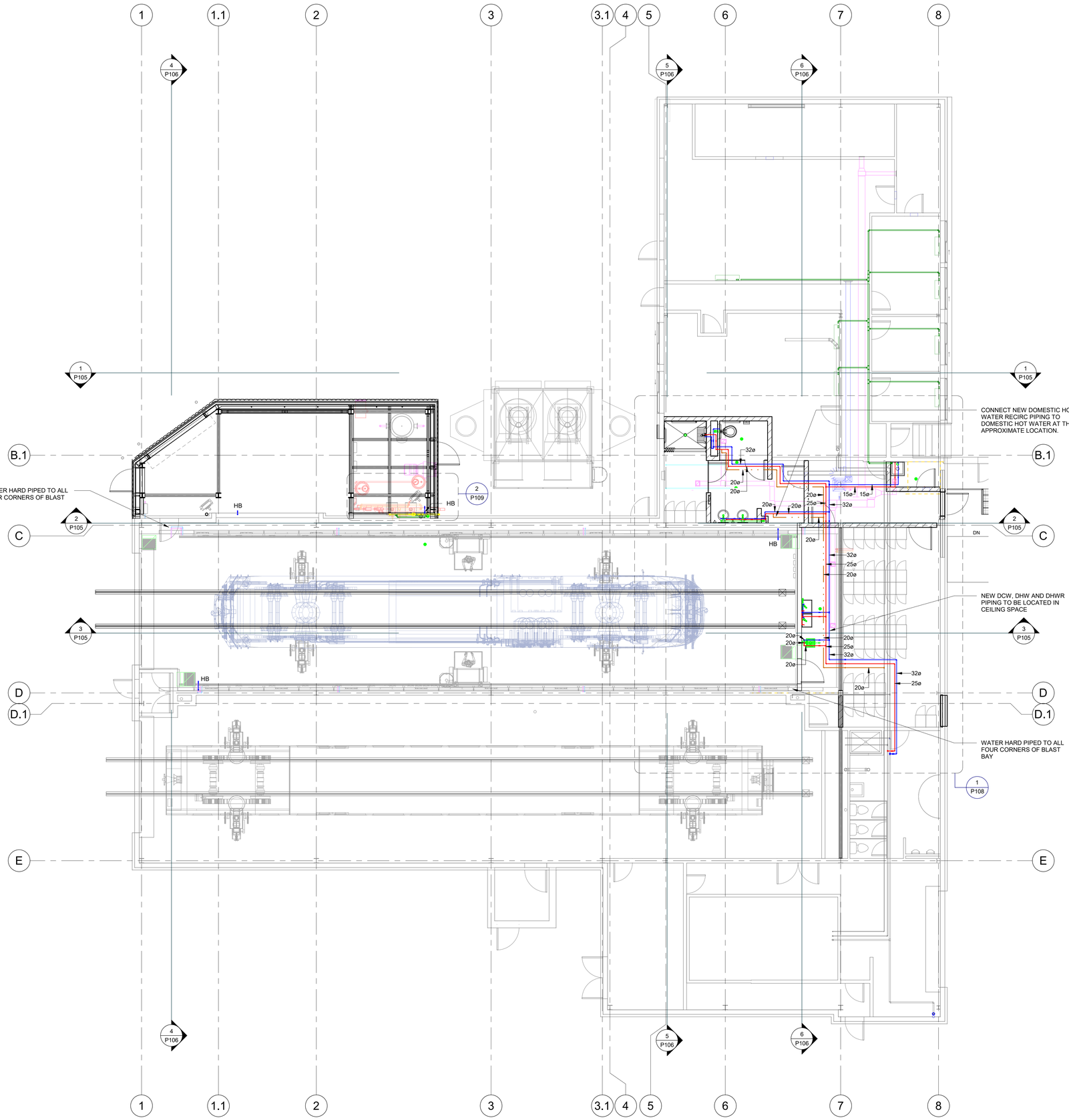

1 P102

LOW LEVEL GROUND FLOOR PLAN - HVAC

Scale: 1 : 75

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SHEET TITLE

GROUND FLOOR PLAN - PD

SHEET NUMBER

P102

PROJECT GROUND FLOOR PLAN - PD
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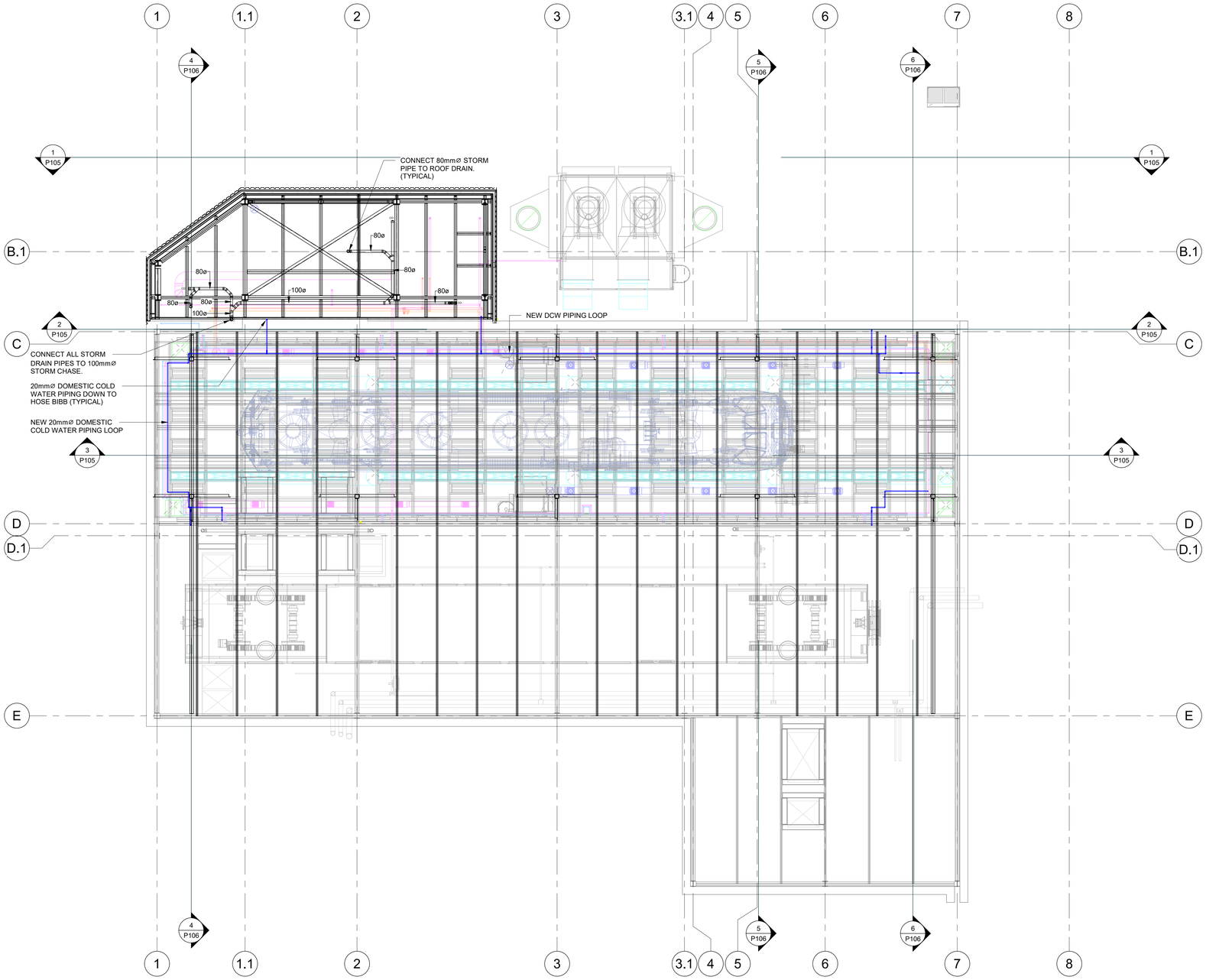

1 P103 — **CEILING LEVEL PLAN - HVAC**

Scale: 1 : 75

PROGRESS LEVEL PLAN - PD
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PROJECT NUMBER

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SHEET TITLE

HIGH LEVEL PLAN - PD

SHEET NUMBER

P103

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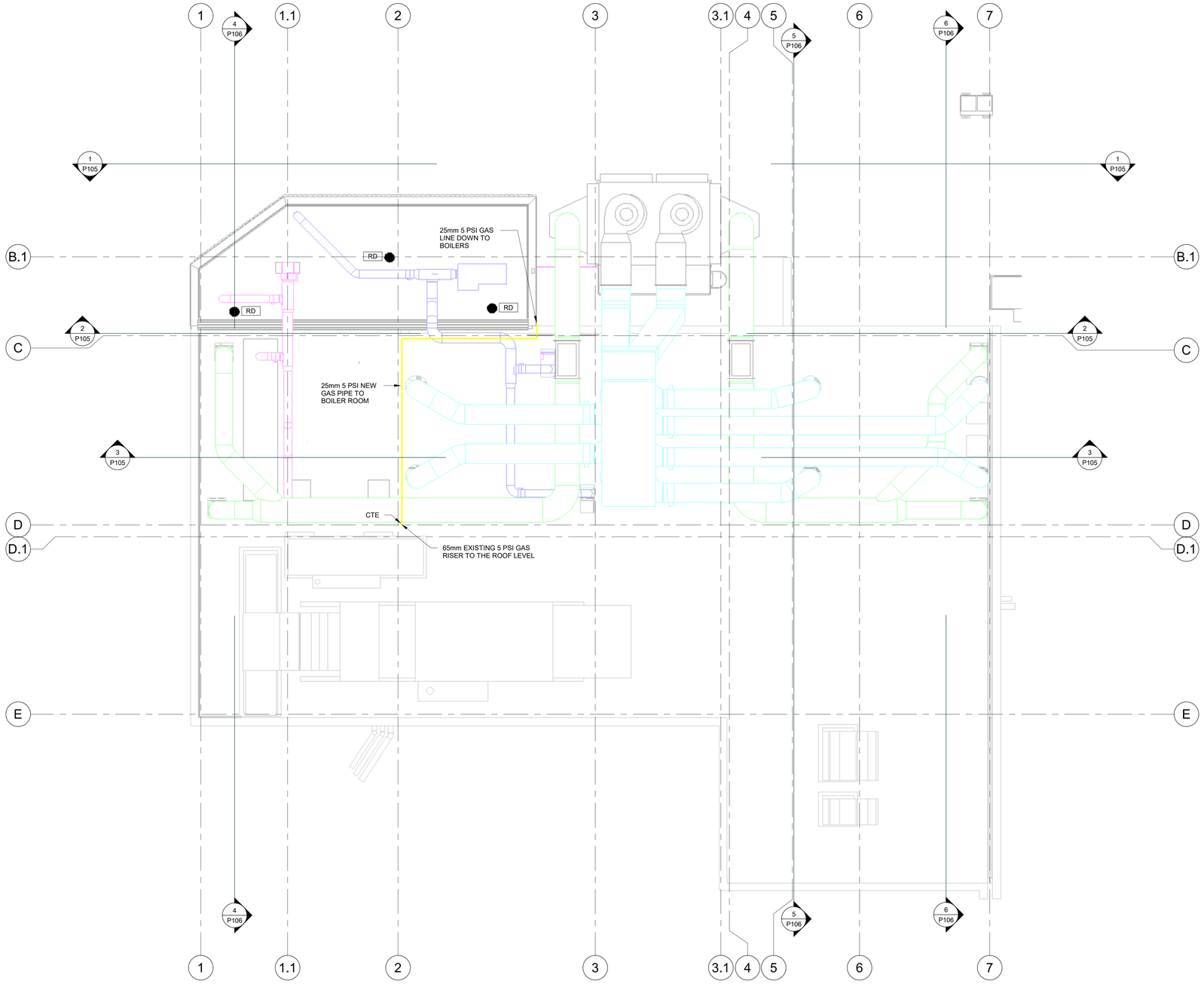

1 HIGH ROOF LEVEL PLAN - PD

P104 | REF: 1 / P105

Scale: 1 : 75

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SHEET TITLE

HIGH ROOF PLAN - PD

SHEET NUMBER

P104

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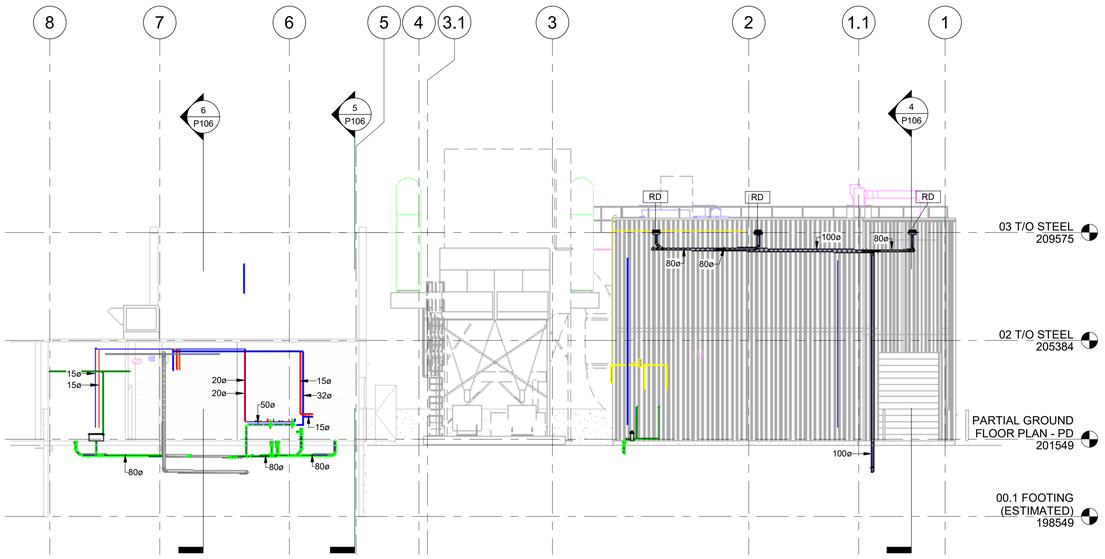
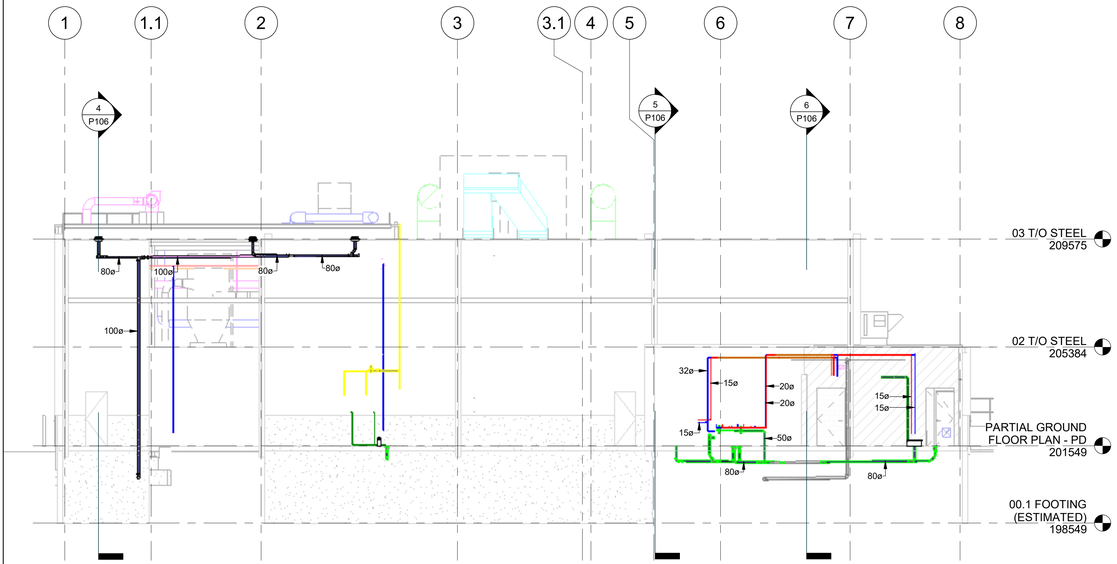


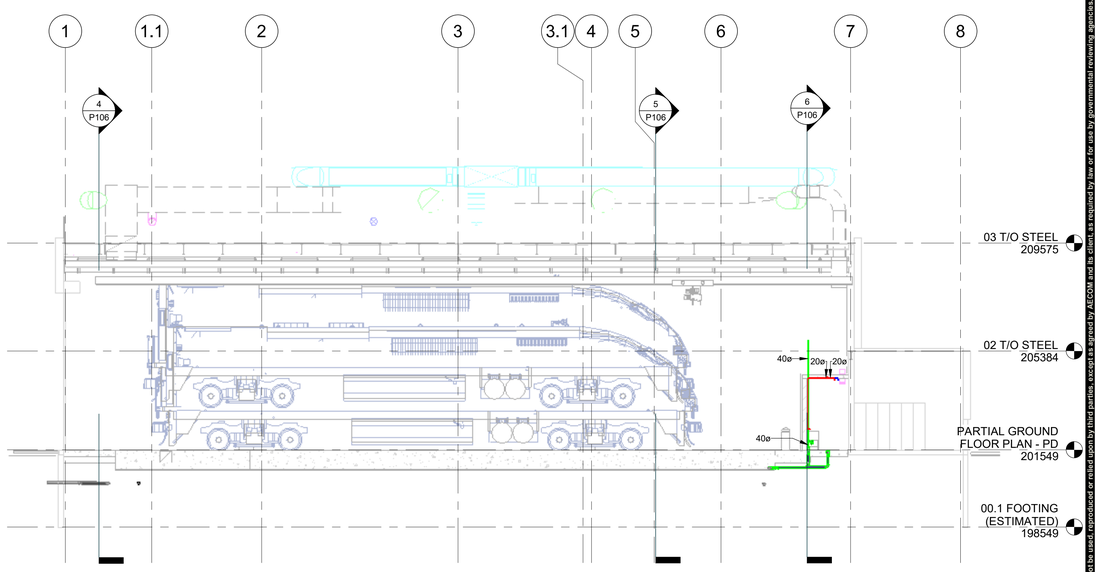
1 **BUILDING SECTION 1 - PD**

P105 | REF: 1 / P101 Scale: 1 : 100



2 **BUILDING SECTION 2 - PD**

P105 | REF: 1 / P101 Scale: 1 : 100



3 **BUILDING SECTION 3 - PD**

P105 | REF: 1 / P101 Scale: 1 : 100

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BUILDING SECTIONS - PD

SHEET NUMBER

P105

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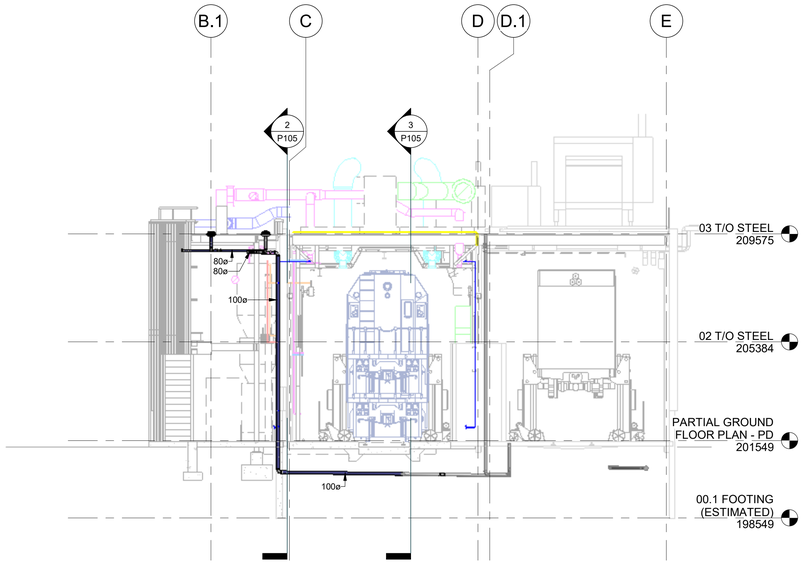
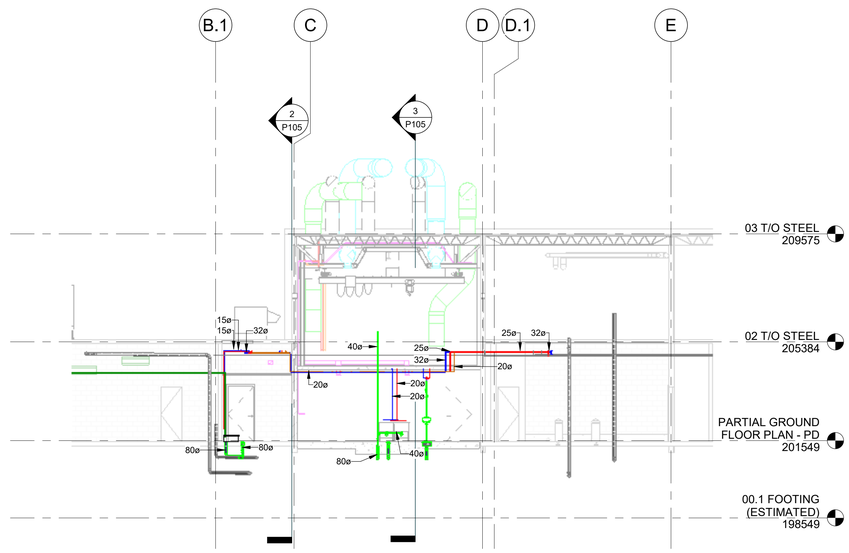


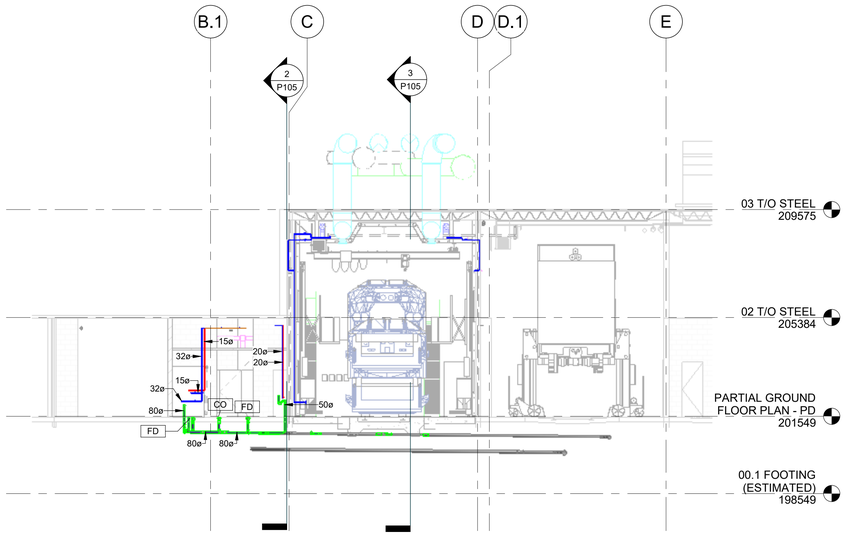
4 **BUILDING SECTION 4 - PD**

P106 | REF: 1 / P101 Scale: 1 : 100



6 **BUILDING SECTION 6 - PD**

P106 | REF: 1 / P101 Scale: 1 : 100



5 **BUILDING SECTION 5 - PD**

P106 | REF: 1 / P101 Scale: 1 : 100

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SHEET TITLE

BUILDING SECTIONS -PD

SHEET NUMBER

P106

PROGRAM BUILDING SECTIONS -PD
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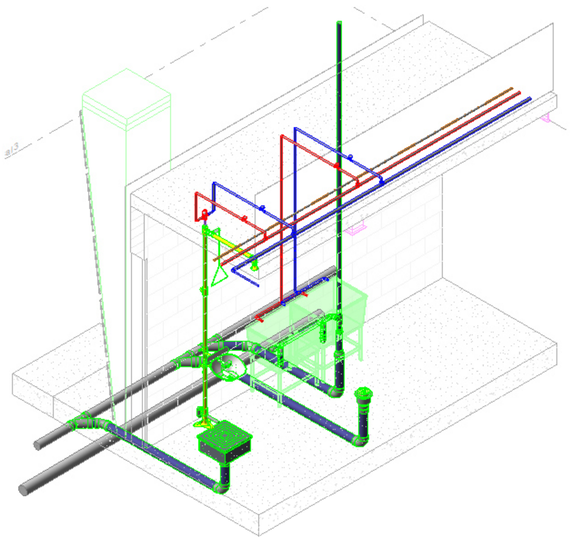
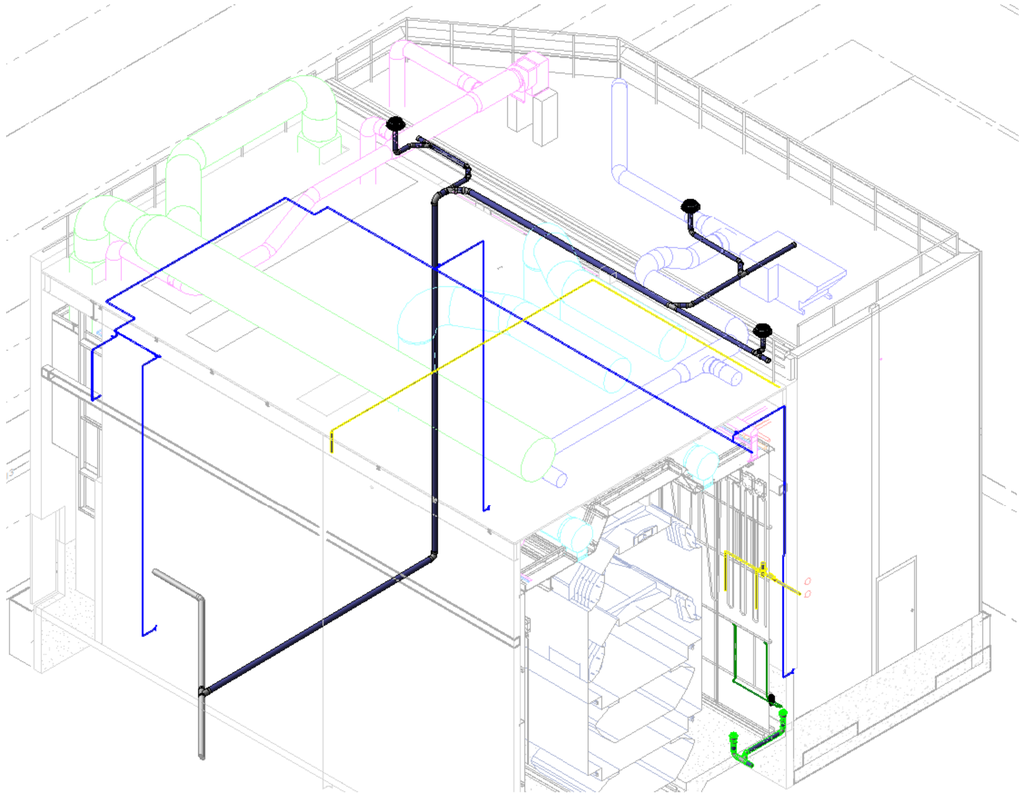
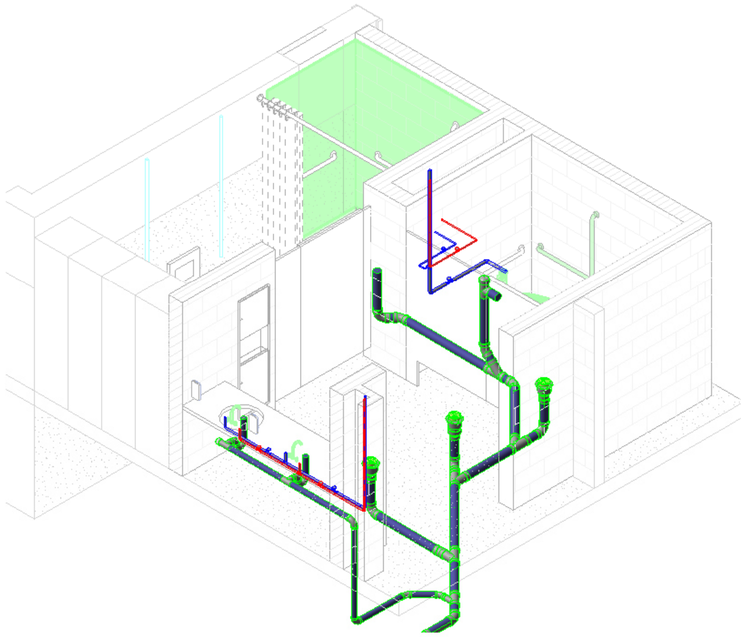


1 | ISOMETRIC VIEW - DIRTY ROOM - PD
P107 | Scale:



3 | ISOMETRIC VIEW - BUILDING ADDITION - PD
P107 | Scale:



2 | ISOMETRIC VIEW - WOMENS WR / LOCKERS - PD
P107 | Scale:

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PROJECT NUMBER

60678205

SHEET TITLE

BUILDING ISOMETRIC - PD

SHEET NUMBER

P107

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P107-BUILDING ISOMETRIC - PD

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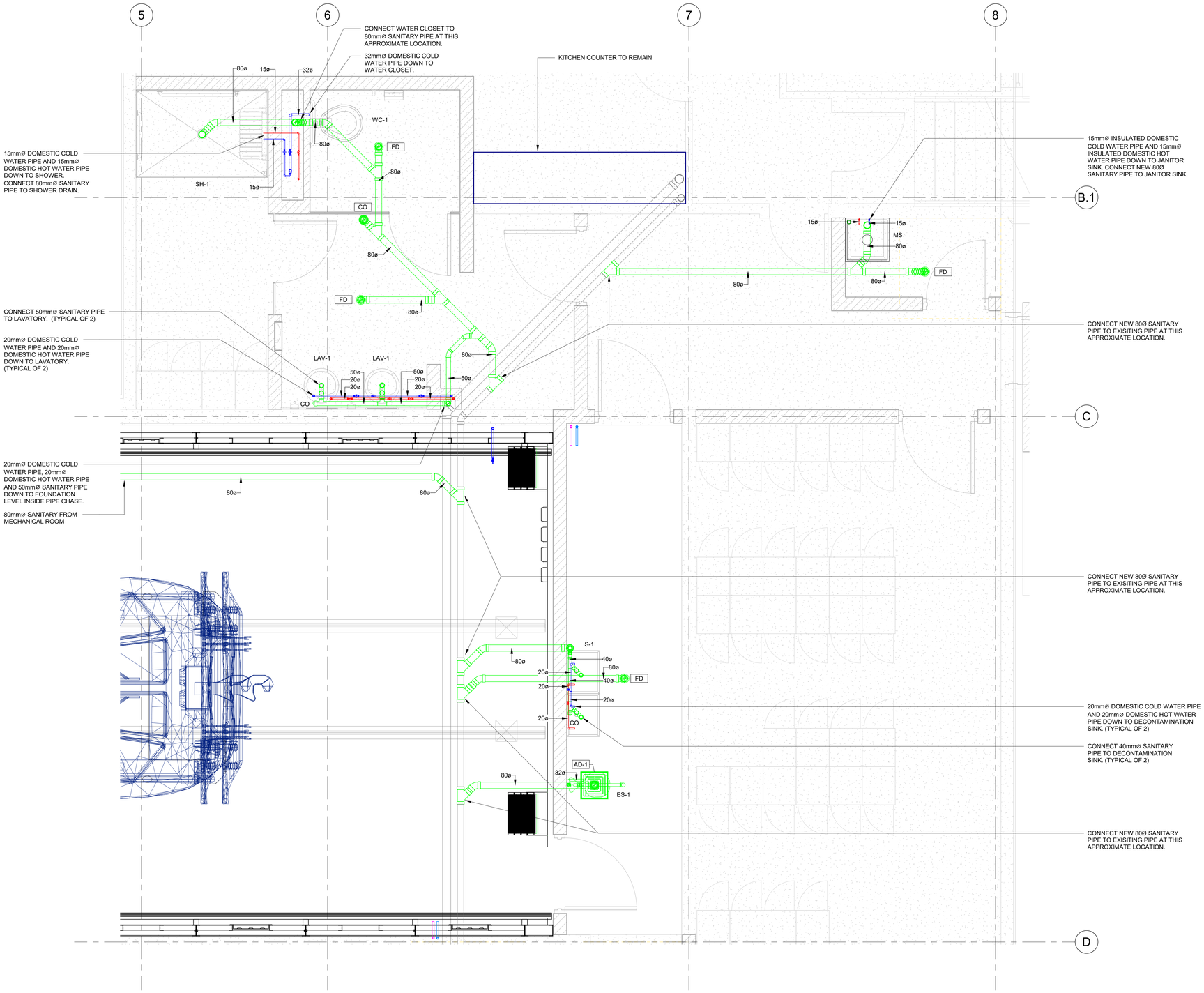

1 PARTIAL GROUND FLOOR PLAN - PD

P108 | REF: 1 / P105

Scale: 1 : 25

AECOM

PROJECT

GRIT BLAST UPGRADE
915/916 McINTYRE ST. E, NORTH BAY, ON

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PROJECT NUMBER

60678205

SHEET TITLE

PARTIAL GROUND FLOOR PLAN

SHEET NUMBER

P108

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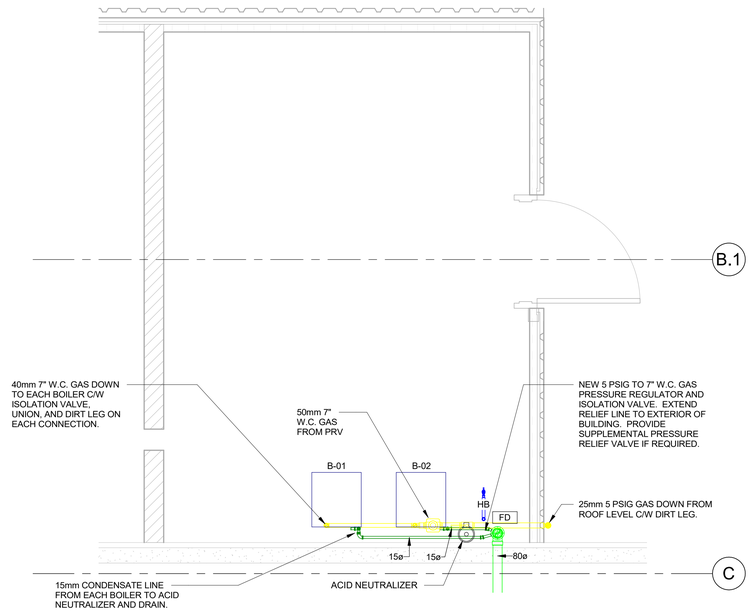
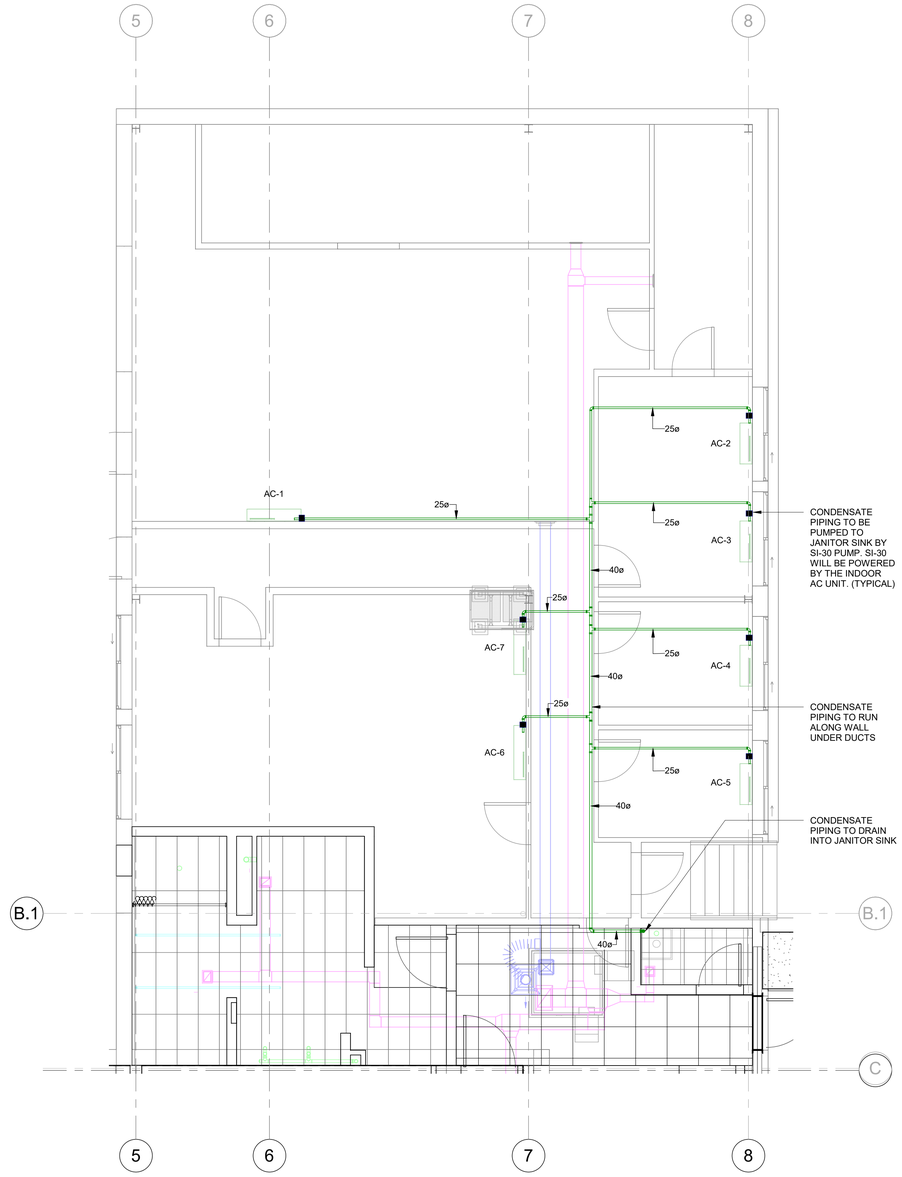


2 **MECHANICAL ROOM PLAN**

P109 | REF: 1 / P105 | Scale: 1 : 25



1 **HIGH LEVEL GROUND FLOOR PLAN - PD**

P109 | Scale: 1 : 50

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SHEET TITLE

PARTIAL GROUND FLOOR PLAN

SHEET NUMBER

P109

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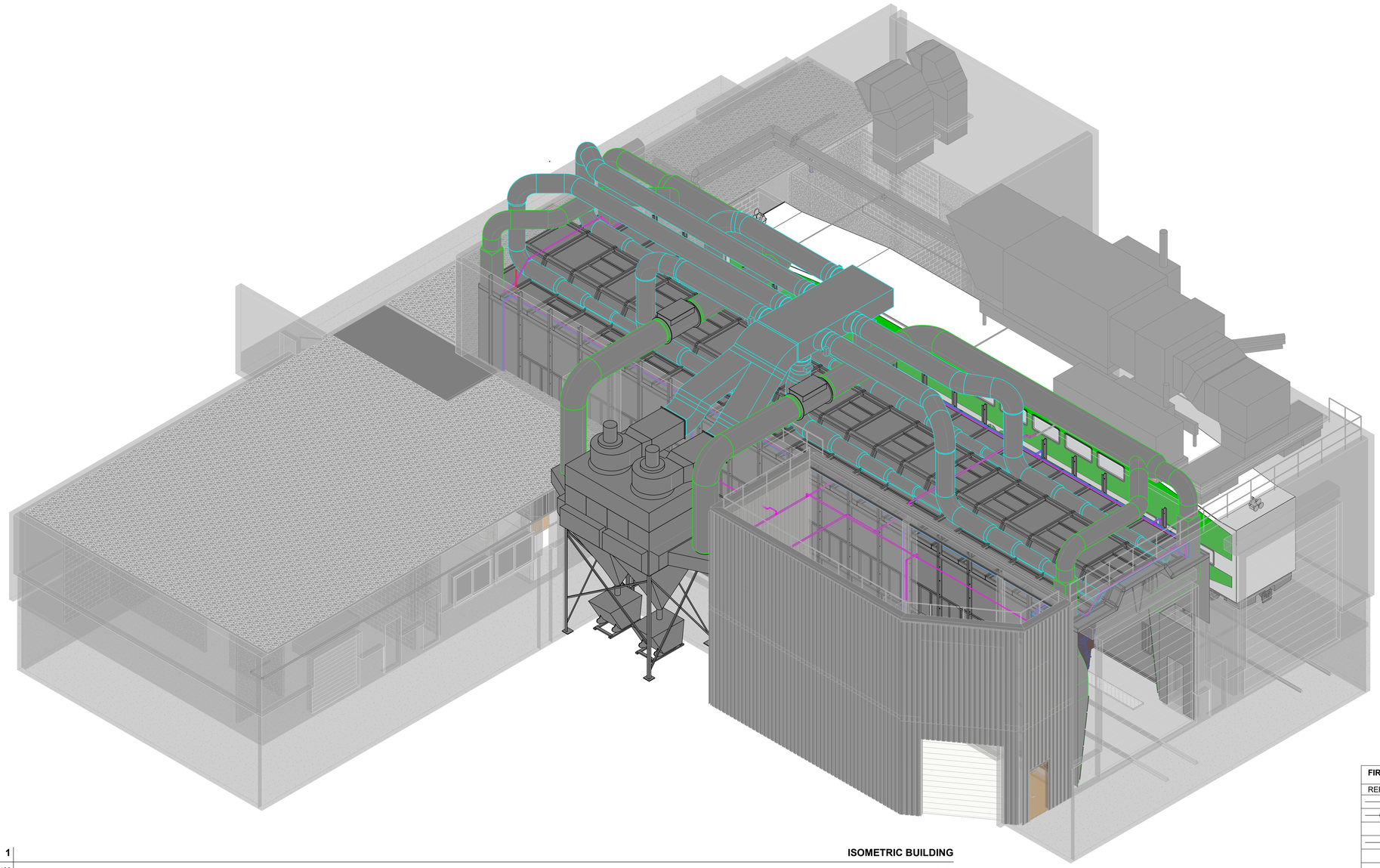

1
FP100

ISOMETRIC BUILDING

Scale:

GENERAL NOTES

1. OBTAIN AND PAY FOR ALL REQUIED PERMITS.
2. PROVIDE SHOP DRAWINGS TO THE CONSULTANT FOR REVIEW. ALL SHOP DRAWINGS MUST BE REVIEWED, STAMPED AND SIGNED BY THE CONTRACTOR PRIOR TO SUBMITTING TO THE CONSULTANT. REVIEW SHALL INCLUDE VERIFYING UNIT DIMENSIONS AND CLEARANCES.
3. MAINTAIN RECORD DRAWINGS ON AN ON-GOING BASIS. DRAWINGS SHALL BE AVAILABLE FOR PERIODIC REVIEW BY THE OWNER DURING CONSTRUCTION.
4. ALL WORK SHALL COMPLY WITH APPLICABLE CODES.
5. INSTRUCT AND TRAIN THE OWNER AND/OR THEIR DELEGATES ON PROPER OPERATION OF SYSTEM.
6. CONTRACTOR TO PERFORM INTEGRATED SYSTEM TESTING OF FIRE PROTECTION SYSTEM IN ACCORDANCE WITH CAN ULC S1001 AFTER THE NEW FIRE ALARM SYSTEM IS IN PLACE AND TIED TO THE NEW.
7. DO NOT SCALE DRAWINGS. THE LOCATIONS OF ALL ITEMS SHOWN ON THE DRAWINGS OR SPECIFIED THAT ARE NOT DEFINITELY FIXED BY DIMENSIONS ARE APPROXIMATE ONLY. THE EXACT LOCATIONS NECESSARY TO SECURE THE BEST CONDITIONS AND RESULTS MUST BE DETERMINED BY THE SITE CONDITIONS. REVIEW ALL REVISIONS WITH THE OWNER.
8. FLOOR PLAN SHALL BE READ IN CONJUNCTION WITH SCHEMATICS, DETAILS AND SPECIFICATION. NEITHER THE DRAWINGS NOR THE SPECS SHALL BE USED ALONE. MISINTERPRETATION OF ANY REQUIREMENTS OF EITHER PLANS OR SPECIFICATIONS SHALL NOT CHANGE THE REQUIREMENTS OR INTENT OF THE SPECS FOR PROPER COMPLETION OF THE WORK TO THE FULL APPROVAL OF THE CONSULTANT AND THE OWNER.
9. SHOULD ANY DISCREPANCY APPEAR BETWEEN THE DRAWINGS AND SPECIFICATIONS, SPECIFICATIONS TAKE PRECEDENCE OVER THE DRAWINGS. IF THERE IS DOUBT AS TO THE TRUE MEANING AND INTENT OF EITHER THE DRAWINGS OR THE SPECIFICATIONS, A RULING SHALL BE OBTAINED FROM THE OWNER BEFORE SUBMITTING THE TENDER.
10. PRIOR TO COMMENCEMENT OF WORK, ORDERING OF EQUIPMENT AND/OR FABRICATING MATERIALS, THE CONTRACTOR SHALL VISIT THE SITE TO VERIFY EXISTING CONDITIONS. THIS SHALL BE DONE IN ORDER TO CONFIRM THAT EQUIPMENT AND SERVICES CAN BE INSTALLED SHOWN ON DRAWINGS AND SPECIFIED. IT IS THE CONTRACTOR RESPONSIBILITY TO NOTIFY THE OWNER OF ANY DISCREPANCIES, COMMISSIONS, AND/OR INTERFERENCES PRIOR TO COMMENCEMENT OF WORK.
11. CONTRACTOR SHALL REVIEW THE APPLICABLE DESIGNATED SUBSTANCE SURVEY.

DEMOLITION NOTES

1. EVERY EFFORT HAS BEEN MADE TO OUTLINE THE DEMOLITION SCOPE OF WORK; HOWEVER, THE DEMOLITION DRAWINGS REPRESENT ONLY THE GENERAL LOCATION AND NUMBER OF DEVICES, EQUIPMENT, ETC. TO ASSIST IN EVALUATING THE DEMOLITION SCOPE OF WORK. DRAWINGS ARE BASED ON PREVIOUS AS-BUILTS OR FIELD EVALUATION.
2. THE CONTRACTOR IS STRONGLY ADVISED TO REVIEW THE SITE PRIOR TO BID. CONTRACTOR SHALL INCLUDE FOR ALL COSTS ASSOCIATED WITH ACCESSING, REMOVING, REINSTALLING AND PROTECTING EQUIPMENT AND WORK AREAS.
3. CONTRACTOR IS RESPONSIBLE FOR RESTORATION OF FIRE-SEPARATIONS AS REQUIRED FOR DEMOLITION / INSTALLATION OF NEW EQUIPMENT AND PIPING.
4. CONTRACTOR TO DETERMINE THE MOST EFFICIENT METHOD OF COMPLETING THE WORK AND TO FORMULATE A CONSTRUCTION SCHEDULE AND PROVIDE TO CLIENT FOR APPROVAL PRIOR TO COMMENCEMENT OF WORK.
5. BE RESPONSIBLE AND PAY FOR ANY DAMAGE TO THE EXISTING BUILDING INCURRED BY WORK OF THIS DIVISION, OR REPAIR TO THE SATISFACTION OF THE OWNER.
6. CARRY OUT THE WORK WITH A MINIMUM OF NOISE, DUST AND DISTURBANCE.
7. PROVIDE DAILY CLEAN UP AND PROPER DISPOSAL OF DEBRIS GENERATED BY DAILY OPERATIONS. ON COMPLETION OF THE WORK, ALL TOOLS, SURPLUS MATERIALS AND WASTE MATERIALS SHALL BE REMOVED AND THE PREMISES LEFT IN A CLEAN AND PERFECT CONDITION.

FP DRAWING LIST

SHEET NUMBER	SHEET NAME
FP100	BUILDING ISOMETRIC - FP
FP101	LOW LEVEL GROUND FLOOR PLAN - FP
FP102	HIGH LEVEL GROUND FLOOR PLAN - FP
FP103	BUILDING ISOMETRIC - FP

HAZARD CLASSIFICATION SCHEDULE

	HAZARD CLASSIFICATION	OCCUPANCIES
1	LIGHT	OFFICES, CORRIDORS, STAIRS, WASHROOMS, LUNCH ROOMS, TRAINING ROOM
2	ORDINARY GROUP 1	STORAGE ROOMS & TOOL CRIBS, MECHANICAL ROOMS, DIRTY ROOM, ELECTRICAL ROOM
3	ORDINARY GROUP 2	GRIT BLASTING BAY, RECLAIM / STORAGE AREA

FIRE LEGEND - PIPING

REFER	DESCRIPTION
	VALVE
	PUMP
M	WATER METER
	BACK FLOW VALVE
CTE	CONNECT TO EXISTING
FEX	PORTABLE FIRE EXTINGUISHER (WALL HUNG / SURFACE MOUNTED)
	FIRE DEPARTMENT CONNECTION
	STRAINER
DC	DRAIN COCK
BWV	BACK WATER VALVE
P	PRESSURE GAUGE
WSP	WET SPRINKLER PIPE
FS	FLOW SWITCH
	COMPRESSOR
	CHECK VALVE
	ALARM CHECK VALVE
	ELECTRIC CONTROL VALVE
S	ELECTRONICALLY SUPERVISED VALVE
	PIPE ELBOW DROP
	PIPE ELBOW RISE
	PIPE TEE DROP
	PIPE TEE RISE
FAA	ANNUNCIATE PANEL
SCP	SUPRESSION SYSTEM CONTROL PANEL
SGP	SUPRESSION SYSTEM GRAPHIC PANEL
A	SUPRESSION SYSTEM ABORT STATION
D	SUPRESSION SYSTEM DISCHARGE
M	SUPRESSION SYSTEM MANUAL STATION
	SIDEWALL SPRINKLER HEADS PENDANT
	SIDEWALL SPRINKLER HEADS UPRIGHT
	SPRINKLER HEADS PENDANT
	SPRINKLER HEADS UPRIGHT
TS	TEMPERATURE SENSOR
PS	PRESSURE SENSOR
FFD	FUNNEL FLOOR DRAIN

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PROJECT NUMBER

60678205

SHEET TITLE

BUILDING ISOMETRIC - FP

SHEET NUMBER

FP100

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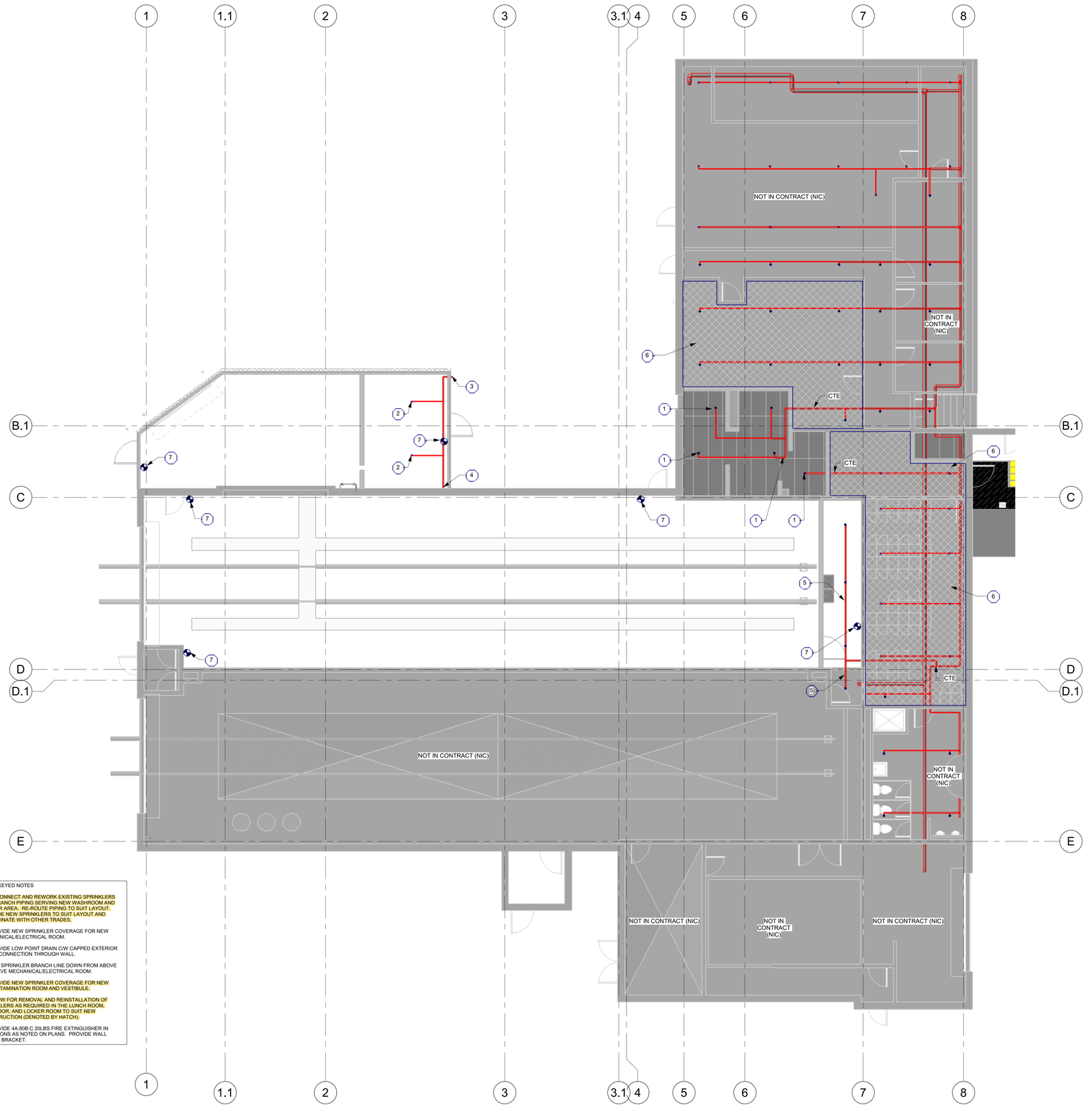

FP102 KEYED NOTES

1- DISCONNECT AND REWORK EXISTING SPRINKLERS AND BRANCH PIPING SERVING NEW WASHROOM AND LOCKER AREA. RE-ROUTE PIPING TO SUIT LAYOUT. PROVIDE NEW SPRINKLERS TO SUIT LAYOUT AND COORDINATE WITH OTHER TRADES.

2- PROVIDE NEW SPRINKLER COVERAGE FOR NEW MECHANICAL/ELECTRICAL ROOM.

3- PROVIDE LOW POINT DRAIN C/W CAPPED EXTERIOR DRAIN CONNECTION THROUGH WALL.

4- NEW SPRINKLER BRANCH LINE DOWN FROM ABOVE TO SERVE MECHANICAL/ELECTRICAL ROOM.

5- PROVIDE NEW SPRINKLER COVERAGE FOR NEW DECONTAMINATION ROOM AND VESTIBULE.

6- ALLOW FOR REMOVAL AND REINSTALLATION OF SPRINKLERS AS REQUIRED IN THE LUNCH ROOM, CORRIDOR, AND LOCKER ROOM TO SUIT NEW CONSTRUCTION (DENOTED BY HATCH).

7- PROVIDE 4A:80B:C 20LBS FIRE EXTINGUISHER IN LOCATIONS AS NOTED ON PLANS. PROVIDE WALL MOUNT BRACKET.

1
FP101

LOW LEVEL GROUND FLOOR PLAN - FP

Scale: 1 : 75

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PROJECT

GRIT BLAST UPGRADE
915/916 McINTYRE ST. E, NORTH BAY, ON

CLIENT

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SHEET TITLE

LOW LEVEL GROUND FLOOR PLAN - FP

SHEET NUMBER

FP101

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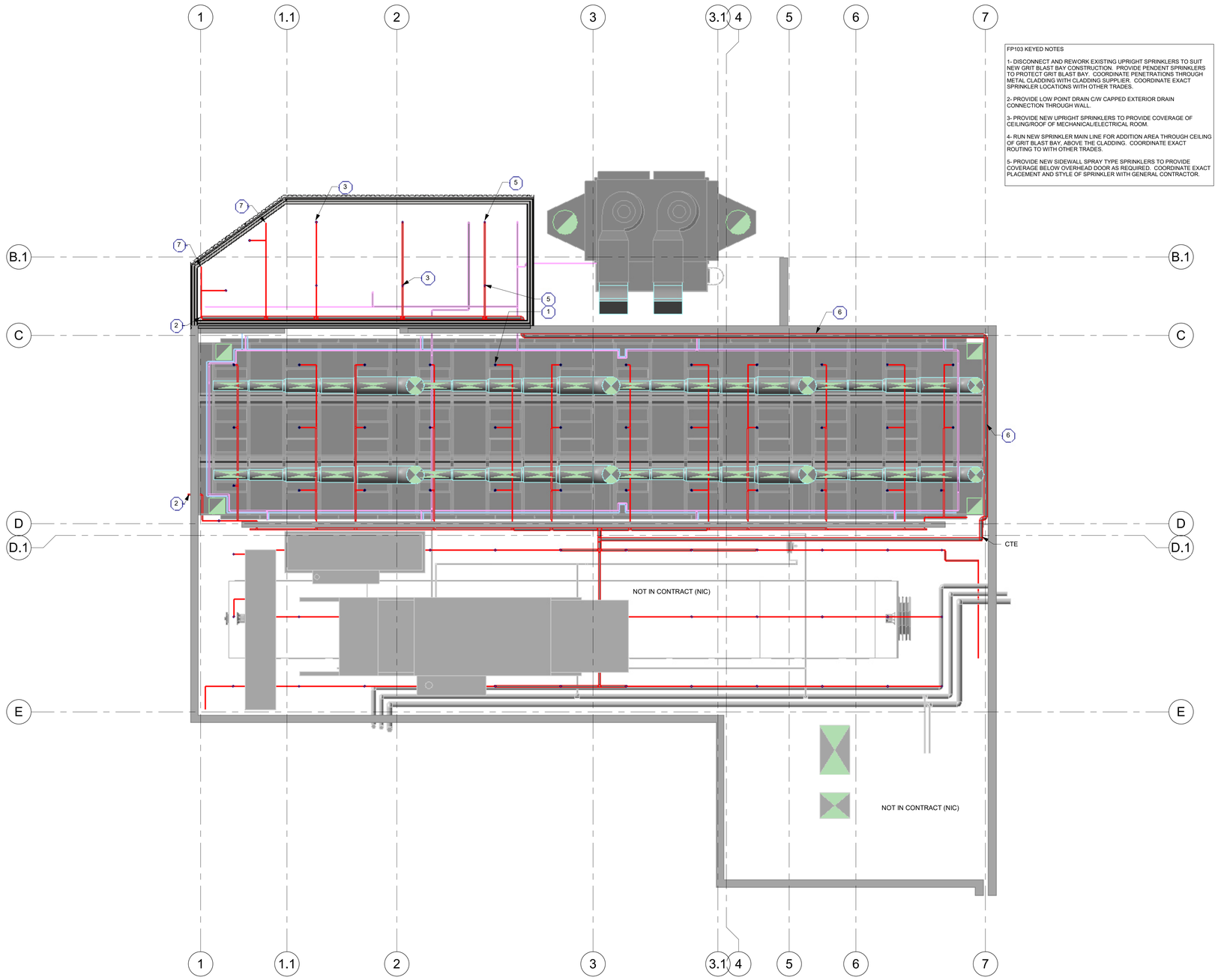

FP103 KEYED NOTES

1- DISCONNECT AND REWORK EXISTING UPRIGHT SPRINKLERS TO SUIT NEW GRIT BLAST BAY CONSTRUCTION. PROVIDE PENDENT SPRINKLERS TO PROTECT GRIT BLAST BAY. COORDINATE PENETRATIONS THROUGH METAL CLADDING WITH CLADDING SUPPLIER. COORDINATE EXACT SPRINKLER LOCATIONS WITH OTHER TRADES.

2- PROVIDE LOW POINT DRAIN C/W CAPPED EXTERIOR DRAIN CONNECTION THROUGH WALL.

3- PROVIDE NEW UPRIGHT SPRINKLERS TO PROVIDE COVERAGE OF CEILING/ROOF OF MECHANICAL/ELECTRICAL ROOM.

4- RUN NEW SPRINKLER MAIN LINE FOR ADDITION AREA THROUGH CEILING OF GRIT BLAST BAY, ABOVE THE CLADDING. COORDINATE EXACT ROUTING TO WITH OTHER TRADES.

5- PROVIDE NEW SIDEWALL SPRAY TYPE SPRINKLERS TO PROVIDE COVERAGE BELOW OVERHEAD DOOR AS REQUIRED. COORDINATE EXACT PLACEMENT AND STYLE OF SPRINKLER WITH GENERAL CONTRACTOR.

1 HIGH LEVEL GROUND FLOOR PLAN - FP

FP102 | REF: 1 / FP107

Scale: 1 : 75

AECOM

PROJECT

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SHEET TITLE

HIGH LEVEL GROUND FLOOR PLAN - FP

SHEET NUMBER

FP102

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FP102-HIGH LEVEL GROUND FLOOR PLAN - FP
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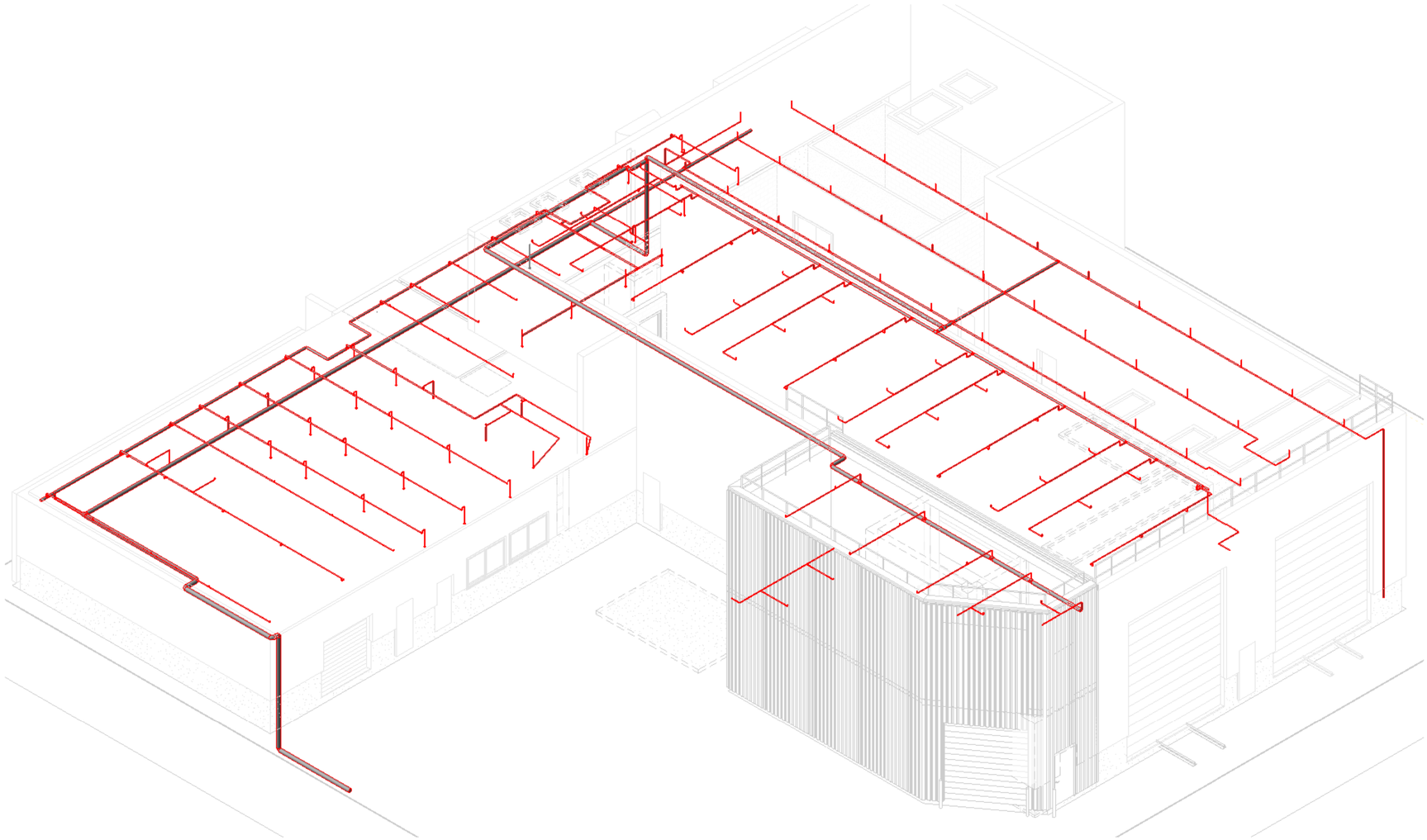

1 FP103 — **ISOMETRIC BUILDING - SPRINKLER**

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ISSUE/REVISION

No.	DESCRIPTION	DATE
5	ISSUED FOR BUDGET - VALUE ENG	
1	ISSUED FOR TENDER	2023/07/28

PROJECT NUMBER

60678205

SHEET TITLE

BUILDING ISOMETRIC - FP

SHEET NUMBER

FP103

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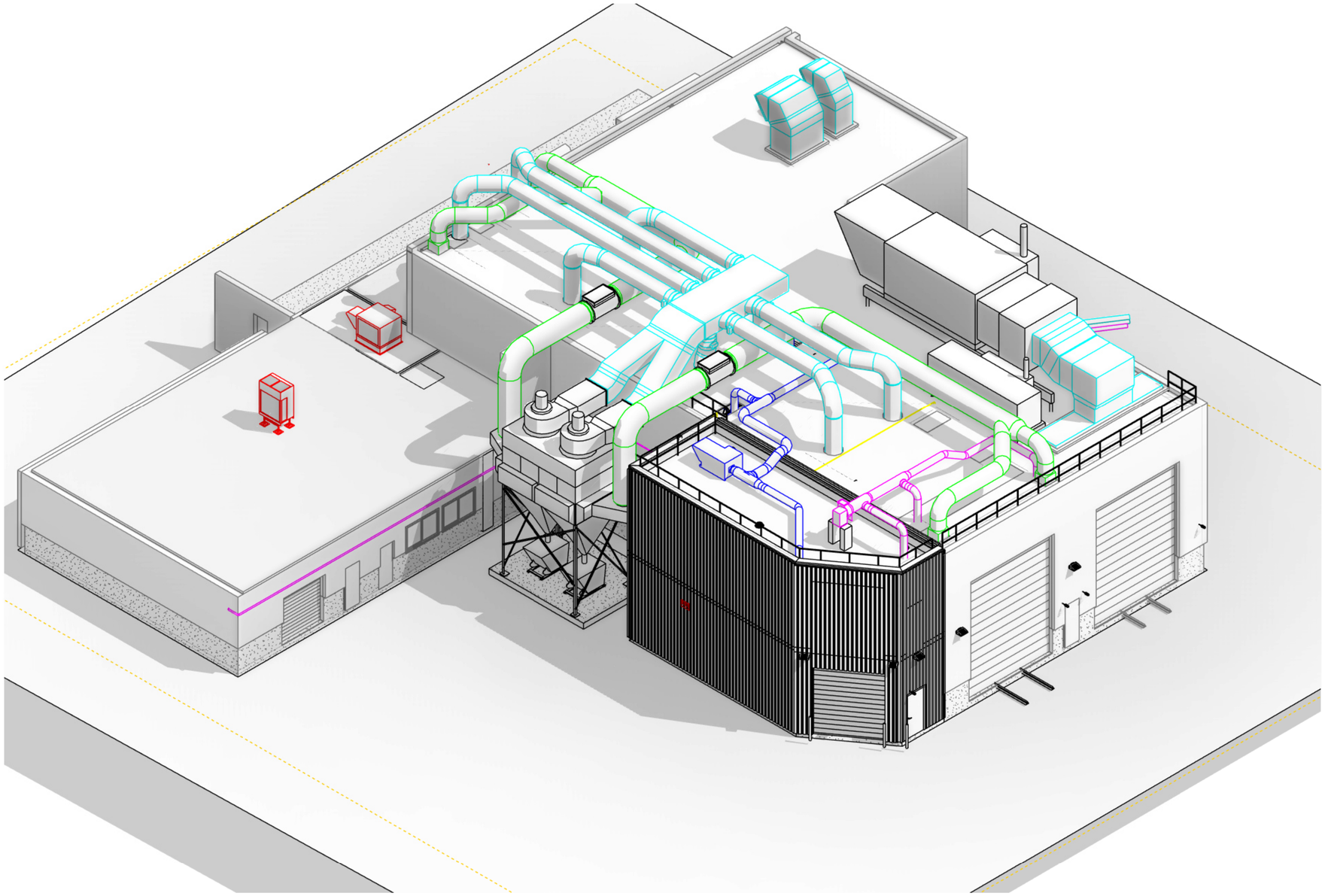
FP103-BUILDING ISOMETRIC - FP

ISO B1 707 x 1000mm
APPROVED: PDK
CHECKED: CC
DESIGNER: CFL
PROJECT MANAGEMENT INITIALS:



1 | ISOMETRIC VIEW - OVERALL BUILDING - HVAC

M100 | Scale:

HVAC DRAWING LIST

SHEET NUMBER	SHEET NAME
M100	ISOMETRIC VIEW - OVERALL BUILDING - HVAC
M101	GROUND FLOOR PLAN - HVAC
M102	HIGH LEVEL PLAN - HVAC
M103	HIGH ROOF PLAN - HVAC
M104	REFLECTED CEILING PLAN
M105	BUILDING SECTIONS - HVAC
M106	PARTIAL HVAC PLANS
M107	BUILDING SECTIONS - HVAC
M108	BUILDING SECTIONS - HVAC
M109	BUILDING ISOMETRIC - HVAC DUCTWORK
M110	MECHANICAL EQUIPMENT SCHEDULES
M111	HEATING AND CONTROL SCHEMATIC

AECOM

PROJECT

GRIT BLAST UPGRADE
915/916 McINTYRE ST. E, NORTH BAY, ON

CLIENT

REGISTERED OWNER:
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No.	DESCRIPTION	DATE
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PROJECT NUMBER

60678205

SHEET TITLE

ISOMETRIC VIEW - OVERALL BUILDING - HVAC

SHEET NUMBER

M100

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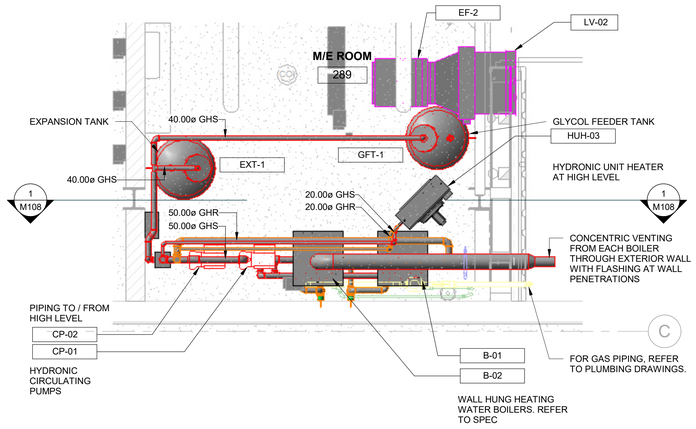
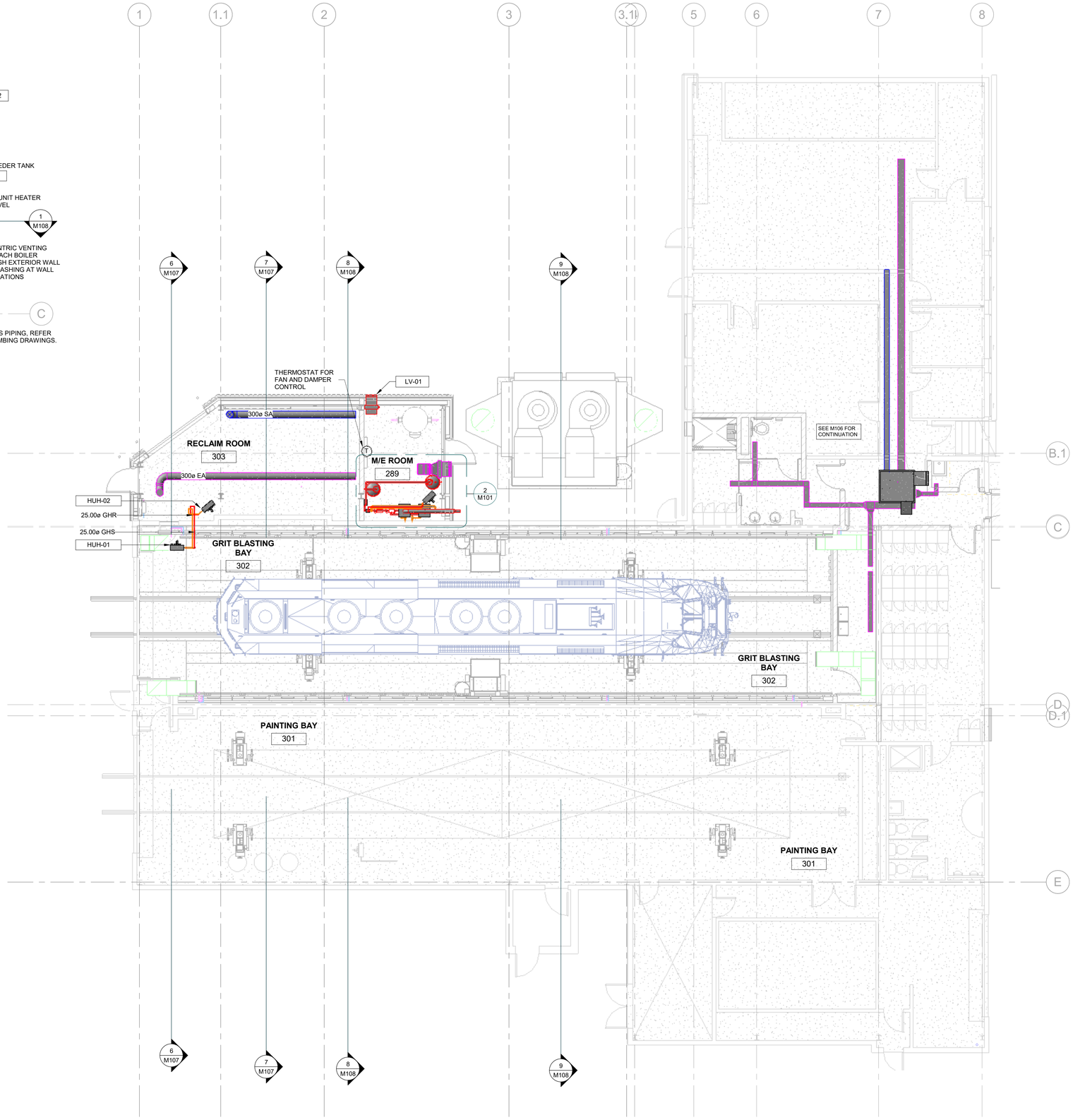
M100-ISOMETRIC VIEW - OVERALL BUILDING - HVAC



2 | **PARTIAL M/E ROOM FLOOR PLAN - HVAC**

M101 | REF: 1 / M101 — Scale: 1 : 25



1 | **GROUND FLOOR PLAN - HVAC**

M101 | REF: 1 / M105 — Scale: 1 : 75

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PROJECT NUMBER

60678205

SHEET TITLE

GROUND FLOOR PLAN - HVAC

SHEET NUMBER

M101

ISO B1 707 x 1000mm APPROVED: PDK CHECKED: CB DESIGNER: CFL PROJECT MANAGEMENT INITIALS:
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M101-GROUND FLOOR PLAN - HVAC
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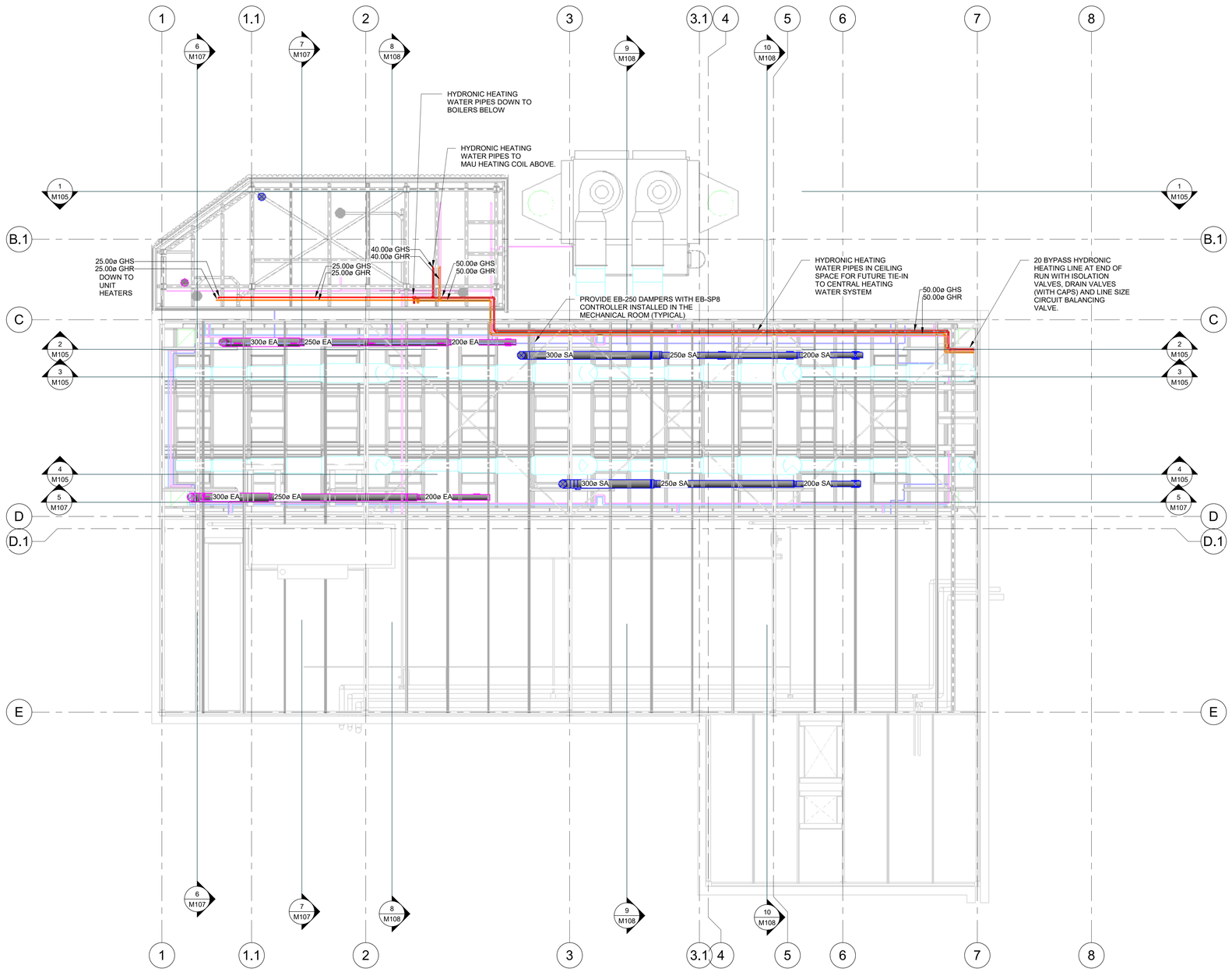

1 M102 — **HIGH LEVEL PLAN - HVAC**

Scale: 1 : 75

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M102 HIGH LEVEL PLAN - HVAC

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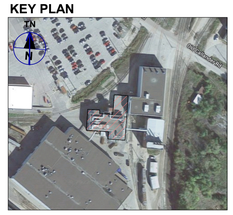
KEY PLAN



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No.	DESCRIPTION	DATE
5	ISSUED FOR BUDGET - VALUE ENG	
1	ISSUED FOR TENDER	2023/07/28

PROJECT NUMBER

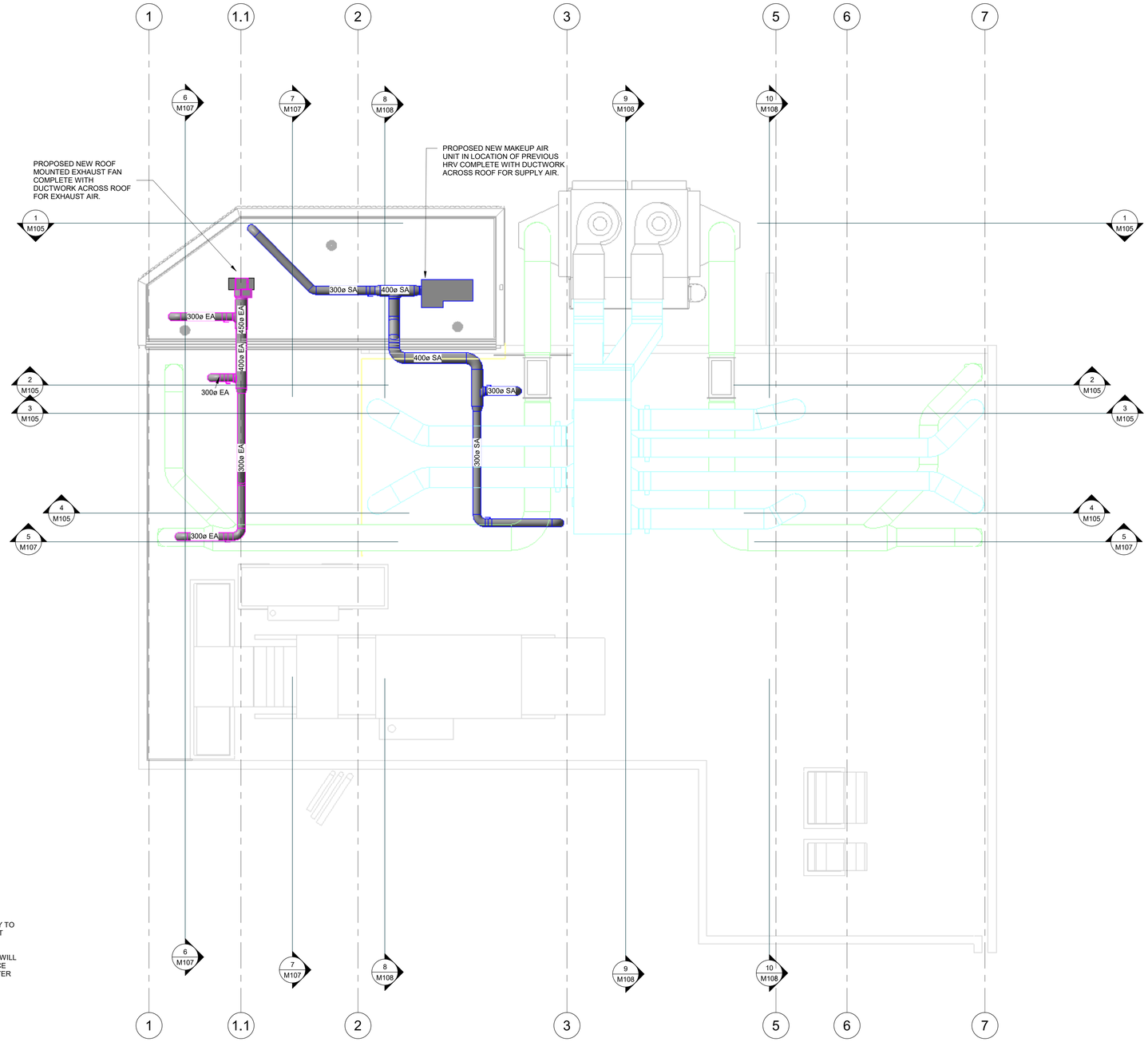
60678205

SHEET TITLE

HIGH LEVEL PLAN - HVAC

SHEET NUMBER

M102



DRY BLASTING OPERATION

DUST COLLECTOR WILL OPERATE AT 100% CAPACITY TO DELIVER CLEAN AIR IN BLAST BAY AND ERV WILL ALSO OPERATE. HEAT FROM THE DUST COLLECTOR MOTORS WILL BE USED TO HEAT THE SPACE ALONG WITH THE UNIT HEATER AT THE O/H DOOR.

1 | **HIGH ROOF LEVEL PLAN - HVAC**

M103 | REF: 1 / M105

Scale: 1 : 75

AECOM

PROJECT

GRIT BLAST UPGRADE
915/916 McINTYRE ST. E, NORTH BAY, ON

CLIENT

REGISTERED OWNER:
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No.	DESCRIPTION	DATE
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PROJECT NUMBER

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SHEET TITLE

HIGH ROOF PLAN - HVAC

SHEET NUMBER

M103

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M103-HIGH ROOF PLAN - HVAC

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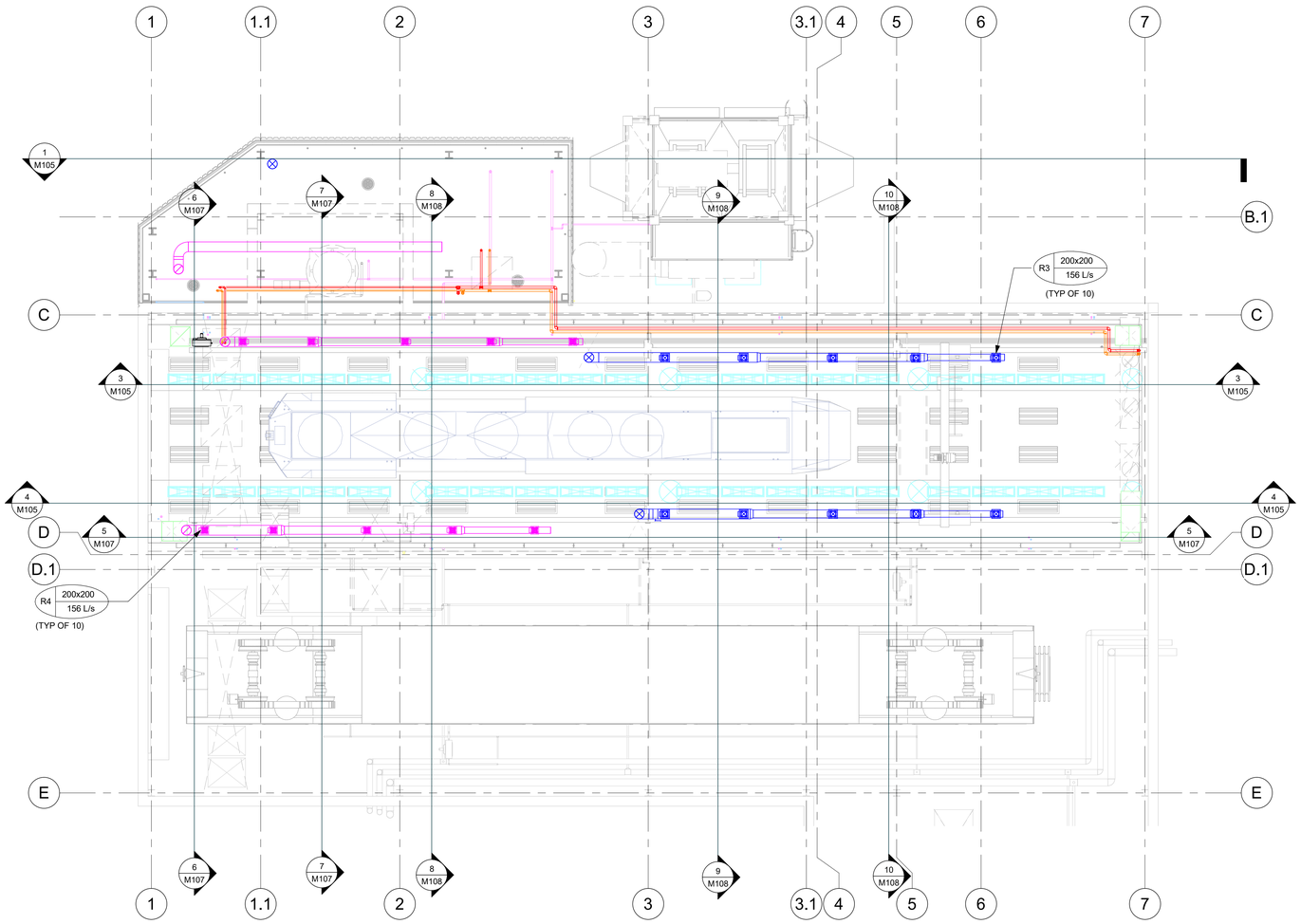

1 **REFLECTED CEILING PLAN - HVAC**

M104 | REF: 1 / M105

Scale: 1 : 75

AECOM

PROJECT

GRIT BLAST UPGRADE
915/916 McINTYRE ST. E, NORTH BAY, ON

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SHEET TITLE

REFLECTED CEILING PLAN

SHEET NUMBER

M104

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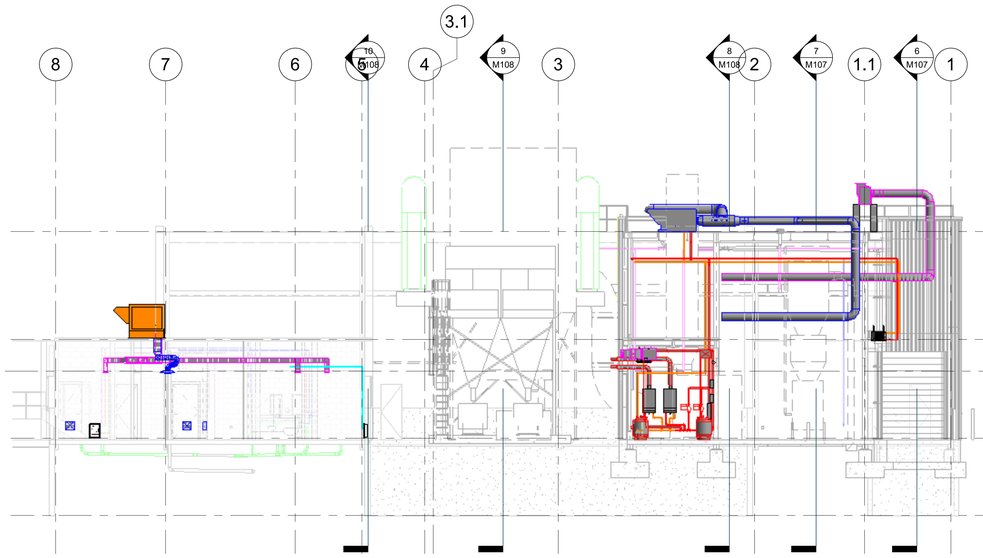

1 **BUILDING SECTION 1 - HVAC**

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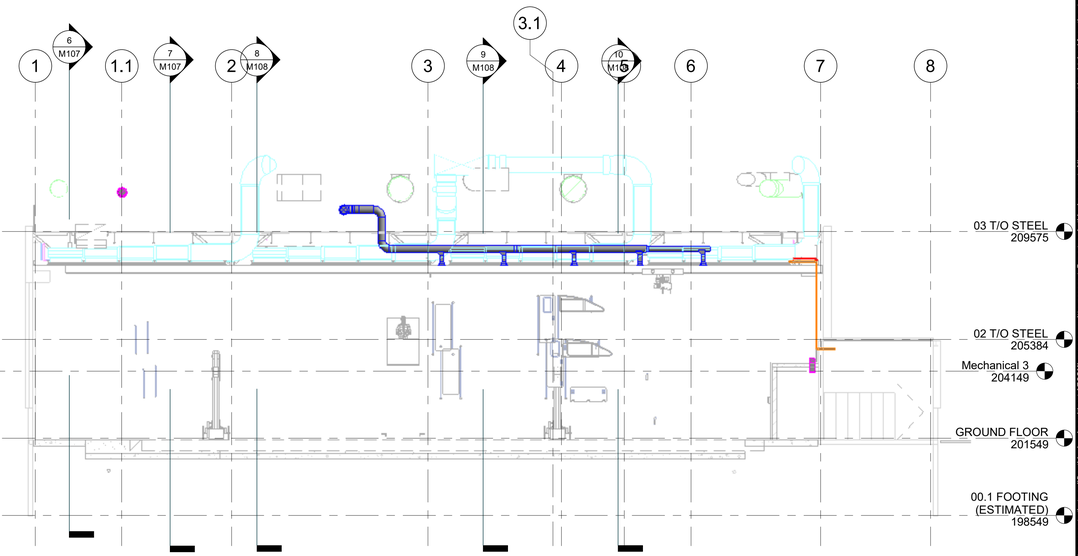
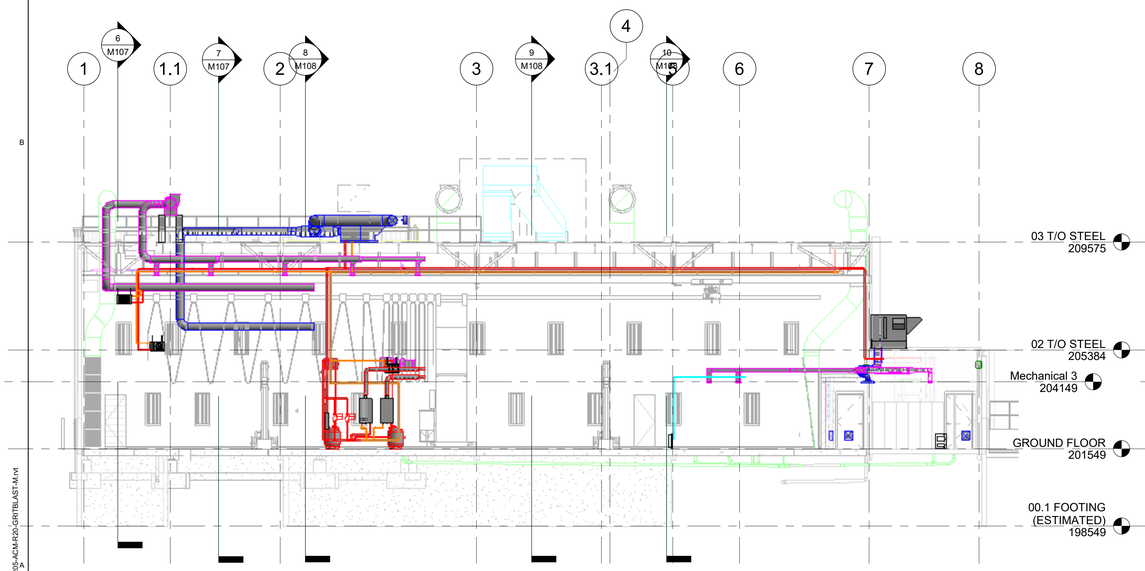


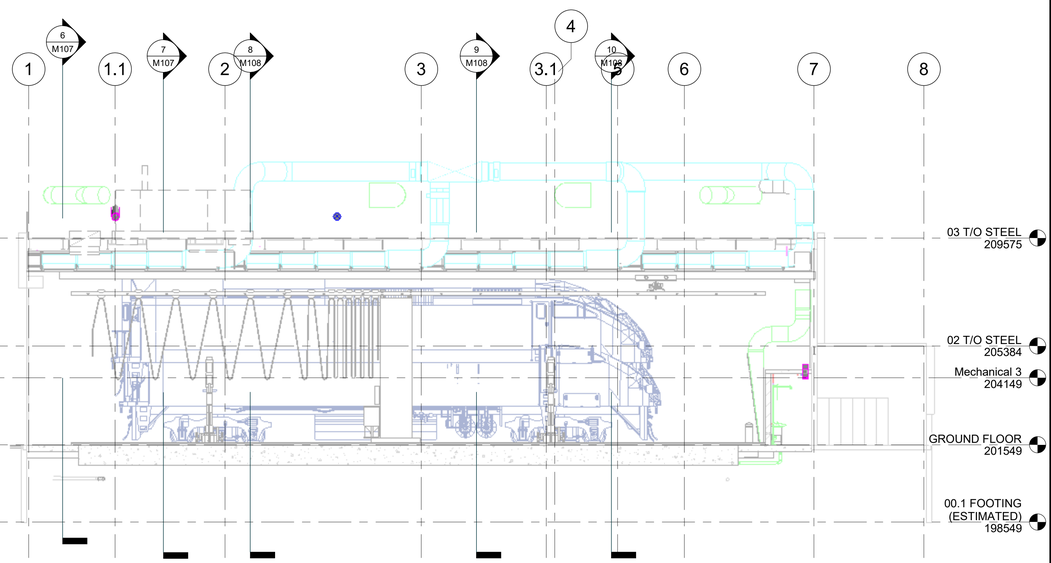
3 **BUILDING SECTION 3 - HVAC**

M105 | REF: 1 / M102 Scale: 1 : 100



2 **BUILDING SECTION 2 - HVAC**

M105 | REF: 1 / M102 Scale: 1 : 100



4 **BUILDING SECTION 4 - HVAC**

M105 | REF: 1 / M102 Scale: 1 : 100

AECOM

PROJECT

GRIT BLAST UPGRADE
915/916 McINTYRE ST. E, NORTH BAY, ON

CLIENT

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PROJECT NUMBER

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SHEET TITLE

BUILDING SECTIONS - HVAC

SHEET NUMBER

M105

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MINERALIZING SECTIONS - HVAC

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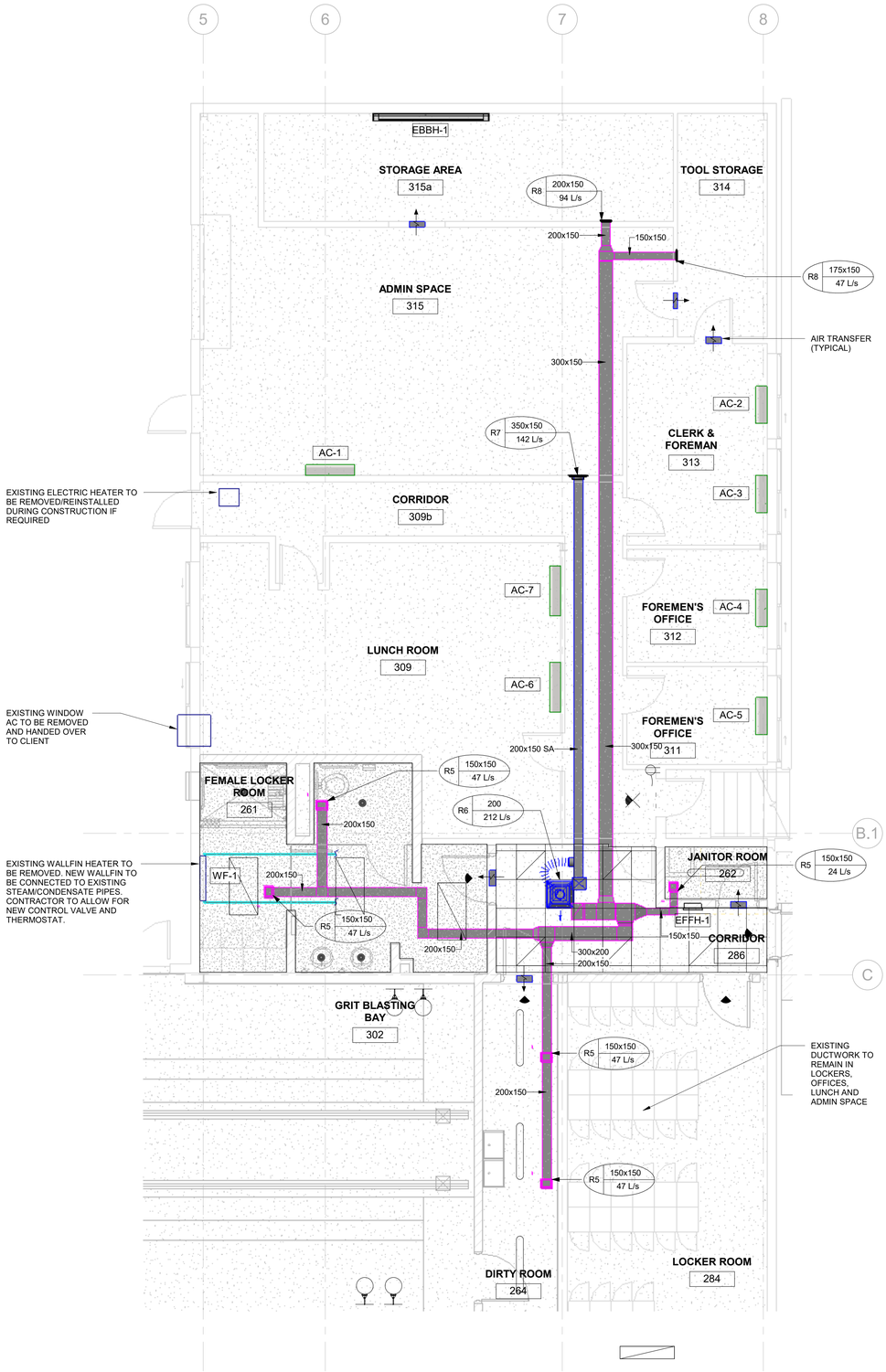
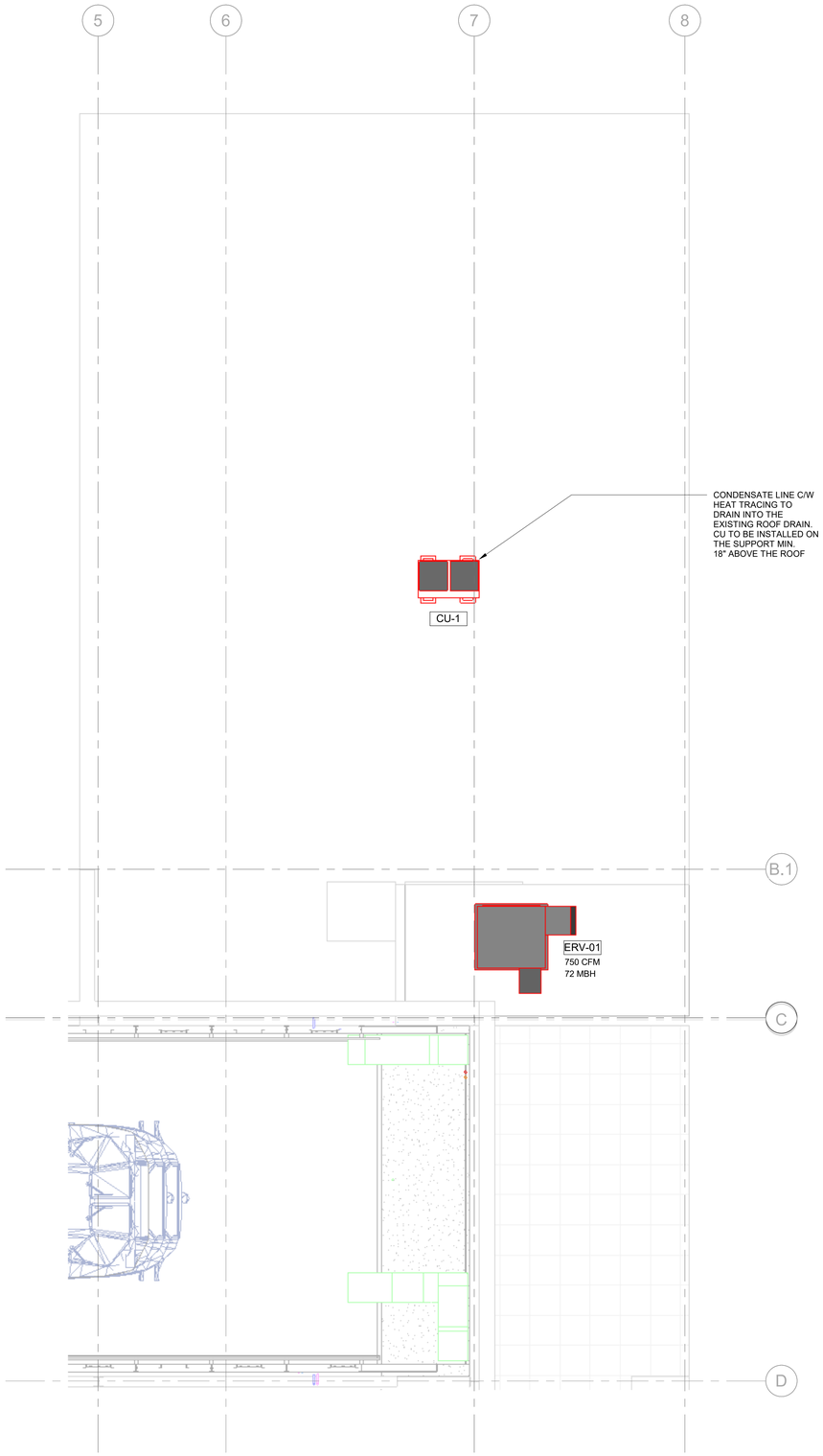


4 PARTIAL GROUND FLOOR PLAN - HVAC

M106 | REF: 1 / M105

Scale: 1 : 50



2 PARTIAL ROOF PLAN

M106 | REF: 1 / M105

Scale: 1 : 50

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PROJECT

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915/916 McINTYRE ST. E, NORTH BAY, ON

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KEY PLAN

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PROJECT NUMBER

60678205

SHEET TITLE

PARTIAL HVAC PLANS

SHEET NUMBER

M106

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M106-PARTIAL HVAC PLANS
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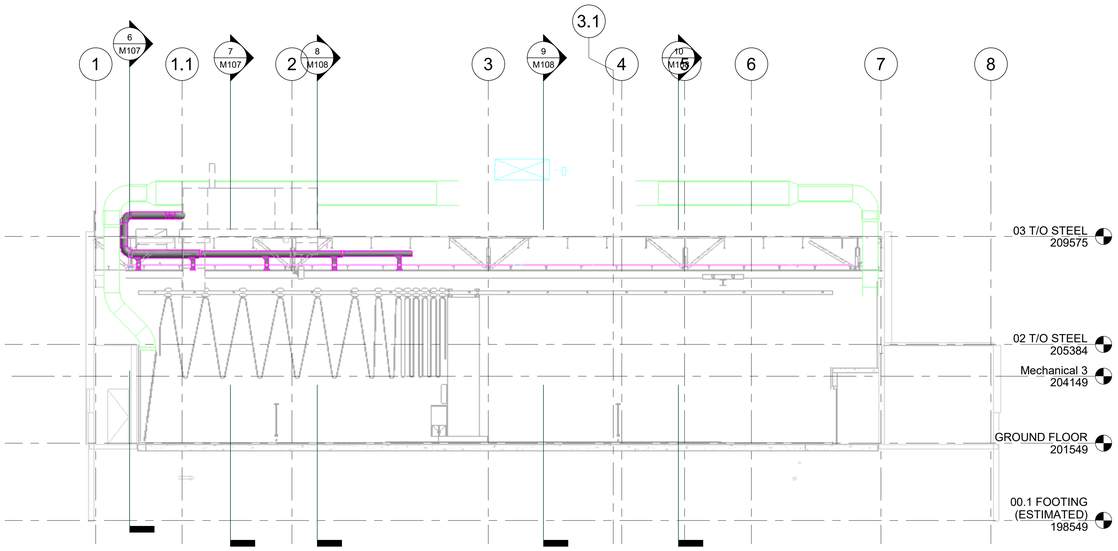
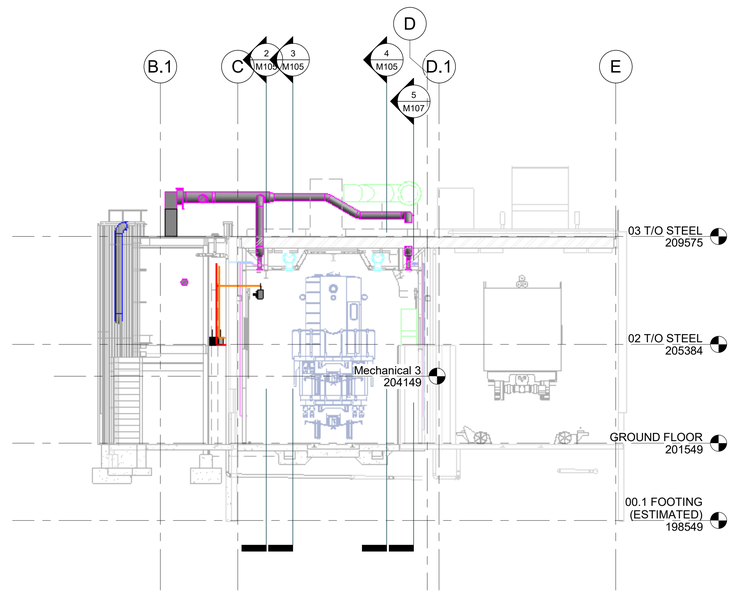
DESIGNER: CFL
PROJECT MANAGEMENT INITIALS:



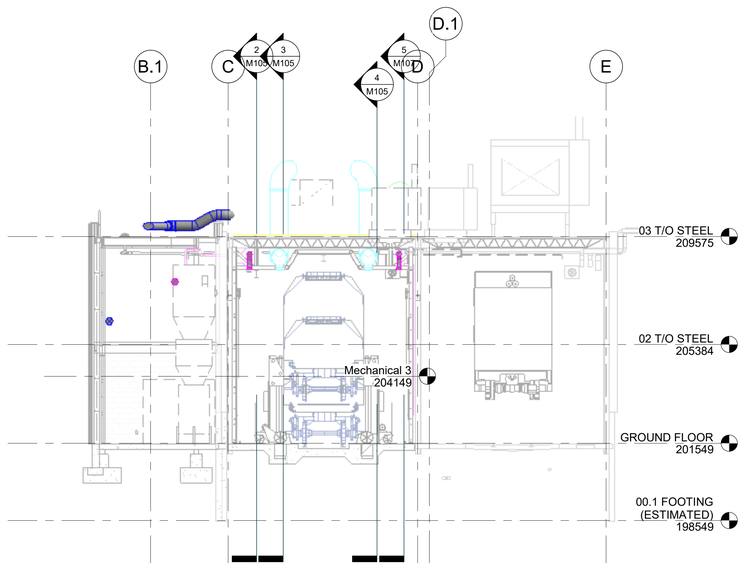
5 BUILDING SECTION 5 - HVAC

M107 | REF: 1 / M102 | Scale: 1 : 100



6 BUILDING SECTION 6 - HVAC

M107 | REF: 1 / M101 | Scale: 1 : 100



7 BUILDING SECTION 7 - HVAC

M107 | REF: 1 / M101 | Scale: 1 : 100

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PROJECT

GRIT BLAST UPGRADE
915/916 McINTYRE ST. E, NORTH BAY, ON

CLIENT

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REGISTRATION

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KEY PLAN

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ISSUE/REVISION

No.	DESCRIPTION	DATE
5	ISSUED FOR BUDGET - VALUE ENG	
1	ISSUED FOR TENDER	2023/07/28

PROJECT NUMBER

60678205

SHEET TITLE

BUILDING SECTIONS - HVAC

SHEET NUMBER

M107

MECHANICAL BUILDING SECTIONS - HVAC
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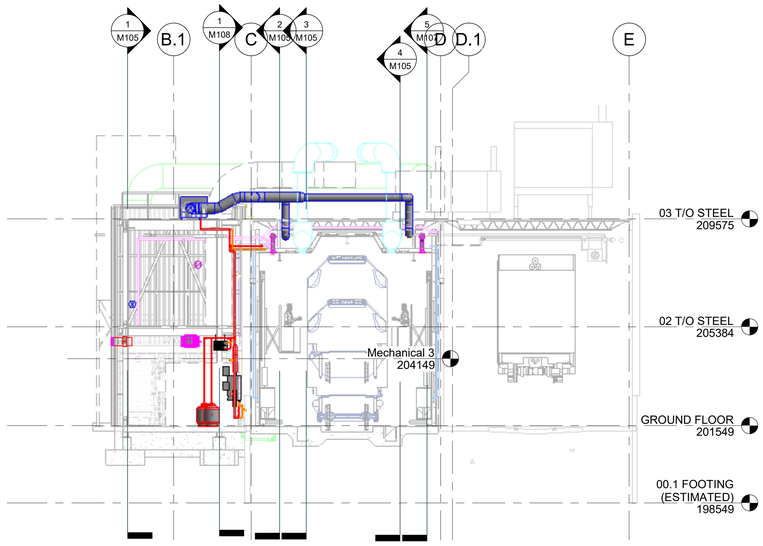
PROJECT MANAGEMENT INITIALS:



8 BUILDING SECTION 8 - HVAC

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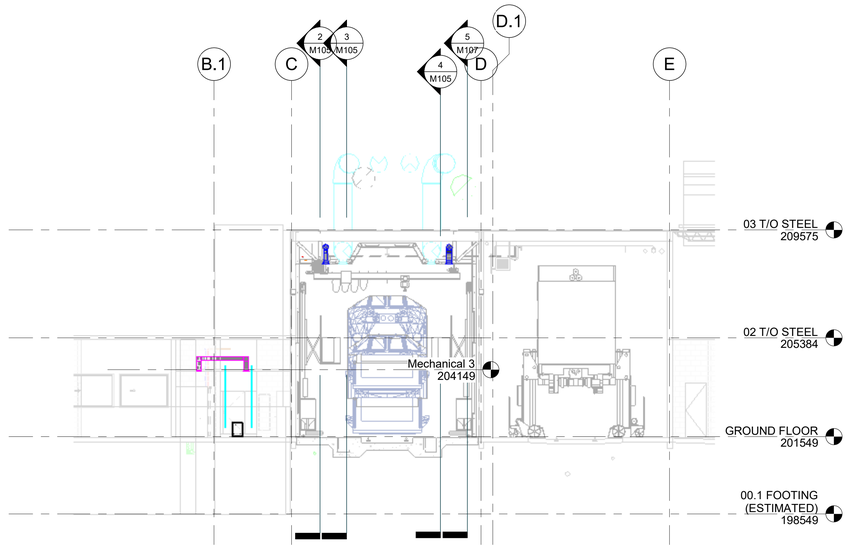

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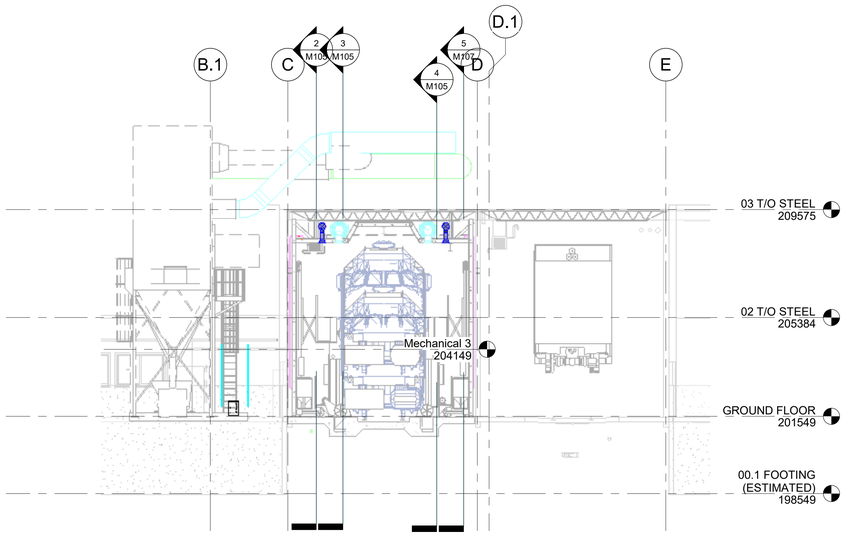

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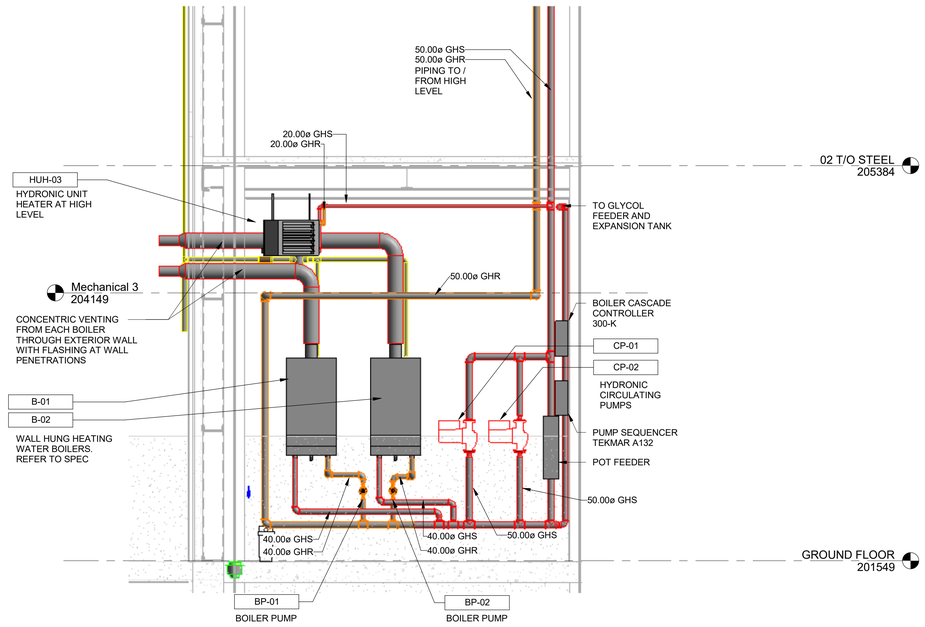
M108 | REF: 1 / M101 Scale: 1 : 100



1 BUILDING SECTION 11 - HVAC

M108 | REF: 2 / M101 Scale: 1 : 25

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PROJECT

GRIT BLAST UPGRADE
915/916 McINTYRE ST. E, NORTH BAY, ON

CLIENT

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REGISTRATION

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KEY PLAN

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ISSUE/REVISION

No.	DESCRIPTION	DATE
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PROJECT NUMBER

60678205

SHEET TITLE

BUILDING SECTIONS - HVAC

SHEET NUMBER

M108

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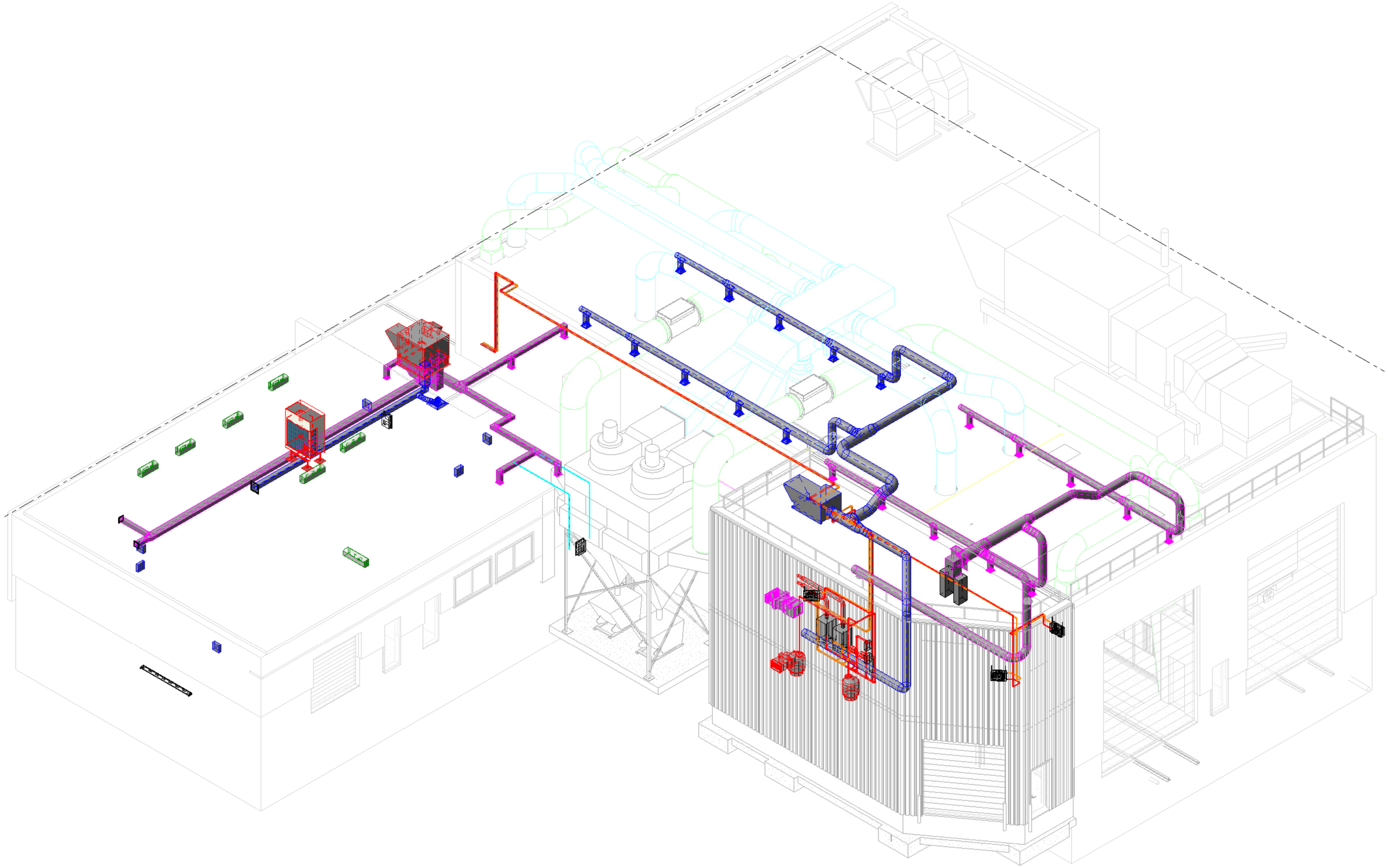

1
M109

ISOMETRIC VIEW - OVERALL BUILDING - HVAC

NTS

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1	ISSUED FOR TENDER	2023/07/28

PROJECT NUMBER

60678205

SHEET TITLE

BUILDING ISOMETRIC - HVAC DUCTWORK

SHEET NUMBER

M109

M109-BUILDING ISOMETRIC - HVAC DUCTWORK
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CHECKED: CC
DESIGNER: CFL
PROJECT MANAGEMENT INITIALS:
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MYMECHANICAL EQUIPMENT SCHEDULES
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ENERGY AND HEAT RECOVERY VENTILATOR (ERV & HRV) SCHEDULE - PART 1 OF 5

GENERAL				SUPPLY FAN SYSTEM / ARRAY												BARE FAN SOUND POWER WITH COPLANER SILENCER (dB re: 10E-12 watts)																	
																INLET										OUTLET									
TAG	MANUFACTURER	MODEL	AREA SERVED	AIRFLOW TOTAL	EXTERNAL STATIC PRESSURE	TOTAL STATIC PRESSURE	QUANTITY OF FAN / MOTORS	AIRFLOW PER FAN	FAN / MOTOR TYPE	FAN ARRANGEMENT (W X H)	FAN WHEEL SIZE	FAN MOTOR NOMINAL POWER	FAN MOTOR BRAKE POWER	FAN / MOTOR RPM	FAN / MOTOR DRIVE / CONTROL	63	125	250	500	1K	2K	4K	8K	LwA	Lw	63	125	250	500	1K	2K	4K	8K	LwA	Lw
ERV-01	COOK	ERV-1500	OFFICES & WASHROOMS	354 L/s	186.82 Pa		1	354 L/s	----	1 X 1 ARRAY		0.4 kW		1153	COMMON VFD											93	87	76	72	69	67	63	58	77	

ENERGY AND HEAT RECOVERY VENTILATOR (ERV & HRV) SCHEDULE - PART 2 OF 5

GENERAL	RETURN FAN SYSTEM / ARRAY												BARE FAN SOUND POWER WITH COPLANER SILENCER (dB re: 10E-12 watts)																					
																INLET										OUTLET									
TAG	AIRFLOW TOTAL	EXTERNAL STATIC PRESSURE	TOTAL STATIC PRESSURE	QUANTITY OF FAN / MOTORS	AIRFLOW PER FAN	FAN / MOTOR TYPE	FAN ARRANGEMENT (W X H)	FAN WHEEL SIZE	FAN MOTOR NOMINAL POWER	FAN MOTOR BRAKE POWER	FAN / MOTOR RPM	FAN / MOTOR DRIVE / CONTROL	63	125	250	500	1K	2K	4K	8K	LwA	Lw	63	125	250	500	1K	2K	4K	8K	LwA	Lw
ERV-01	354 L/s	186.82 Pa		1	354 L/s	----	1 X 1 ARRAY	-	0.4 kW		1153	COMMON VFD	94	90	79	74	70	69	65	60	79													

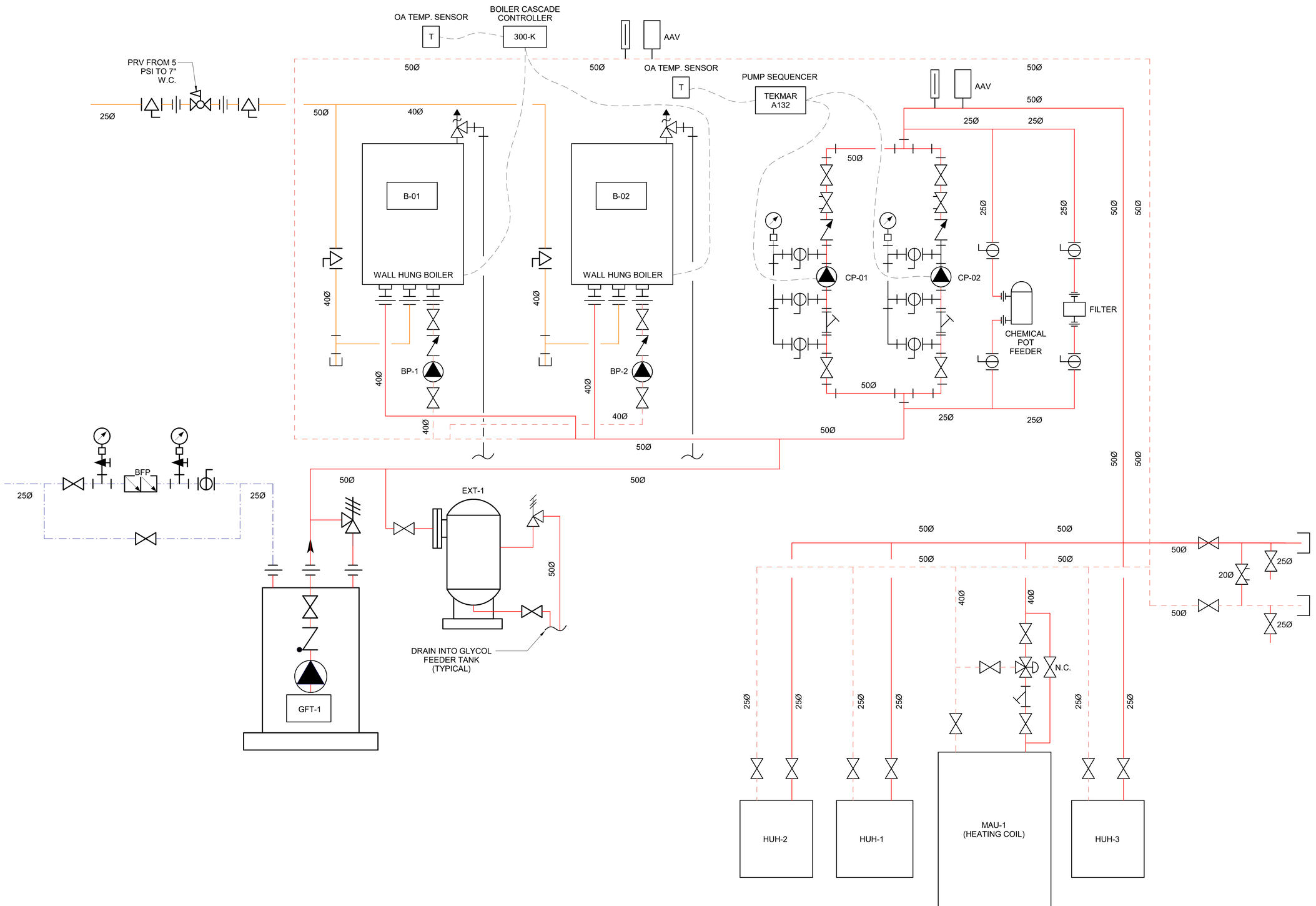
ENERGY AND HEAT RECOVERY VENTILATOR (ERV & HRV) SCHEDULE - PART 3 OF 5

	PRE-HEATING COIL																		RE-HEATING COIL															
		AIR SIDE						FLUID SIDE					GENERAL							AIR SIDE						FLUID SIDE					GENERAL					
TAG	OUTPUT	AIRFLOW PER COIL	NUMBER OF COILS	FACE VELOCITY	WIDTH (IN)	HEIGHT (IN) (PER COIL)	AIR PRESSURE DROP	MEDIUM	FLOW	EWT	LWT	MAXIMUM PRESSURE DROP	NUMBER OF ROWS	CONNECTION DIAMETER	FIN MATERIAL	FPI	TUBE DIA	TUBE MATERIAL	OUTPUT	AIRFLOW PER COIL	NUMBER OF COILS	FACE VELOCITY	WIDTH (MM)	HEIGHT (MM) (PER COIL)	MAXIMUM PRESSURE DROP	MEDIUM	FLOW	EWT	LWT	MAXIMUM PRESSURE DROP	NUMBER OF ROWS	CONNECT DIAMETER	FIN MATERIAL	FPI	TUBE DIA	TUBE MATERIAL
ERV-01	9.0 kW	354 L/s	1	0.203 m/s	305	305	0.00 Pa	ELECTRIC					0	0.00	ALUMINUM	0	0.00	COPPER	10.0 kW	354 L/s	1	0.000 m/s	406	406		ELECTRIC							ALUMINUM	14		COPPER

ENERGY AND HEAT RECOVERY VENTILATOR (ERV & HRV) SCHEDULE - PART 4 OF 5

| | | ENERGY RECOVERY SECTION | | | | | | | | | | | | | | | | | | |

ISO B1 707 x 1000mm
APPROVED: Approver
CHECKED: Checker
DESIGNER: Designer
PROJECT MANAGEMENT INITIALS:



WATER HEATING AND CONTROL SCHEMATIC

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PROJECT

GRIT BLAST UPGRADE
915/916 McINTYRE ST. E, NORTH BAY, ON

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No.	DESCRIPTION	DATE
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PROJECT NUMBER

60678205

SHEET TITLE

HEATING AND CONTROL SCHEMATIC

SHEET NUMBER

M111

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C B A
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1. STRUCTURAL GENERAL NOTES

1.1 ALL WORK SHALL BE EXECUTED IN ACCORDANCE WITH THE LATEST EDITION OF ONTARIO OCCUPATIONAL HEALTH AND SAFETY ACT AND REGULATIONS.

1.2 DIMENSIONS IN MILLIMETERS.

1.3 ALL NOTES REQUIRED HERE HAVE TO BE READ IN CONJUNCTION OF THE SPECS AND IN CASE OF CONFLICT MORE STRINGENT REQUIREMENTS PREVAIL

1.4 SAFEGUARD THE EXISTING STRUCTURES, SERVICES AND UTILITIES WHICH WILL BE AFFECTED BY THE WORK.

1.5 READ STRUCTURAL DRAWINGS IN CONJUNCTION WITH OTHER CONTRACT DOCUMENTS. REPORT ANY DISCREPANCIES TO THE CONSULTANT. FOR LOCATIONS AND DETAILS OF HANDRAILS, GRATINGS, PIPE SLEEVES, OPENINGS FOR PIPES, HVAC DUCTS, FLOOR DRAINS, SLUICE GATES, SLIDE PLATES, THIMBLES, EMBEDDED ITEMS, ELECTRICAL CABLES, CONDUITS, DUCT BANKS, TRANSFORMER PADS AND SIMILAR ITEMS, SEE ARCHITECTURAL, MECHANICAL, ELECTRICAL AND PROCESS DRAWINGS.

1.6 BEFORE PROCEEDING WITH THE WORK, CHECK AND VERIFY ALL DIMENSIONS AND ELEVATIONS SHOWN ON THE DRAWINGS. REPORT ANY DISCREPANCIES.

1.7 REFER TO TYPICAL DETAIL DRAWINGS WHICH APPLY TO ALL OF THE STRUCTURAL WORK, IF NOT SHOWN ON THE CONTRACT DRAWINGS.

1.8 ALL EMBEDDED ITEMS REQUIRED FOR ARCHITECTURAL, PROCESS, MECHANICAL, ELECTRICAL AND INSTRUMENTATION SERVICES SHALL BE INCORPORATED INTO THE STRUCTURES.

1.9 THE STRUCTURE IS DESIGNED TO RESIST DESIGN LOADS IN THE COMPLETED STAGE ONLY. DO NOT EXCEED THESE LOADS DURING CONSTRUCTION.

1.10 SELECTED BACKFILL MATERIAL SHOWN ON ALL DRAWINGS REFER TO SUITABLE NON-CONTAMINATED IMPORTED MATERIAL APPROVED BY THE GEOTECHNICAL CONSULTANTS.

1.11 FOR LIQUID RETAINING STRUCTURE, DO NOT BACKFILL AGAINST STRUCTURE UNTIL WATERTIGHTNESS TEST IS COMPLETE. WATERTIGHTNESS TEST SHALL BE PERFORMED BY THE CONTRACTOR IN ACCORDANCE WITH SPECIFICATION FOR TIGHTNESS TESTING OF ENVIRONMENTAL ENGINEERING CONCRETE STRUCTURES (ACI 350.1-10) AND COMMENTARY, SECTION 2, TYPE OF CONTAINMENT STRUCTURE-OTHER TYPES.

1.12 ANY DAMAGE TO THE EXISTING STRUCTURES AND ADJACENT PROPERTIES SHALL BE MADE GOOD BY THE CONTRACTOR AT HIS OWN COST TO THE SATISFACTION OF THE CONSULTANT.

1.13 REPORT IN WRITING TO THE CONSULTANT PRIOR TO COMMENCING WORK ANY CONDITIONS OR DEFECTS ENCOUNTERED ON SITE WHICH MAY ADVERSELY AFFECT THE PERFORMANCE OF THE WORK.

1.14 ALL PIPE SUPPORTS TO BE DESIGNED BY GENERAL CONTRACTOR AS PER SPEC. DIV. 15 UNLESS OTHERWISE SHOW ON STRUCTURAL DRAWINGS

1.15 THE STRUCTURAL DRAWINGS SHALL BE IN CONJUNCTION WITH ARCHITECTURAL, MECHANICAL AND ELECTRICAL DRAWINGS.

1.16 ALL DESIGN CONSTRUCTION, MATERIALS AND WORKMANSHIP SHALL BE IN ACCORDANCE WITH THE ONTARIO BUILDING CODE 2012, NATIONAL BUILDING CODE 2015 AND STRUCTURAL COMMENTARIES (PART 4). ABIDE BY LOCAL; MUNICIPAL BY-LAWS AND OTHER REGULATORY AGENCIES THAT MAY AFFECT THE WORK.

1.17 ALL DIMENSIONS, ELEVATIONS, OPENINGS FOR PIPES, SLEEVES, EQUIPMENT LOCATIONS AND THE LIKE SHALL BE CHECKED WITH THE ARCHITECTURAL, MECHANICAL AND ELECTRICAL DRAWING. REPORT ANY DISCREPANCIES TO DCC BEFORE PROCEEDING WITH THE WORK. DO NOT SCALE THESE DRAWINGS.

1.18 THE CONTRACTOR SHALL REVIEW THE SITE CONDITIONS AND ASSUME RESPONSIBILITY FOR EXISTING SERVICES (WATER; POWER; SEWAGE; GAS ETC.) THAT POTENTIALLY EXIST AT THE SITE.

1.19 PROVIDE ALL NECESSARY SHORING, SCAFFOLDING AND UNDERPINNING TO EXECUTE THE PROJECT SAFELY, WETHER OR NOT INDICATED ON DESIGN DRAWINGS.

2. REFERENCE DESIGN CODES

2.1 THE STRUCTURAL DESIGN IS BASED ON THE FOLLOWING CODES (AND ASSOCIATED REFERENCED CODES) :

-ONTARIO BUILDING CODE, 2012

-ACI 350M-06, CODE REQUIREMENTS FOR ENVIRONMENTAL ENGINEERING CONCRETE STRUCTURES AND COMMENTARY.

-CSA STANDARD A23.1-09, CONCRETE MATERIALS AND METHODS OF CONCRETE CONSTRUCTION.

-CSA STANDARD A23.2 -09, METHODS OF TEST FOR CONCRETE

-CSA STANDARD A23.3-04, DESIGN OF CONCRETE STRUCTURES

-CSA STANDARD A23.4-04, PRECAST CONCRETE - MATERIALS AND CONSTRUCTION

-CSA STANDARD S16.1-09, DESIGN OF STEEL STRUCTURES

-CSA STANDARD S157.1-05 (R2010) STRENGTH DESIGN IN ALUMINUM

-CSA STANDARD S304.1-04, DESIGN OF MASONRY STRUCTURES

2.2 ALL LIQUID CONVEYANCE AND RETAINING STRUCTURES ARE DESIGNED TO COMPLY WITH THE REQUIREMENTS OF ACI 350(M)-06.

3. DESIGN LOADS

3.1 DESIGN LOADS AS PER ONTARIO BUILDING CODE 2012.

3.2 IMPORTANCE CATEGORY: NORMAL

3.3 REFERENCE LOCATION - CITY OF NORTH BAY

3.4 SEISMIC DATA:
$S_a(0.2)$= 0.25
$S_a(0.5)$= 0.15
$S_a(1.0)$= 0.079
$S_a(2.0)$= 0.027
PGA= 0.110

LIVE LOAD (WIND):
q50 = 0.34 kPa, Iw (ULS) = 1.0, Iw (SLS) = 0.75
TERRAIN TYPE = OPEN
INTERNAL PRESSURE CATEGORY = 3

ASSUMED SEISMIC SITE RESPONSE = SITE CLASS "A", TO BE CONFIRMED BY A GEOTECHNICAL ENGINEER PRIOR TO CONSTRUCTION

3.5 EXISTING DESIGN LOADS:
a. ROOF DESIGN LOADS
i. DEAD LOAD = 27 PSF (1.29 KPa)
ii. SNOW LOAD = 43 PSF (2.06 KPa) - PART 4, OBC 2012
b. GROUND FLOOR IS DESIGNED FOR LIVE LOAD OF 12 KPa

3.6 LOADS SHOWN ON STRUCTURAL DRAWINGS ARE UNFACRTORED (UNO).

3.7 NEW BUILDING:
SELF WEIGHT (SWT) = 0.15 kN/m² (METAL DECK) + 0.6 kN/m² (BEAMS AND JOISTS) = 0.75 kN/m²
SUPERIMPOSED DEAD LOAD = 0.5 kN/m² (ROOFING) + 0.25 kN/m² (CEILING) + 0.25 kN/m² (M&E) = 1.0 kN/m²
LIVE LOAD = 2.16 kN/m² MINIMUM + SNOW PILING AREAS NOTED ON A PLAN

4. FOUNDATIONS

4.1 REFER TO THE GEOTECHNICAL REPORTS PREPARED BY K.H KING ASSOCIATES LTD, REF No. 306_S.12 FOR THE DETAILS OF SHORING, EXCAVATION AND CONSTRUCTION DEWATERING. THE SUBGRADES OF THE FOUNDATIONS SHALL BE ASSESSED BY GEOTECHNICAL ENGINEER TO CONFIRM THE ADEQUACY OF THE BEARING STRATA. ANY NONCONFORMANCE SHALL BE REPORTED TO THE STRUCTURAL ENGINEER FOR REMEDIAL ACTION. ASSUMED BEARING CAPACITY ULS = 300kPa SLS = 200 kPa, TO BE CONFIRMED BY A GEOTECHNICAL AT EACH FOOTING LOCATION PRIOR TO CONSTRUCTION.

4.2 FOUND FOOTINGS WHICH ARE EXPOSED TO FREEZING WEATHER, A MINIMUM OF 1500mm BELOW FINISHED GRADE UNLESS SPECIFIED OTHERWISE.

4.3 REFER TO CIVIL DRAWINGS FOR DETAILS OF CONCRETE SIDEWALKS OR WALKWAYS.

4.4 BACKFILL FOUNDATION WALLS EQUALLY ON BOTH SIDES IN LEVELS NOT EXCEEDING 600mm.

4.5 ALL GRANULAR BACKFILL (ENGINEERED FILL) SHALL COMPLY WITH THE REQUIREMENTS OF THE SOIL REPORT.

4.6 ALL BEARING SURFACES TO BE APPROVED BY GEOTECHNICAL ENGINEER PRIOR TO POURING CONCRETE.

4.7 PROTECT ALL FOOTINGS, WALLS, SLABS ON GRADE AND ADJACENT SOIL AGAINST FROST ACTION AND FREEZING AT ALL TIMES DURING CONSTRUCTION.

4.8 PROVIDE SLAB ON GRADE THICKENING UNDER ALL NON-LOAD BEARING MASONRY WALLS UNLESS NOTED. PROVIDE INDIVIDUAL WALL FOOTINGS UNDER ALL OTHER WALLS UNLESS NOTED. REFER TO TYPICAL DETAILS OR FOUNDATIONS.

4.9 PROVIDE SLAB ON GRADE THICKENING TO SUIT ANY ANCHORS OR INSERTS AS REQUIRED, UNLESS NOTED.

4.10 REFER TO ARCHITECTURAL, ELECTRICAL AND MECHANICAL DRAWINGS FOR DIMENSIONS, ELEVATIONS, DETAILS AND LOCATIONS OF SLAB DEPRESSIONS, SLOPES, TRENCHES, ETC.

4.11 PROVIDE 50mm [2"] THICK CONCRETE SLAB (MUD SLAB) UNDER FOOTINGS WHEN SOIL AND WEATHER CONDITIONS CREATE MUDDY SURFACE ON SITE.

4.12 PROVIDE 20mm [3/4"] CHAMFER AT EXPOSED CORNERS.

4.13 PROVIDE TEMPORARY SHORING, ETC. ADEQUATE TO SUPPORT EXISTING STRUCTURE DURING CONSTRUCTION. PROVIDE SHOP DRAWINGS, STAMPED AND SIGNED BY A PROFESSIONAL ENGINEER OR CONSULTANT, FOR REVIEW.

5. CONCRETE

5.1 THE CONCRETE MIX DESIGNS SHALL BE IN ACCORDANCE WITH THE CONTRACT SPECIFICATIONS.

5.2 PROVIDE 20mm CHAMFER STRIPS ON EXTERNAL CORNERS OF BEAMS, JOISTS AND COLUMNS.

5.3 REINFORCING STEEL - CONFORM TO CSA STANDARD G30.18-M92 (R2002) GRADE 400R DEFORMED BARS.

5.4 ALL REINFORCING BARS SHALL BE SUPPORTED IN THE FORMS AND SPACED WITH STANDARD ACCESSORIES SO THAT THERE IS NO MOVEMENT DURING CONCRETE PLACEMENT.

LOCATION	CONCRETE COVER	DESIGN STRENGTH AT 28 DAYS	EXPOSURE CLASS
EXTERIOR WALLS & PIERS	60mm	35 MPa	C-1
FOOTINGS	SURFACE CAST AGAINST GROUND = 75mm OTHERWISE = 50mm	35 MPa	C-1
SLAB ON GRADE	SURFACE CAST AGAINST GROUND = 75mm OTHERWISE = 50mm	35 MPa	C-1
EXTERIOR CONCRETE PADS EXTERIOR SLAB ON GRADE	75mm	35 MPa	C-1

5.6 ALL REINFORCING STEEL IN PLACE TO BE INSPECTED BY ENGINEER BEFORE POURING THE CONCRETE.

5.7 NOT MORE THAN 50% OF REBAR TO BE SPLICED AT ANY ONE LOCATION EXCEPT AS SHOWN ON DRAWINGS.

5.8 CONTINUOUS FLEXIBLE PVC WATER STOP MANUFACTURED BY GREENSTREAK STYLE NUMBER 705 SHALL BE PROVIDED (UNO) AT ALL CONSTRUCTION / EXPANSION JOINTS BELOW GRADE OR WHERE LIQUID TIGHTNESS IS REQUIRED.

5.9 FORMWORK AND FORM TIES SHALL COMPLY WITH THE REQUIREMENTS OF ACI 350-06 AND PROJECT SPECIFICATIONS.

6. ALUMINUM

6.1 ALUMINUM DESIGN IS IN ACCORDANCE WITH CSA S157-05/S157.1. GENERAL CONTRACTOR SHALL BE RESPONSIBLE FOR DESIGN, SUPPLY, AND INSTALLATION OF ALL ALUMINUM COMPONENTS.

6.2 ALUMINUM GRATING SHALL BE BOLTED TO THE STRUCTURAL MEMBERS OF THE PLATFORM.

6.3 ALUMINUM GRATING SHALL BE THE PRESSURE LOCKED TYPE 6063-T6 PER ASTM B-221-08, WITH CROSS BARS DEFORMED OR SWAGED TO PREVENT TURNING. GRATING TO BE MANUFACTURED BY FISHER AND LUDLOW OR APPROVED EQUAL. EDGES OF GRATING SHALL BE BANDED. FABRICATOR SHALL PROVIDE NOT LESS THAN FOUR (4) S.S. SADDLE CLIPS FOR EACH GRATING PANEL DESIGNED TO FIT OVER TWO (2) BEARING BARS. FABRICATOR SHALL PROVIDE S.S. BOLTS, NUT & WASHER FOR EACH CLIP REQUIRED. GRATING MATERIAL, LOAD DESIGN & INSTALLATION SHALL CONFORM TO THE SPECIFICATION.

6.4 ALL HAND RAILING SHALL BE WITH WELDED, SEAMLESS, EXTRUDED PIPE AND SHALL BE A WELDED WELDS SHALL BE CIRCUMFERENTIAL WELDS GROUND SMOOTH & EVEN. GUARDRAILS AND POSTS SHALL BE ALUMINUM ALLOY 6061-T6, FABRICATOR TO PROVIDE A COAT OF BITUMINOUS PAINT OR ISOLATION WASHERS TO BANK OF POST MOUNTING PLATE IN CONTACT WITH GALVANIZED STRUCTURAL FRAME. GUARDRAIL SYSTEM SHALL BE DESIGNED IN ACCORDANCE WITH THE SPECIFICATION.

6.5 PROVIDE SHOP DRAWINGS FOR PLATFORM & ALL COMPONENTS CERTIFIED BY A PROFESSIONAL ENGINEER REGISTERED IN ONTARIO FOR REVIEW AND APPROVAL.

6.6 UNDER NO CIRCUMSTANCES SHALL ALUMINUM CONTACT DISSIMILAR METAL, BETWEEN ALUMINUM GRATING, ALUMINUM STAIR TREADS, OR ALUMINUM HANDRAIL BRACKETS AND STEEL SUPPORTS, INSERT 6mm THICK NEOPRENE ISOLATOR PADS, 85 ± 5 SHORE A DUROMETER, SIZED FOR FULL WIDTH AND LENGTH OF BRACKET OR SUPPORT.

6.7 ALUMINUM SURFACES TO BE PLACED NEXT TO OR EMBEDDED IN CONCRETE OR MASONRY SHALL BE GIVEN A HEAVY COATING OF ALKALI-RESISTANT BITUMINOUS PAINT, OR ISOLATED WITH A SUITABLE PLASTIC TAPE OR OTHER ISOLATION MATERIAL.

6.8 PROVIDE 2 COATS OF BITUMINOUS PAINT WHERE ALUMINUM IS IN CONTRACT WITH CONCRETE/.STEEL.

7. STRUCTURAL STEEL

7.1 DESIGN, FABRICATION AND ERECTION OF STRUCTURAL STEEL IN ACCORDANCE WITH CSA STANDARD - CAN/CSA-S16.

7.2 MATERIAL: ROLLED SECTIONS TO CSA G40.21, GRADE 350W. HSS TO CSA G40.21-M, GRADE 350W CLASS H, PLATES AND ANGLES TO CSA G40.21 GRADE 300W.

7.3 ANCHOR BOLTS ASTM F1554 GRADE 36.

7.4 CONFORM TO LATEST EDITION OF CSA W59 FOR WELDING.

7.5 ATTACHMENTS TO STRUCTURAL STEEL AND TRUSSES, FOR MECHANICAL, ELECTRICAL AND OTHER SERVICES SHALL BE MADE BY APPROVED CLAMPING DEVICES OR U-BOLT TYPE CONNECTORS. NO CUTTING, DRILLING OR WELDING OF STEEL MEMBERS WILL BE PERMITTED UNLESS APPROVED IN WRITING BY THE ENGINEER.

7.6 DESIGN, DETAILING AND FABRICATION OF ALL CONNECTIONS SHALL CONFORM TO CSA STANDARD CAN/CSA/S16.

ALL FORCES AND MOMENTS SHOWN ON THE DESIGN DRAWINGS ARE FACTORED VALUES.

ALL CONNECTION FORCES ARE REVERSIBLE AND ACT CONCURRENTLY. IF CONNECTIONS DETAILS OR FORCES ARE NOT SHOWN ON THE DESIGN DRAWINGS,

- WHERE NO DETAILS ARE PROVIDED, BEAM CONNECTIONS TO BE DESIGNED FOR ULTIMATE SHEAR RESISTANCE OR FOR BEAM SHEAR SHOWN ON DRAWING.
- VERTICAL BRACING CONNECTIONS SHALL BE DESIGNED FOR THE MINIMUM OF 50% CAPACITY OF THE NET SECTION IN TENSION OR 100% OF THE COMPRESSION CAPACITY OF THE COMPRESSION BRACING, WHICH EVER GOVERNS THE MEMBER SELECTION.

7.7 ALL FIELD BOLTED CONNECTIONS WILL BE BEARING TYPE U.N.O. USING ASTM F3125 GRADE A325M BOLTS. M20 MINIMUM DIAMETER (U.N.O.) C/W NUT AND ONE (1) HARDENED WASHER, MINIMUM TWO (2) BOLTS PER CONNECTION. GALVANIZED BOLTS, NUTS AND WASHERS SHALL BE USED FOR ALL CONNECTIONS.

7.8 MINIMUM CONNECTION MATERIAL THICKNESS 10mm (UNO)

7.9 MINIMUM SHOP WELD IS 6mm CONTINUOUS FILLET UNLESS NOTED.

7.10 FIELD WELDS REQUIRE APPROVAL FROM ENGINEER UNLESS NOTED ON THE DRAWINGS, AND REQUIRE TESTING AT THE EXPENSE OF CONTRACTOR.

7.11 BURNING OF HOLES IN THE FIELD FOR BOLTED CONNECTIONS WILL NOT BE PERMITTED.

7.12 EXTERIOR EXPOSED STEEL SHALL BE HOT-DIP GALVANIZED. (UNO)

7.13 GROUT UNDER BASE PLATES TO BE NON-METALLIC TYPE (SIKA TYPE 211 OR STERNSON TYPE M-BED). AFTER GROUT HAS CURED, THE ANCHOR BOLTS ARE TO BE BACKED OFF AND RETIGHTENED IN ORDER TO OBTAIN A PRE-TENSION. NOMINAL GROUT THICKNESS = 20mm

7.14 PROVIDE TEMPORARY SUPPORTS REQUIRED FOR THE ERECTION OF STEEL FRAMING AND PARTLY ASSEMBLED STEEL FRAMING TO RESIST ERECTION, WIND AND SEISMIC LOADS.

7.15 THE GENERAL CONTRACTOR SHALL BE RESPONSIBLE TO DESIGN, SUPPLY AND INSTALL SUPPORTS FOR PIPE, DUCTS, AND CABLE TRAY, WHERE SUPPORTS ARE NOT SHOWN ON THE DRAWINGS. DRAWINGS AND CALCULATIONS SHALL BE SEALED BY A PROFESSIONAL ENGINEER REGISTERED IN ONTARIO.

7.16 ALL JOINTS SHALL BE WELDED USING 490 MPa STRENGTH ELECTRODES, OR BEARING TYPE CONNECTIONS USING M20 ASTM A325M HIGH STRENGTH BOLTS, UNLESS NOTED.

7.17 FABRICATOR AND ERECTOR TO BE FULLY CERTIFIED BY CWB UNDER REQUIREMENTS OF CSA W47.1 DIVISION 1 OR DIVISION 2.

7.18 ALL JOINTS SHALL BE WELDED USING 490 MPa STRENGTH ELECTRODES, OR BEARING TYPE CONNECTIONS USING M20 ASTM A325M HIGH STRENGTH BOLTS, UNLESS NOTED.

7.19 ALL STRUCTURAL STEEL CONNECTIONS, INCLUDING CONNECTIONS TO EXISTING STRUCTURAL STEEL, ARE TO BE DESIGNED BY THE STRUCTURAL STEEL FABRICATOR'S RETAINED ENGINEER.

7.20 SUBMIT SHOP DRAWINGS FOR REVIEW. SHOP DRAWINGS SHALL BE STAMPED AND SIGNED BY A PROFESSIONAL ENGINEER REGISTERED IN THE PROVINCE OF ONTARIO.

7.21 ALL STRUCTURAL STEEL CONNECTION SHOWN ON DESIGN DRAWINGS ARE CONCEPTUAL ONLY. IT IS THE CONTRACTOR'S RESPONSIBILITY TO DESIGN ALL STRUCTURAL STEEL CONNECTIONS, INCLUDING CONNECTIONS TO EXISTING STRUCTURE, TO SUIT DESIGN REQUIREMENTS AND FIT EXISTING SITE CONDITIONS.

7.22 ALL WELDS EXPOSED TO VIEW SHALL BE GROUND SMOOTH.

7.23 STRUCTURAL STEEL SUBCONTRACTOR MUST CONDUCT DETAILED SITE REVIEWS AND MEASUREMENTS TO ASCERTAIN THE CONFIGURATIONS, SIZES AND DIMENSIONS OF THE EXISTING STRUCTURE, PRIOR TO FABRICATION OR INSTALLATION.

10. MASONRY NOTES:

10.1 MASONRY IS DESIGNED TO COMPLY WITH THE REQUIREMENTS OF CSA-S304.1 "MASONRY DESIGN FOR BUILDING LIMIT STATES DESIGN".

10.2 MASONRY CONSTRUCTION AND REINFORCEMENT TO THE REQUIREMENTS OF CSA-A371 "MASONRY CONSTRUCTION FOR BUILDINGS".

10.3 MASONRY CONNECTORS TO CSA-A370.

10.4 HOLLOW CONCRETE BLOCK WALL TO CSA-A165.1 "CONCRETE MASONRY UNITS".

10.5 MORTAR AND GROUT TO CSA-A179, TYPE 'S' (UNO).

10.6 LOAD BEARING SOLID CONCRETE BLOCK TO CSA A165.1, TYPE S/15/C/M.

10.7 LOAD BEARING HOLLOW CONCRETE BLOCK TO CSA A165.1, TYPE H/15/C/M.

10.8 NON-LOAD BEARING MASONRY WALL: PROVIDE 15M@800 c/c x 750 LONG VERTICAL REBARS WITH 150 EMBEDMENT TO CONCRETE (AGGREGATE SIZE LESS THAN 10mm)

10.9 MASONRY WALLS SHALL BE ADEQUATELY BRACED TO RESIST WIND PRESSURE AND OTHER LATERAL FORCES DURING CONSTRUCTION.

10.10 PROVIDE LINTELS OVER ALL OPENINGS OR RECESSES IN MASONRY WALLS INCLUDING THOSE FOR MECHANICAL AND ELECTRICAL SERVICES OR EQUIPMENT.

10.11 PROVIDE ADDITIONAL 1-15M VERTICAL FULL HEIGHT COMPLETE WITH MATCHING DOWELS AT CORNERS, INTERSECTIONS, EACH SIDE OF OPENINGS, AND EACH SIDE OF CONTROL JOINTS. (UNO)

10.12 PROVIDE REINFORCING DOWELS INTO BLOCK WALLS TO MATCH VERTICAL REINFORCING IN BLOCK WALLS LAPS IN REINFORCING.
15M - 600mm
20M - 800mm

10.13 MASONRY WALLS SHOWN ON STRUCTURAL DRAWINGS ARE LOAD BEARING (UNO).

10.14 FULLY GROUT CONCRETE MASONRY BLOCK CELLS WITH REINFORCEMENT.

10.15 PROVIDE CHASES AND POCKETS IN WALLS FOR STRUCTURAL STEEL BEARING AND NSTALL ALL BEARING PLATES.

10.16 BLOCK IN SOLID AROUND ALL BEAM AND CHANNEL BEARING LOCATIONS IN MASONRY WALLS.

10.17 BLOCKS SUPPORTING CONCENTRATED LOADS TO BE GROUTED SOLID 2 BLOCK COURSES BELOW BEARING OR AS NOTED OTHERWISE.

10.18 NO MASONRY WORK PERMITTED WITH TEMPERATURES BELOW 5°C UNLESS PROVISIONS ARE MADE FOR HEATING THE MATERIALS AND PROTECTING THE WORK.

10.19 HIGH LIFT GROUTING IS NOT PERMITTED.

10.20 INTERSECTING BLOCK WALLS SHALL BE INTERLOCKED.

10.21 CONCRETE MASONRY UNITS TO HAVE A MINIMUM COMPRESSIVE STRENGTH OF 15 MPa.

10.22 ALL LOAD BEARING CONCRETE BLOCK MORTAR SHALL BE TYPE S MORTAR. USE TYPE N MORTAR AT ARCHITECTURAL MASONRY VENEER.

10.23 PROVIDE 15M DOWELS x 800 [2'-8"] LG AT 800mm [2'-8"] MAX. o.c. IN CONCRETE FOUNDATION WALL TO MASONRY WALLS ABOVE, U.N.O. ON PLAN. FILL SOLID WITH CONCRETE AT DOWEL LOCATIONS.

10.24 ALL CONCRETE MASONRY UNITS SHALL BE REINFORCED WITH 15M@800 FULL HEIGHT UNLESS OTHERWISE NOTED ON PLAN.

10.25 CONCRETE FILL SHALL BE OF HIGH SLUMP (180mm TO 200mm) CONCRETE WITH A COMPRESSIVE STRENGTH OF 20 MPa AT 28 DAYS.

10.26 ALL CONCRETE MASONRY BLOCK CELLS WITH REINFORCEMENT SHALL BE FULLY GROUTED.

10.27 PROVIDE 2-15M VERTICALS FULL HEIGHT REINFORCEMENT AT ALL WALL ENDS, CORNERS, INTERSECTIONS, EACH SIDE OF OPENINGS AND AT EACH SIDE OF CONTROL JOINTS.

11. GUARDRAILS/HANDRAILS (ALL ALUM. U.N.O):

11.1 GUARDRAILS/HANDRAILS SHALL BE DESIGNED, FABRICATED, AND INSTALLED BY THE CONTRACTOR.
GUARDRAIL DESIGN SHALL COMPLY WITH THE REQUIREMENTS OF OBC 2012 SECTION 4.1.5.14 CLAUSES 1(b), 1(c), 2, AND 4.
HANDRAIL DESIGN SHALL COMPLY WITH THE REQUIREMENTS OF OBC 2012 SECTION 3.4.6.5.
BOTH GUARDRAIL AND HANDRAIL NEED CONSIDER ADDITIONAL LOAD DUE TO LIGHTING POSTS MOUNTED TO RAILING POSTS, REFER TO ELECTRICAL DRAWINGS FOR LOCATIONS

11.2 CONTRACTOR SHALL SUBMIT TO THE CONSULTANT FOR REVIEW OF STRUCTURAL SHOP DRAWINGS AND DESIGN CALCULATION STAMPED BY A PROFESSIONAL ENGINEER LICENSED TO PRACTICE IN ONTARIO.

12. STEEL DECK:

12.1 SUBMIT DESIGN BRIEFS, ERECTION AND SHOP DRAWINGS TO THE CONSULTANT FOR REVIEW.

12.2 ROOF DECK IS DESIGNED AS A DIAPHRAGM FOR ALL LATERAL LOADS.

12.3 DESIGN FOR MINIMUM 3-SPAN CONTINUOUS AND SPANNING IN DIRECTION SHOWN (UNO).

13. SHOP DRAWINGS:

13.1 SUBMIT HARD COPIES OR PDF'S OF SHOP DRAWINGS FOR REVIEW BEFORE START OF WORK.

13.2 ALL SHOP DRAWINGS ARE TO BE REVIEWED AND STAMPED BY THE CONTRACTOR PRIOR TO DISTRIBUTION.

13.3 AFTER REVIEW, SHOP DRAWINGS WILL BE STAMPED AND RETURNED. DO NOT COMMENCE FABRICATION UNTIL RETURNED SHOP DRAWINGS HAVE BEEN APPROVED BY THE CONSULTANT, STAMPED, AND RETURNED.

14. SLAB ON GRADE CONTROL JOINTS AND SAWCUTS:

14.1 SLAB ON GRADE TO BE PLACED ON COMPACTED GRANULAR MATERIAL IN STRICT ACCORDANCE WITH THE SOILS REPORT. COMPACTION TEST ON FILL MATERIAL TO BE CARRIED OUT PRIOR TO SLAB ON GRADE PLACEMENT.

14.2 PROVIDE APPROVED PRE-FORMED KEYED CONTROL JOINTS OR SAW CUTS (WITHIN 24 HOURS) AT MAXIMUM SPACING 3.0m CUT 1/4 (30mm MAX.) DEPTH OF SLAB AND FILL WITH APPROVED MASTIC JOINT FILLER.

14.3 BREAK BOND AT SURFACES OF CONTACT WITH OTHER CONCRETE (USE ASPHALT WATERPROOFING, HEAVY DUTY POLYETHYLENE OR SAND LAYER).

14.4 PROVIDE 10mm ASPHALT IMPREGNATED FIBER BOARD AND CAULKING AROUND ALL COLUMNS AND ALONG ALL WALLS.

14.5 PROVIDE CIRCULAR OR RECTANGULAR POCKETS AROUND COLUMNS. PLACE CONCRETE IN POCKET 2 WEEKS AFTER SLAB IS CONSTRUCTED. REFER TO DETAIL "TYPICAL SAW-CUT AROUND COLUMNS".

14.6 DO NOT PLACE SLAB ON GRADE IN ONE CONTINUOUS POUR IN LENGTHS EXCEEDING 30.0m IN EITHER DIRECTION.

14.7 SUBMIT FOR REVIEW LAYOUT DRAWING WITH CONSTRUCTION JOINT LOCATIONS AND SAW CUT PATTER.

14.8 MAINTAIN MINIMUM SPECIFIED THICKNESS AT ALL DEPRESSIONS AND CHANGES IN ELEVATIONS.

14.9 REFER TO ARCHITECTURAL DRAWINGS FOR EXTENT AND LOCATIONS OF ALL FINISHES AND DEPRESSIONS.

THESE DRAWINGS ARE NOT FOR CONSTRUCTION

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AECOM

PROJECT

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REGISTRATION

INTERIM

INTERIM

KEY PLAN

SEE DRAWING FOR SCALE

ISSUE/REVISION

No.	DESCRIPTION	DATE
4	ISSUED FOR BUDGET - VALUE ENG	05/03/2024
3	ISSUED FOR TENDER	29/09/2023
2	ISSUED FOR 100% CLIENT REVIEW	21/07/2023
1	ISSUED FOR 60% CLIENT REVIEW	31/03/2023

PROJECT NUMBER

60678205

SHEET TITLE

STRUCTURAL GENERAL NOTES

SHEET NUMBER

S-001

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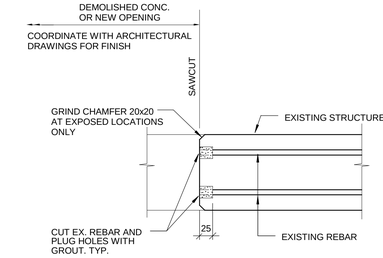
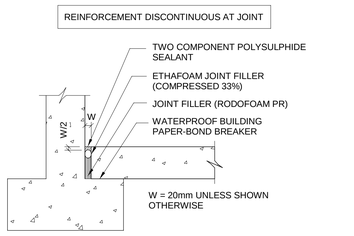
AB	ANCHOR BOLT	FD	FLOOR DRAIN	PL	PLATE
ADD'L	ADDITIONAL	FDN	FOUNDATION	PLY	PLYWOOD
AHR	ANCHOR	FF	FAR FACE	PRCST	PRECAST
ALT	ALTERNATE	FFE	FINISHED FLOOR ELEVATION	RC	REINFORCED CONCRETE
ALUM	ALUMINUM			RD	ROOF DRAIN
APVD	APPROVED	FG	FINISHED GRADE	REINF	REINFORCE
BOT	BOTTOM	FTG	FOOTING	REINF ST	REINFORCE STEEL
BEW	BOTTOM EACH WAY	GALV	GALVANIZED (HOT DIP)	SDL	SUPERIMPOSED DEAD LOAD
				SIM	SIMILAR
BF	BOTTOM FACE	GVL	GRAVEL	SOG	SLAB ON GRADE
BLL	BOTTOM LOWER LAYER	HAS	HEADED ANCHOR STUD	SPECS	SPECIFICATIONS
				SPMDD	STANDARD PROCTOR MAXIMUM DRY DENSITY
BUL	BOTTOM UPPER LAYER	HDR	HEADER		
		HORIZ	HORIZONTAL	SQ	SQUARE
BM	BEAM	HEF	HORIZONTAL	SS	STAINLESS STEEL
BRG	BEARING		EACH FACE	ST	STEEL
c/c	CENTER TO CENTER	HFF	HORIZONTAL FAR FACE	STD	STANDARD
				STIF	STIFFENER
CHKD PL	CHECKERED PLATE	HIF	HORIZONTAL INSIDE FACE	STIF	STRAIGHT
				STRU	STRUCTURE
CJ	CONSTRUCTION JOINT	HK	HOOK	SYMM	SYMMETRICAL
		HNF	HORIZONTAL NEAR FACE	T&B	TOP & BOTTOM
CL	CENTER LINE			TBD	TO BE DETERMINED
CLR	CLEARANCE, CLEAR	HOF	HORIZONTAL OUTSIDE FACE	TEW	TOP EACH WAY
				TF	TOP FACE
COL	COLUMN	HP	HIGH POINT	THK	THICK
CONC	CONCRETE	IF	INSIDE FACE	TJ	TIE JOIST
CONN	CONNECTION	INT	INTERIOR	TLL	TOP LOWER LAYER
CONT	CONTINUOUS	IJ	ISOLATION JOINT	T/O	TOP OF
CTR	CENTER			TOC	TOP OF CONCRETE
CTRD	CENTERED	JT	JOIST		TOP OF CURB
DBA	DEFORMED BAR ANCHOR	LG	LONG	TOF	TOP OF FOOTING/FLOOR
		LL	LIVE LOAD	TOS	TOP OF STEEL
DBS	DOWEL BAR SPLICER	LLV	LONG LEG VERTICAL	TOW	TOP OF WALL
		LNTL	LINTEL	TRANS	TRANSVERSE
DIA	DIAMETER	LONG	LONGITUDINAL	TUL	TOP UPPER LAYER
DIAG	DIAGONAL	LP	LOW POINT	TYP	TYPICAL
DIR	DIRECTION	MAX	MAXIMUM	UNO	UNLESS NOTED OTHERWISE
DWG	DRAWING	MB	MACHINE BOLT		
DWLS	DOWELS	MIN	MINIMUM	u/s	UNDER SIDE OF
EA	EACH	NF	NEAR FACE	VERT	VERTICAL
EE	EACH END	NIC	NOT IN CONTRACT	VEF	VERTICAL EACH FACE
EF	EACH FACE	NTS	NOT TO SCALE	VFF	VERTICAL FAR FACE
EL	ELEVATION	OC	ON CENTER	VIF	VERTICAL INSIDE FACE
EP	EPOXY	OD	OUTTER DIAMETER	VNF	VERTICAL NEAR FACE
EQL SP	EQUALLY SPACED	OF	OUTSIDE FACE	VOF	VERTICAL OUTSIDE FACE
		o/o	OUT TO OUT	WS	WATERSTOP
ES	EACH SIDE	OPNG	OPENING	WWF	WELDED WIRE FABRIC
EW	EACH WAY	PJ	PARTIAL JOINT		
EJ	EXPANSION JOINT	PJF	PREMOLDED JOINT FILLER		
EXIST	EXISTING				
EX	EXISTING				
EXT	EXTERIOR				

NOTE:
FOR ABBREVIATIONS NOT LISTED, SEE 'ABBREVIATIONS FOR USE ON DRAWINGS AND TEXT', PUBLISHED BY THE AMERICAN NATIONAL STANDARDS INSTITUTE INC. (ANSI)

1 STRUCTURAL ABBREVIATIONS
S-002 NTS

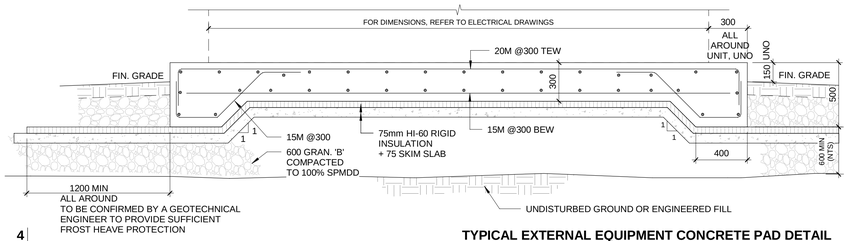


2 NEW OPENING THROUGH EXISTING CONRETE
S-002 Scale: 1 : 10

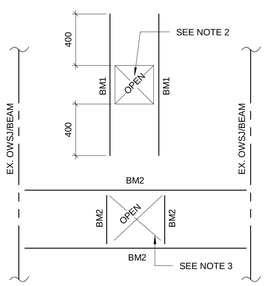


3 TYPICAL ISOLATION JOINT
S-002 Scale: 1 : 20

NOTES:
1. REMOVE ALL LOOSE ORGANIC AND DISTURBED MATERIALS AND PROOF ROLL GROUND PRIOR TO PLACING FOUNDATION OR SLAB.
2. ALLOWABLE BEARING PRESSURE = 100 kPa
3. SUBGRADES TO BE ASSESSED BY GEOTECHNICAL ENGINEER BEFORE CASTING SLAB.
4. CONCRETE PADS SHALL BE PLACED AFTER THE EQUIPMENT SHOP DRAWINGS HAVE BEEN APPROVED.

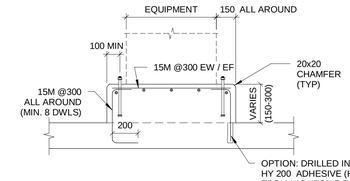


4 TYPICAL EXTERNAL EQUIPMENT CONCRETE PAD DETAIL
S-002 Scale: 1 : 20



NOTES:
1. DO NOT REINFORCE OPENINGS OF LESS THAN 150mm.
2. OPENINGS 150mm BUT LESS THAN 450mm REINFORCED AS SHOWN WHERE BM1 = L76x76x6.4
3. OPENINGS 450mm BUT LESS THAN 1200mm REINFORCE AS SHOWN WHERE BM2 = C150x16
4. FOR LARGER OPENINGS, REFER TO DESIGN DRAWINGS

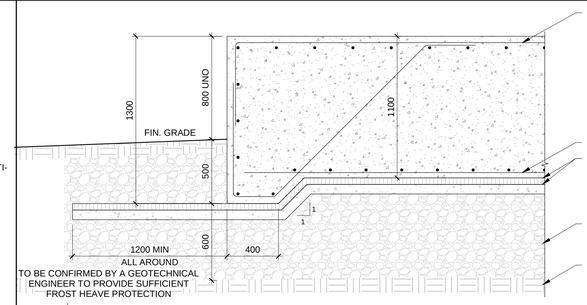
5 OPENINGS IN STEEL DECK
S-002 Scale: 1 : 20



OPTION: DRILLED IN DOWELS IN HILTI-HY 200 ADHESIVE (HILTI RE500 V3 EPOXY ADHESIVE FOR CONC EXPOSED TO LIQUID)
MIN EMBED 140mm INTO SLAB (UNO)

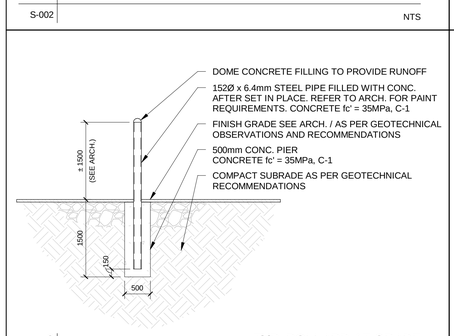
NOTES:
- LEAVE FLOOR SLAB ROUGH BETWEEN POURS.
- FOR DIMENSIONS AND LOCATIONS REFER TO ARCH, MECH, ELEC AND PROCESS DWGS.
- CONTRACTOR SHALL COORDINATE WITH APPROVED EQUIPMENT SHOP DRAWINGS, PROCESS, MECHANICAL AND ELECTRICAL DRAWINGS BEFORE PLACING CONCRETE.
- PADS SHALL BE ATLEAST 150mm LARGER THAN THE FOOT PRINT OF EQUIPMENT SUPPORTS/SKIRTS

6 TYPICAL INTERNAL CONCRETE PAD DETAIL (UNO)
S-002 Scale: 1 : 20

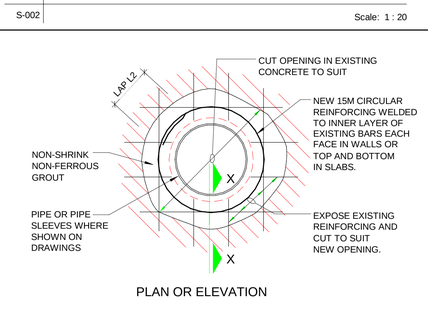


NOTES:
1. REMOVE ALL LOOSE ORGANIC AND DISTURBED MATERIALS AND PROOF ROLL GROUND PRIOR TO PLACING FOUNDATION OR SLAB.
2. SUFFICIENT GROUND BEARING RESISTANCE SHALL BE CONFIRMED BY A GEOTECHNICAL ENGINEER.
3. SUBGRADES TO BE ASSESSED BY GEOTECHNICAL ENGINEER BEFORE CASTING SLAB.

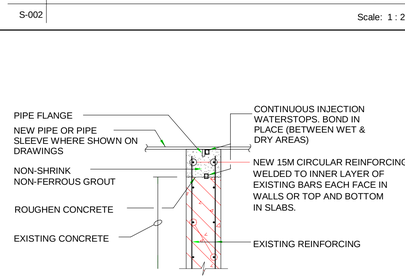
7 EXTERNAL CONCRETE PAD DETAIL
S-002 Scale: 1 : 20



8 TYP. BOLLARD AT GRADE
S-002 Scale: 1 : 50

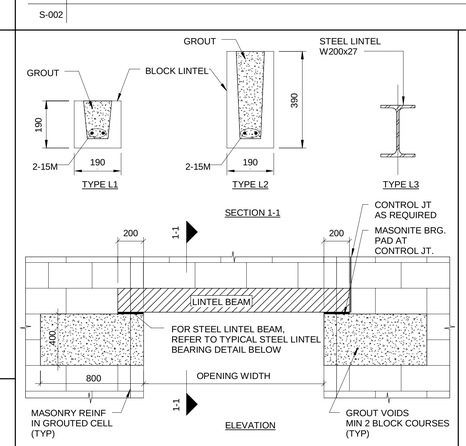


PLAN OR ELEVATION

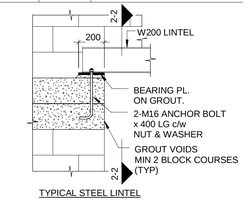


SECTION X-X

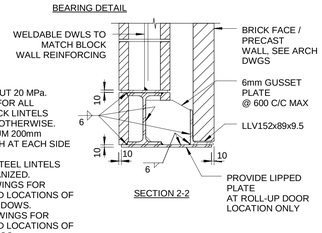
9 NEW PIPE OPENINGS (OPENING LESS THAN 500 DIA.) IN EXISTING WALLS AND SLABS (TYP UNO)
S-002 Scale: 1 : 20



BLOCK WALL LINTEL SCHEDULE		
OPENING WIDTH	TYPE	COMMENTS
< = 1200mm	L1	MIN. 200mm BEARING EACH END
< = 2400mm	L2	MIN. 200mm BEARING EACH END
< = 3200mm	L3	MIN. 200mm BEARING EACH END



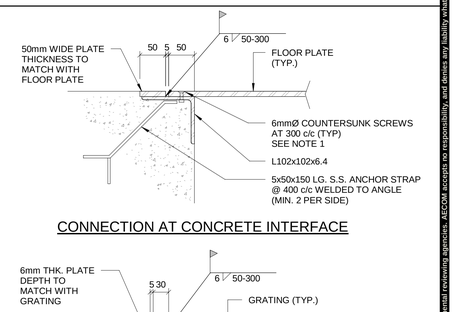
TYPICAL STEEL LINTEL BEARING DETAIL



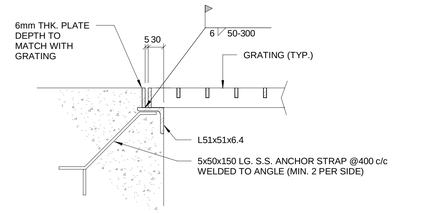
SECTION 2-2

NOTES:
1. CONCRETE GROUT 20 MPa.
2. PROVIDE 2-15M FOR ALL CONCRETE BLOCK LINTELS UNLESS NOTED OTHERWISE.
3. PROVIDE MINIMUM 200mm BEARING LENGTH AT EACH SIDE OF OPENING.
4. ALL EXTERIOR STEEL LINTELS SHALL BE GALVANIZED.
5. SEE ARCH DRAWINGS FOR DIMENSIONS AND LOCATIONS OF DOORS AND WINDOWS.
6. SEE MECH. DRAWINGS FOR DIMENSIONS AND LOCATIONS OF LOUVRE OPENINGS.

14 BLOCK WALL LINTEL DETAIL
S-002 Scale: 1 : 20



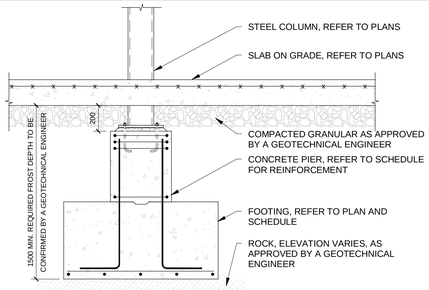
CONNECTION AT CONCRETE INTERFACE



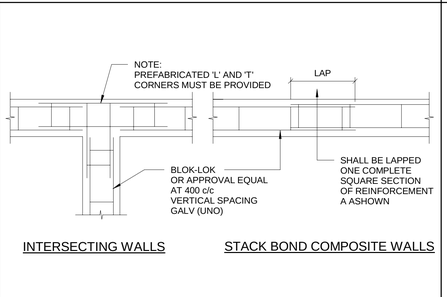
CONNECTION AT CONCRETE INTERFACE

NOTES:
1. CHECKERED PLATE SHALL BE SECURED WITH 6mm DIA. SS COUNTERSUNK SCREWS FASTENED TO SUPPORT BEAMS AT 300 c/c. ADDITIONAL SCREWS SHALL BE USED TO ENSURE FLOOR FLATNESS.
2. GRATING SHALL BE ATTACHED TO THE SUPPORTING STEEL WITH EITHER HILTI X-GR RU GRATING FASTENERS OR FISHER & LUDLOW TYPE 'D' FIXING CLIPS. HILTI FASTENERS SHALL CONSIST OF EM8-15-14P10 STUD AND X-EM8 GRATING FASTENING DISK TO SUIT GRATING HEIGHT, STUD AND DISK TO BE ELECTRO- GALVANIZED. FISHER & LUDLOW CLIP ASSEMBLY SHALL CONSISTS OF A TOP SADDLE CLIP AND 6mm SELF-TAPPING SCREWS. PROVIDE MINIMUM 4 FASTENERS PER PANEL.
3. ALL STEEL MEMBERS SHALL BE HOT-DIP GALVANIZED
4. ALL GRATINGS SHALL BE TYPE B SERRATED.

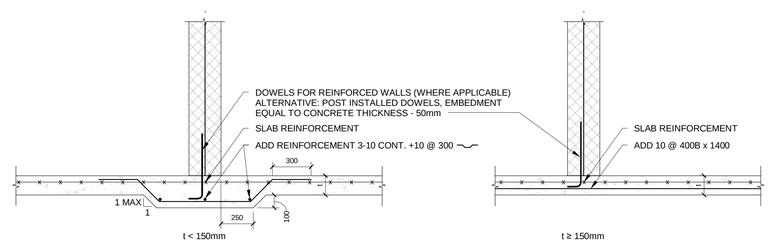
15 FLOOR PLATE AND GRATING CONNECTION DETAILS
S-002 Scale: 1 : 5



16 INTERNAL FOOTING SECTION
S-002 Scale: 1 : 20



10 TYPICAL CONCRETE BLOCK WALL VERTICAL REINFORCEMENT
S-002 Scale: 1 : 20



11 MASONRY PARTITIONS AT SLAB ON GRADE
S-002 Scale: 1 : 20

INTERSECTING WALLS STACK BOND COMPOSITE WALLS

12 TYPICAL CONCRETE BLOCK WALL REINFORCEMENT
S-002 Scale: 1 : 20

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915/916 McINTYRE ST. E, NORTH BAY, ON

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KEY PLAN

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No.	DESCRIPTION	DATE
4	ISSUED FOR BUDGET - VALUE ENG	05/03/2024
3	ISSUED FOR TENDER	29/09/2023
2	ISSUED FOR 100% CLIENT REVIEW	21/07/2023
1	ISSUED FOR 60% CLIENT REVIEW	31/03/2023

PROJECT NUMBER
60678205

SHEET TITLE
STRUCTURAL TYPICAL DETAILS

SHEET NUMBER
S-002

ISO B1 707 x 1000mm
APPROVED: Approver
CHECKED: Checker
DESIGNER: LH
PROJECT MANAGEMENT INITIALS:
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Filename: BM 360//BP-AMER(CAN) 60678205 - ONTC Grit Blast Bay/60678205-ACM-R20-GRITBLAST-AE.rvt
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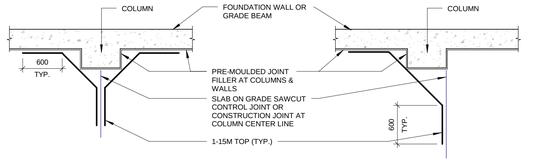
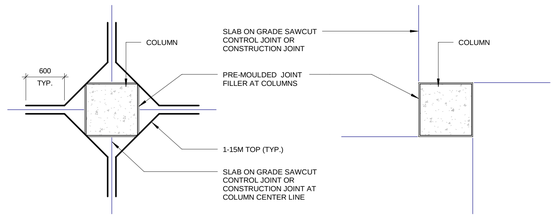


EXTERIOR COLUMN

EXTERIOR COLUMN



INTERIOR COLUMN

ALTERNATE 'A'

INTERIOR COLUMN

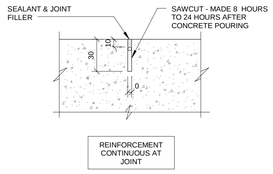
ALTERNATE 'B'

NOTES:

1. SAWCUTS REFER TO DETAIL AND SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.
2. SUBMIT ALTERNATIVE DETAILS FOR REVIEW WELL IN ADVANCE OF SLAB POUR.

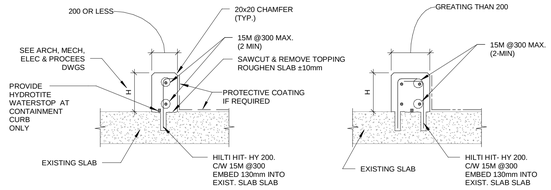
1 SLAB ON GRADE ISOLATION JOINTS AT CONCRETE OR HSS COLUMNS

S-003 Scale: 1 : 40



2 SAWCUT DETAILS

S-003 Scale: 1 : 2



TYPICAL CONCRETE CURB OM EXISTING SLAB

3 TYPICAL CURB DETAIL

S-003 Scale: 1 : 20

ISO B1 707 x 1000mm
APPROVED: Approver
CHECKED: Checker
DESIGNER: Designer
PROJECT MANAGEMENT INITIALS:
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Last Plotted: 2024-03-08 10:21:35 AM
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No.	DESCRIPTION	DATE
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PROJECT NUMBER

60678205

SHEET TITLE

STRUCTURAL TYPICAL DETAILS

SHEET NUMBER

S-003

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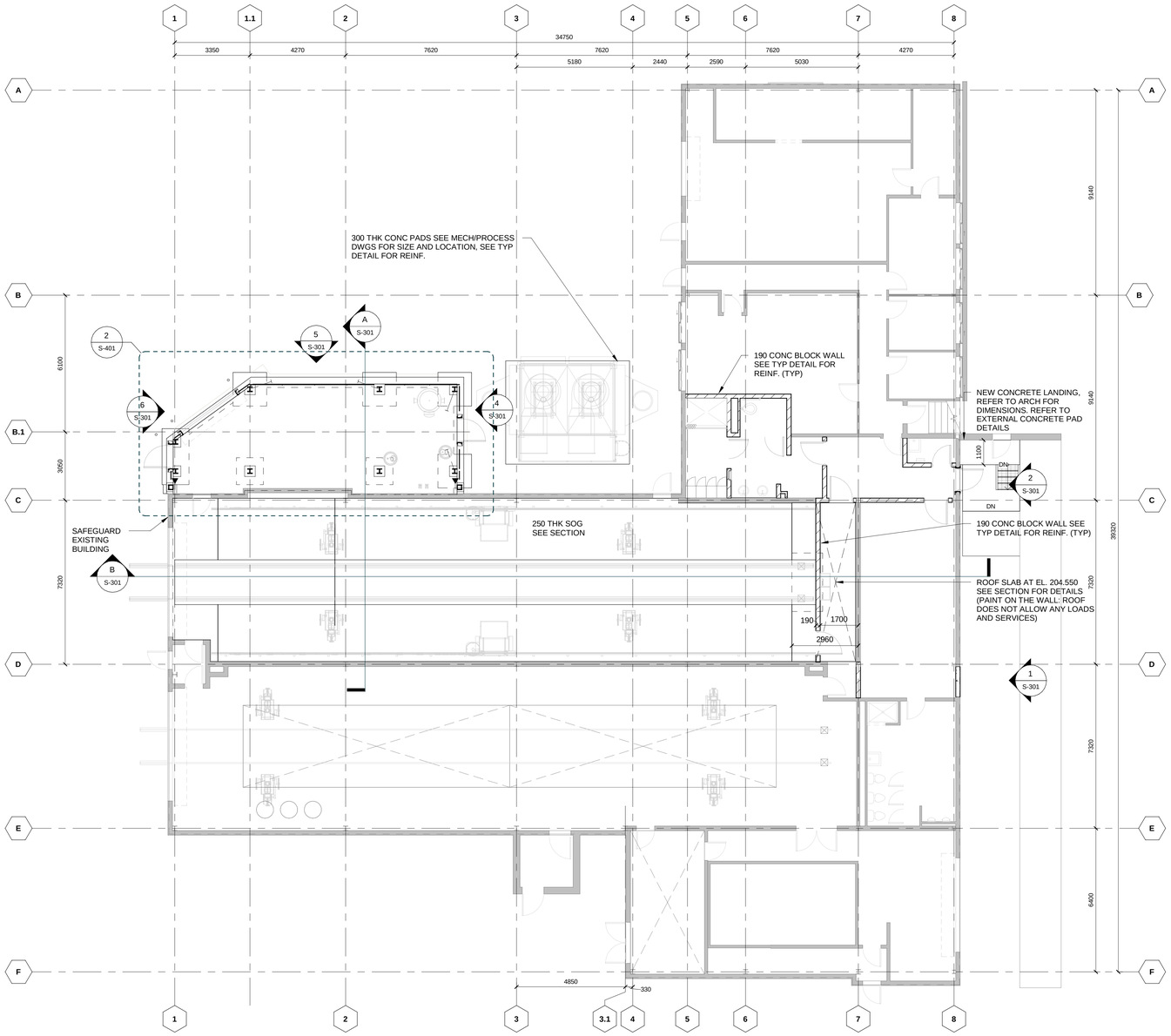

1 **GROUND FLOOR PLAN**

S-101 | REF: 2 / A-150

Scale: 1 : 100

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SCRIPT_R4 - PROJECT KEY KEEP STRUCTURAL S-201 GROUND FLOOR AND MECHANICAL ROOM MID-HEIGHT PLANS
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3	ISSUED FOR TENDER	29/09/2023
2	ISSUED FOR 100% CLIENT REVIEW	21/07/2023
1	ISSUED FOR 60% CLIENT REVIEW	31/03/2023

PROJECT NUMBER

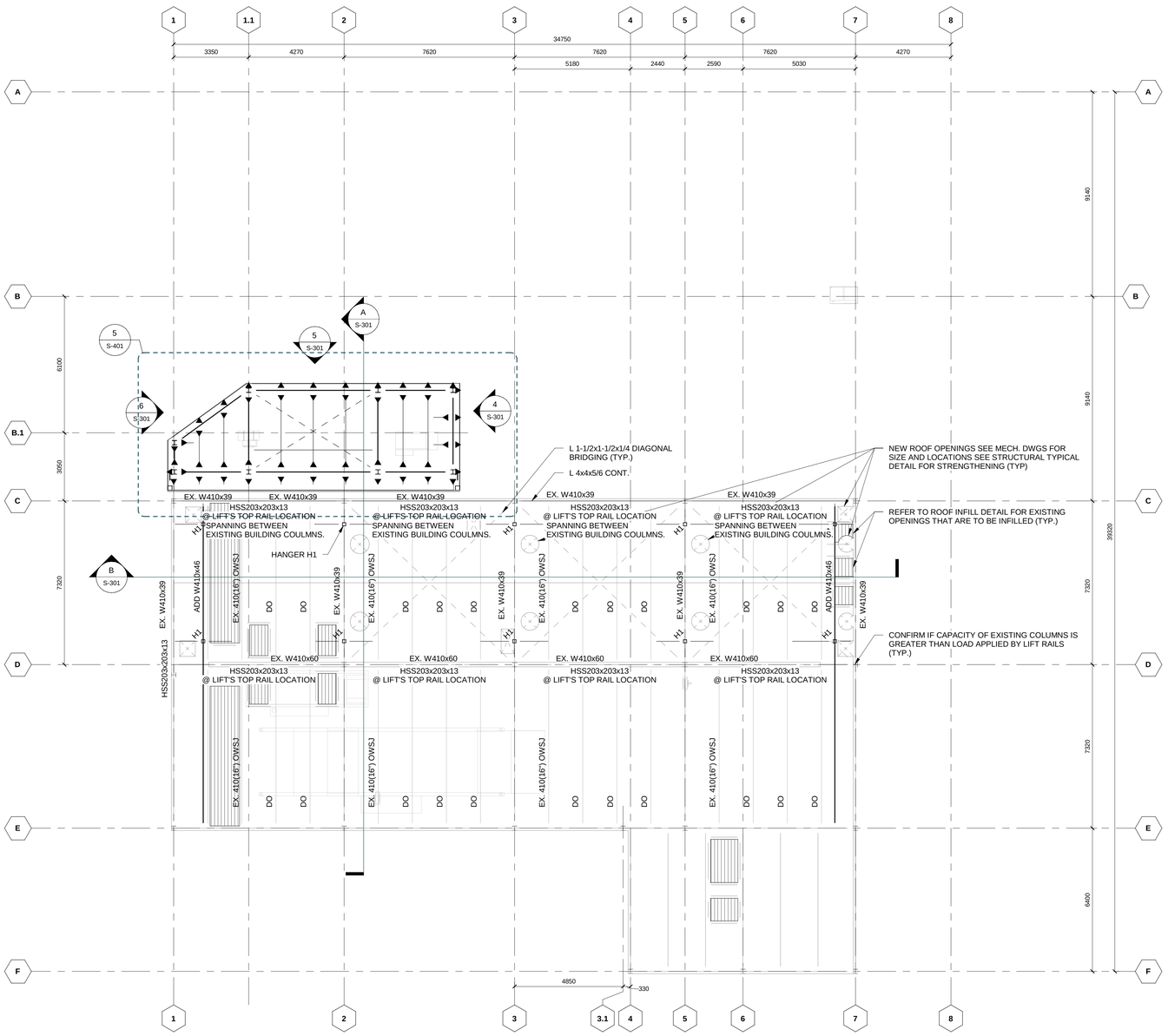
60678205

SHEET TITLE

GROUND FLOOR AND MECHANICAL ROOM MID-HEIGHT PLANS

SHEET NUMBER

S-101



1 ROOF FRAMING PLAN

S-102 | REF: 2 / A-150

Scale: 1 : 100

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1	ISSUED FOR 60% CLIENT REVIEW	31/03/2023

PROJECT NUMBER

60678205

SHEET TITLE

ROOF FRAMING PLAN

SHEET NUMBER

S-102

PROJECT MANAGEMENT INITIALS: DESIGNER: LH CHECKED: Checker APPROVED: Approver ISO B1 707 x 1000mm
Last Plotted: 2024-03-08 10:21:36 AM
Filename: BIM 360://BP-AMER(CAN) 60678205 - ONTC Grit Blast Bay/60678205-ACM-R20-GRITBLAST-AE.rvt
SCALE OF PRODUCT REMAINS PROPORTIONAL TO S-102 ROOF FRAMING PLAN

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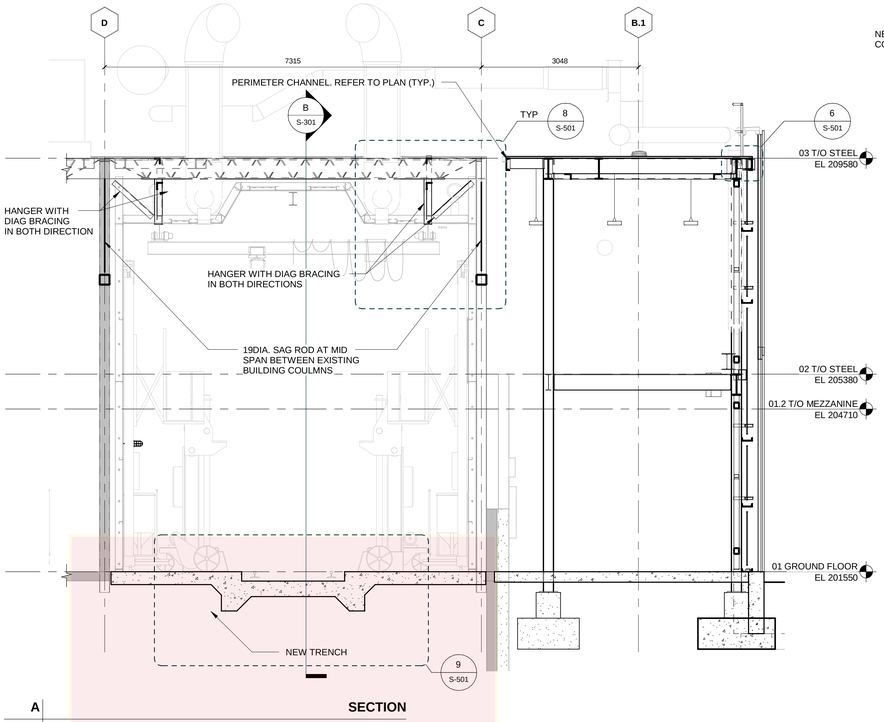
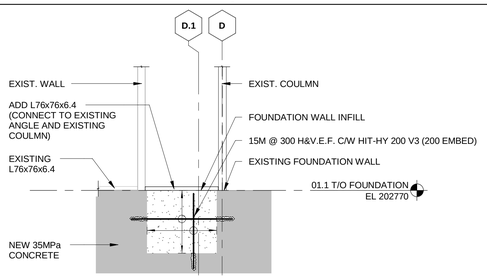


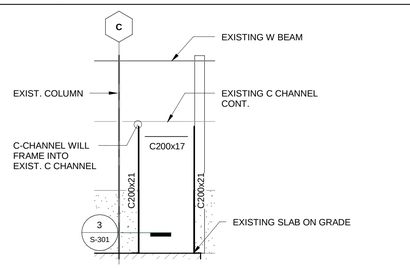
A SECTION

S-301 | REF: 1 / S-101 | Scale: 1 : 50



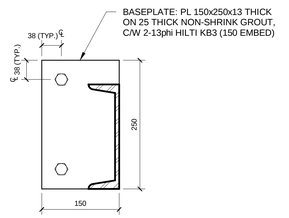
1 CONCRETE FOUNDATION WALL INFILL

S-301 | REF: 1 / S-101 | Scale: 1 : 50



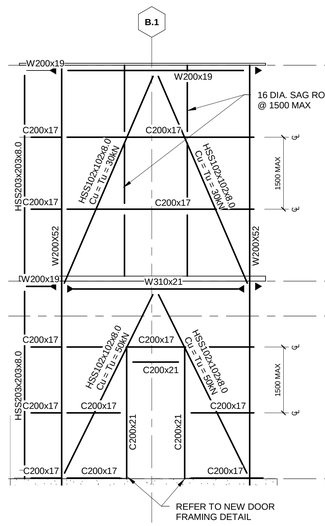
2 NEW DOOR FRAME ELEVATION

S-301 | REF: 1 / S-101 | Scale: 1 : 50



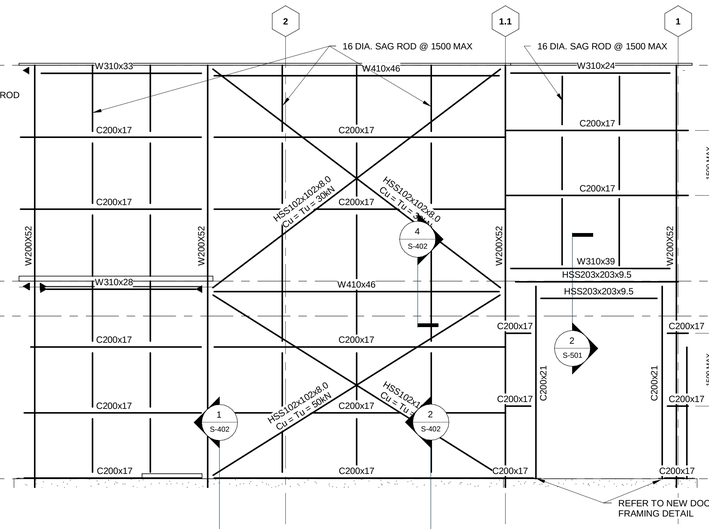
3 BASEPLATE DETAIL

S-301 | REF: 2 / S-301 | Scale: 1 : 5



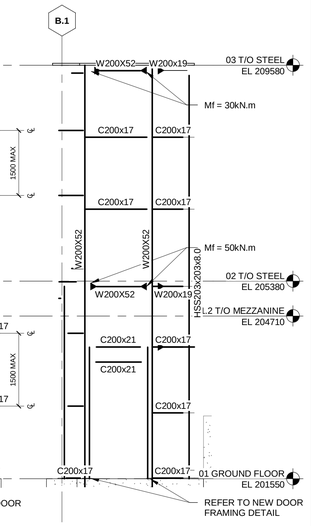
4 EAST BRACING ELEVATION

S-301 | REF: 1 / S-101 | Scale: 1 : 50



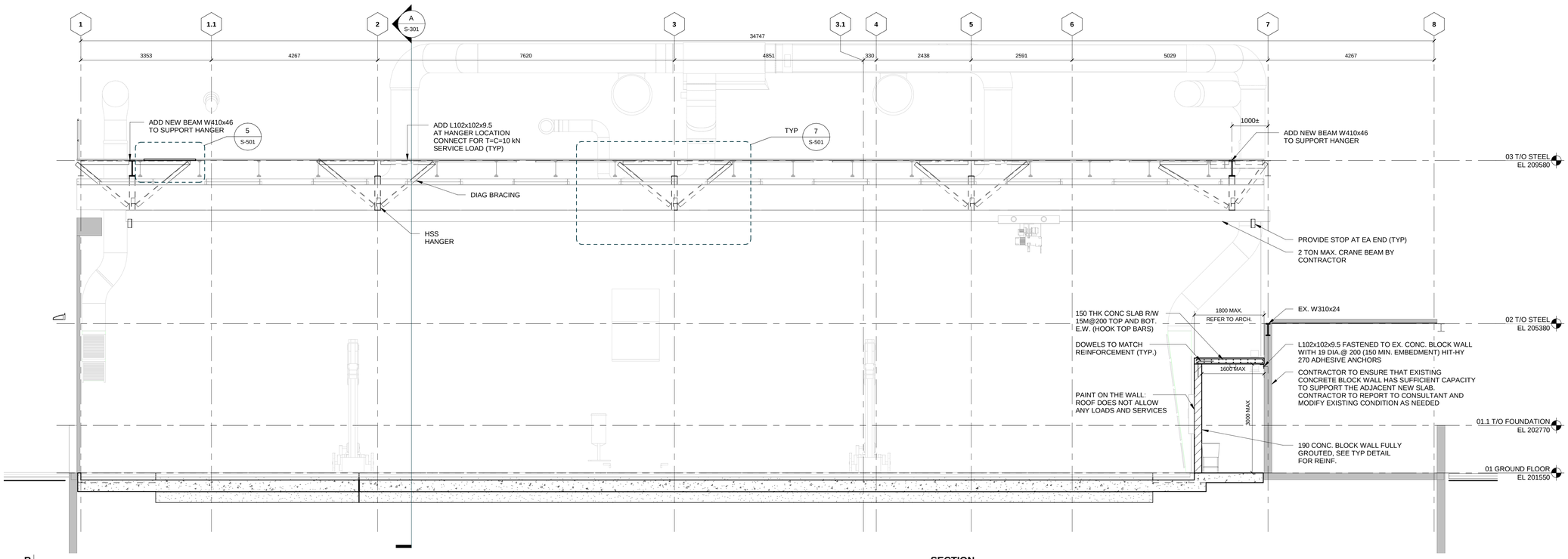
5 NORTH BRACING ELEVATION

S-301 | REF: 1 / S-101 | Scale: 1 : 50



6 WEST BRACING ELEVATION

S-301 | REF: 1 / S-101 | Scale: 1 : 50



B SECTION

S-301 | REF: 1 / S-101 | Scale: 1 : 50

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Filename: BIM 360://BP-AMER(CAN) 60678205 - ONTC Gtd Blast Bay/60678205-ACM-R20-GRITBLAST-AE.rvt
THIS DRAWING IS PRODUCT DELIVERY INFORMATIONAL SCHEDULE/DRAWING AND SECTIONS
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AECOM

PROJECT

BLAST BAY UPGRADE
915/916 McINTYRE ST. E, NORTH BAY, ON

CLIENT

REGISTERED OWNER:
ONTARIO NORTHLAND TRANSPORTATION COMMISSION
555 Oak Street East
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CONSULTANT

PRINCIPAL:
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KEY PLAN

SEE DRAWING FOR SCALE

ISSUE/REVISION

No.	DESCRIPTION	DATE
4	ISSUED FOR BUDGET - VALUE ENG	05/03/2024
3	ISSUED FOR TENDER	29/09/2023
2	ISSUED FOR 100% CLIENT REVIEW	21/07/2023
1	ISSUED FOR 60% CLIENT REVIEW	31/03/2023

PROJECT NUMBER

60678205

SHEET TITLE

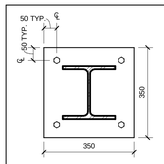
ELEVATIONS AND SECTIONS

SHEET NUMBER

S-301

ISO B1 707 x 1000mm
APPROVED: Approver
CHECKED: Checker
DESIGNER: LH
PROJECT MANAGEMENT INITIALS:
D
C
B
A

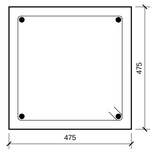
BASEPLATE SCHEDULE



MARK	SIZE	ANCHORAGE	REMARKS
BP1	350x350x19	4-25ph ANCHOR BOLTS x 200 EMBEDMENT FROM TOP OF PIER + 50 HOOK	PROVIDE ANCHOR BOLTS WITH DOUBLE NUT AND WASHER AT BOLT END
BP2	350x350x19	4-25ph ANCHOR BOLTS x 850 EMBEDMENT FROM TOP OF PIER + 50 HOOK	

NOTES:
1. CENTER BASEPLATE ON PIERS, CENTER COLUMNS ON BASEPLATE
2. PROVIDE 50mm NON-SHRINK, NON-METALLIC GROUT BELOW PLATE. ENSURE BASEPLATE IS LEVELED

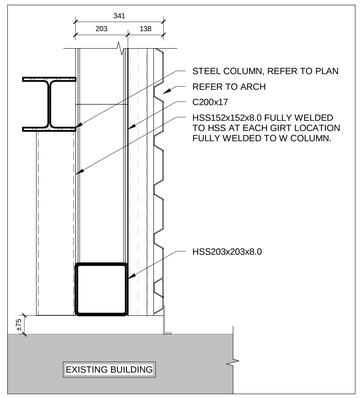
PIER SCHEDULE



MARK	SIZE	ANCHORAGE
P1	475x475	4-20M + 10M CLOSED STIRRUP @ 250 O/C

FOOTING SCHEDULE

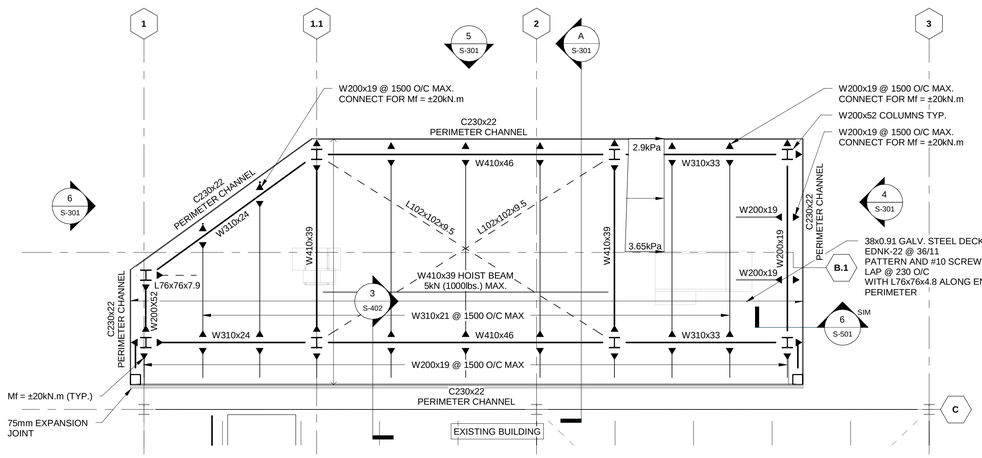
MARK	SIZE	REINFORCEMENT
F1	1200x1200x600 DP	20M @ 300 B.E.W.
F2	1500x1500x600 DP	20M @ 300 T&B.E.W. HOOK TOP REBAR
SF1	600x300 DP	3-15B CONT



6 GIRT STUB OUT CONNECTION

S-401 | REF: 3 / S-401

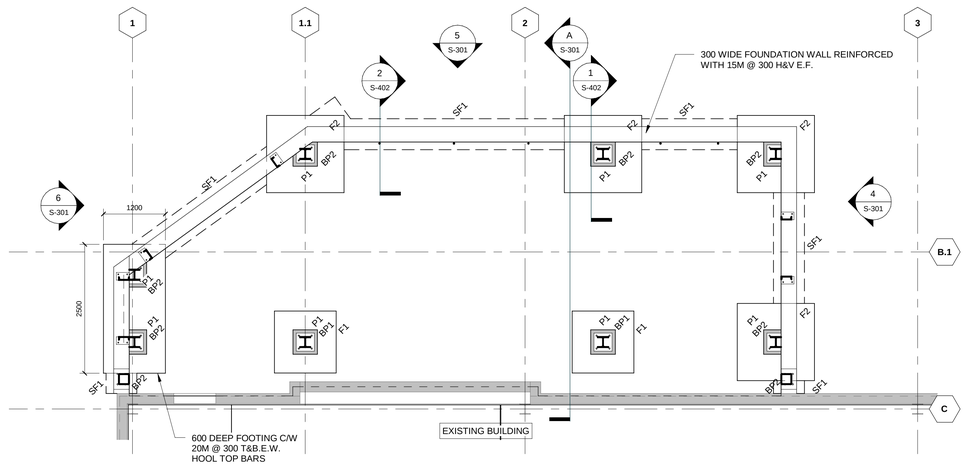
Scale: 1 : 10



5 LEVEL 03 MECHANICAL ROOM ROOF PLAN

S-401 | REF: 1 / S-102

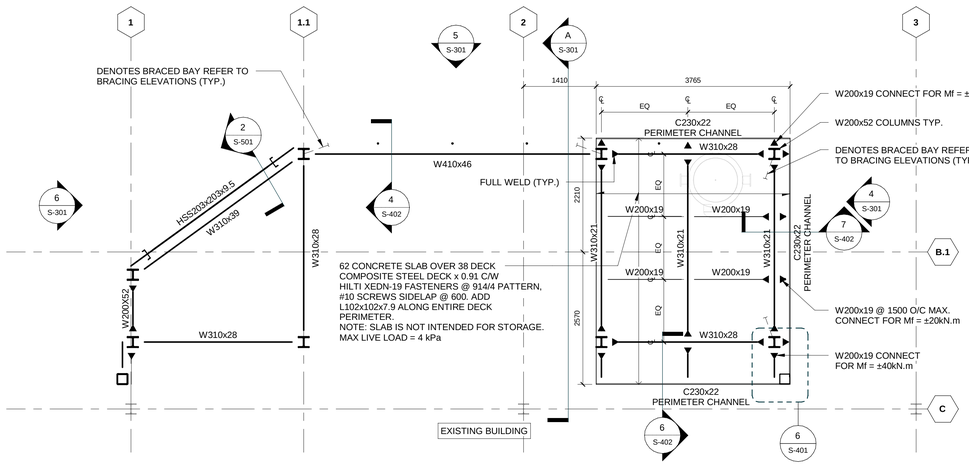
Scale: 1 : 50



1 MECHANICAL ROOM FOUNDATION PLAN

S-401 | REF: 2 / A-150

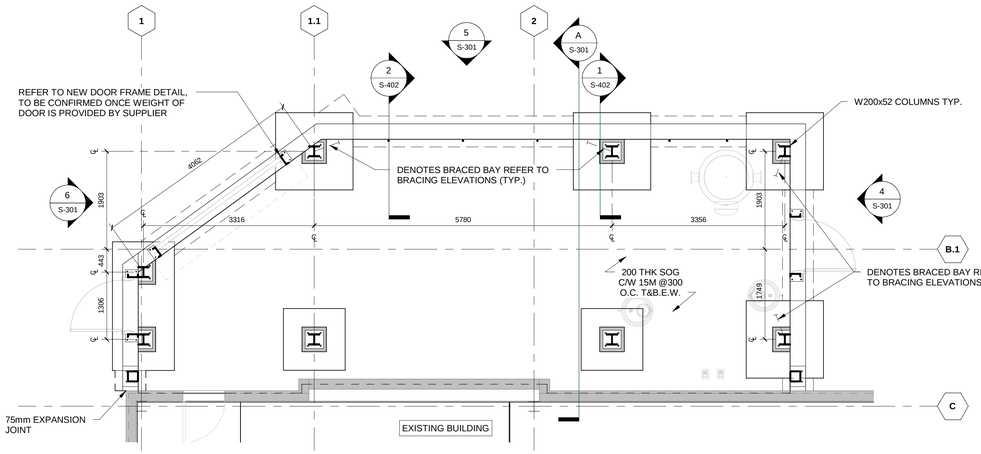
Scale: 1 : 50



4 LEVEL 02 MECHANICAL ROOM T/O STEEL PLAN

S-401 | REF: 2 / A-150

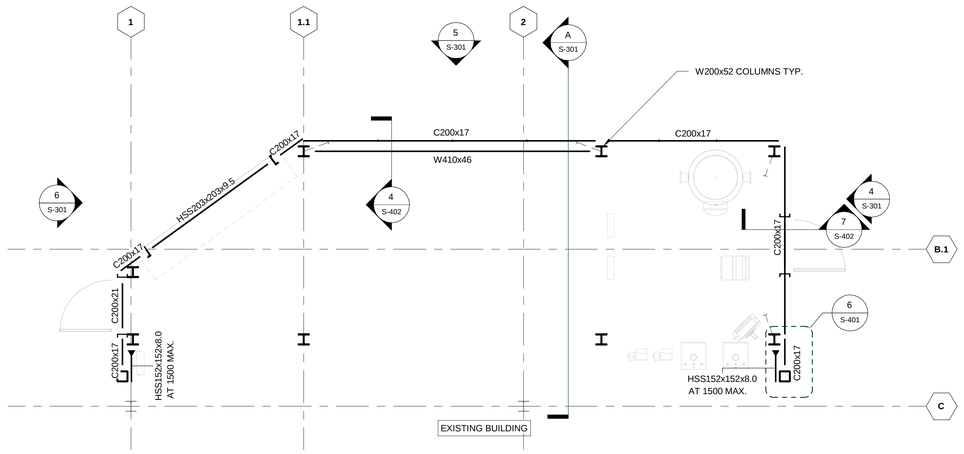
Scale: 1 : 50



2 LEVEL 01 MECHANICAL ROOM PLAN

S-401 | REF: 1 / S-101

Scale: 1 : 50



3 LEVEL 01.2 MECHANICAL ROOM MEZZANINE T/O STEEL PLAN

S-401 | REF: 2 / A-150

Scale: 1 : 50

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915/916 McINTYRE ST. E, NORTH BAY, ON

CLIENT

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Email: address@email.com

REGISTRATION

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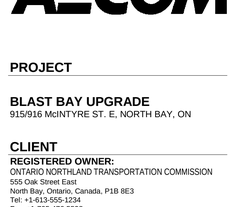
INTERIM

KEY PLAN



SEE DRAWING FOR SCALE

ISSUE/REVISION

No.	DESCRIPTION	DATE
3	ISSUED FOR BUDGET - VALUE ENG	05/03/2024
2	ISSUED FOR TENDER	29/09/2023
1	ISSUED FOR 100% CLIENT REVIEW	21/07/2023

PROJECT NUMBER

60678205

SHEET TITLE

ENLARGED PARTIAL PLANS

SHEET NUMBER

S-401

Last Plotted: 2024-03-08 10:21:44 AM
Filename: BIM 360:/BP-AMER(CAN) 60678205 - CNTC Grit Blast Bay/60678205 - CNTC Grit Blast Bay_ACM-R20-GRITBLAST-AE.rvt
COPY OF PROJECT DELIVERY STRUCTURAL S-401 ENLARGED PARTIAL PLANS

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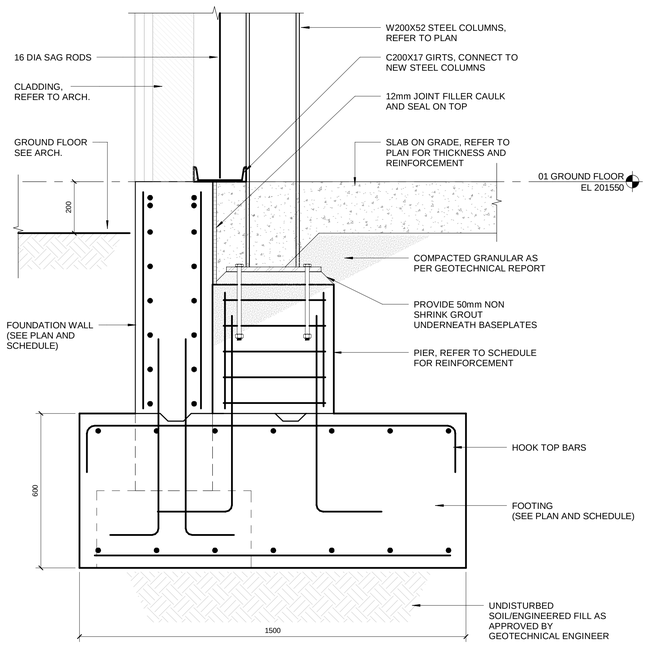
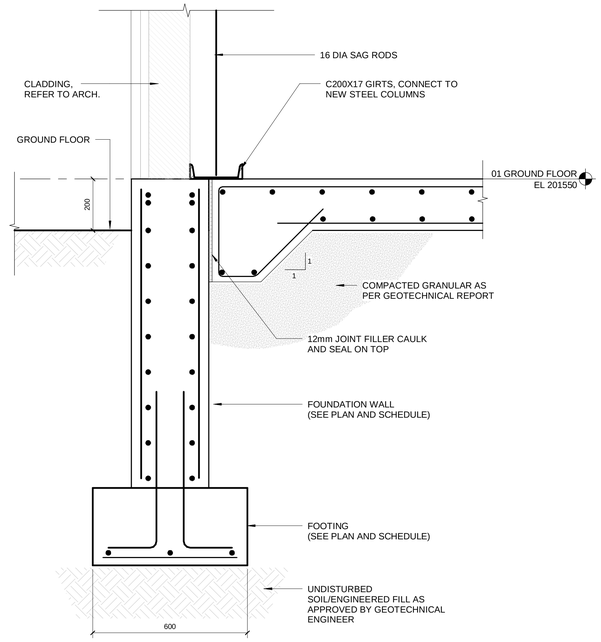


1 SECTION
S-402 | REF: 5 / S-301 Scale: 1 : 10



2 SECTION
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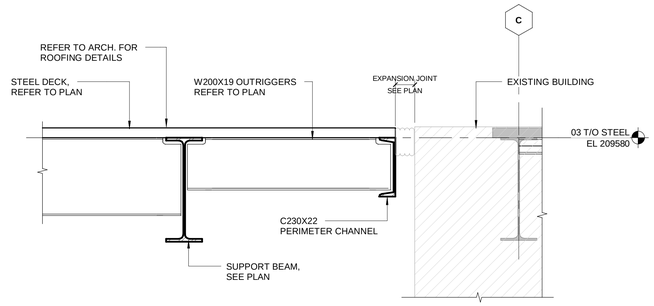

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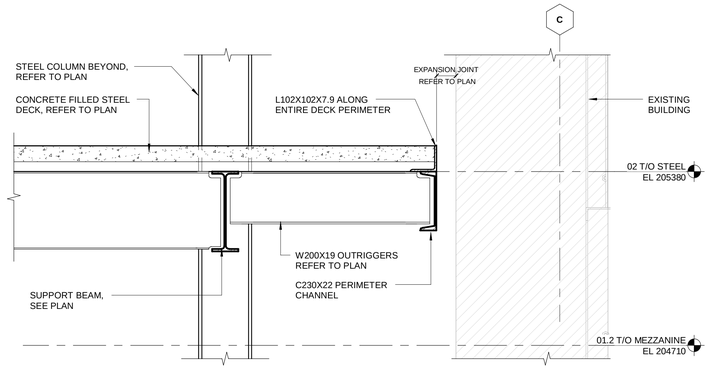

6 SECTION
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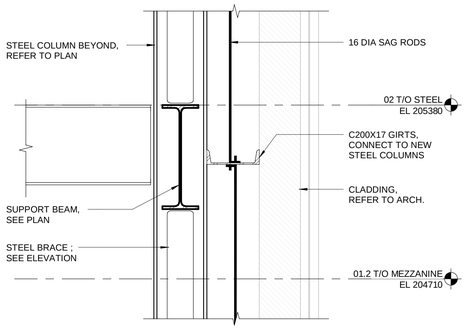
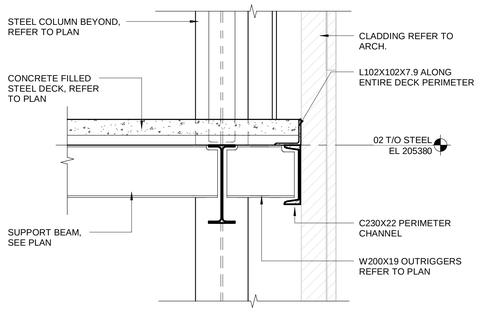


4 SECTION
S-402 | REF: 5 / S-301 Scale: 1 : 10



7 SECTION
S-402 | REF: 3 / S-401 Scale: 1 : 10

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BLAST BAY UPGRADE
915/916 McINTYRE ST. E, NORTH BAY, ON

CLIENT
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REGISTRATION
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KEY PLAN

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ISSUE/REVISION

No.	DESCRIPTION	DATE
1	ISSUED FOR BUDGET - VALUE ENG	05/03/2024

PROJECT NUMBER
60678205

SHEET TITLE
SECTION DETAILS

SHEET NUMBER
S-402

ISO B1 707 x 1000mm
APPROVED: Approver
CHECKED: Checker
DESIGNER: Designer
PROJECT MANAGEMENT INITIALS:
Last Plotted: 2024-03-06 10:21:47 AM
Filename: BIM 360://BP- AMER(CAN) 60678205 - ONTC Grit Blast Bay/60678205 -ACM-R20-GRITBLAST-AE.rvt

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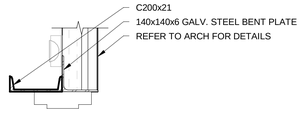
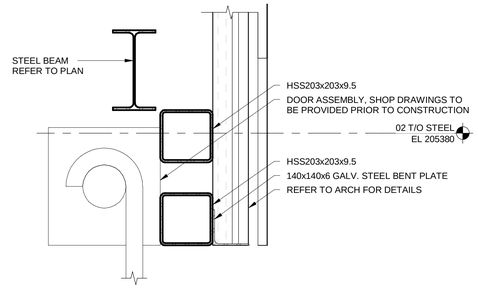
ISO B1 707 x 1000mm
APPROVED: Approver
CHECKED: Checker
DESIGNER: LH
PROJECT MANAGEMENT INITIALS:



1 DOOR HEADER
S-501 | Scale: 1 : 10



2 ROLLING DOOR HEADER
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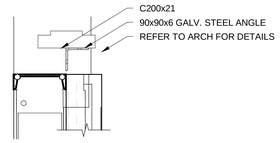
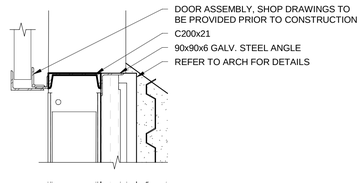
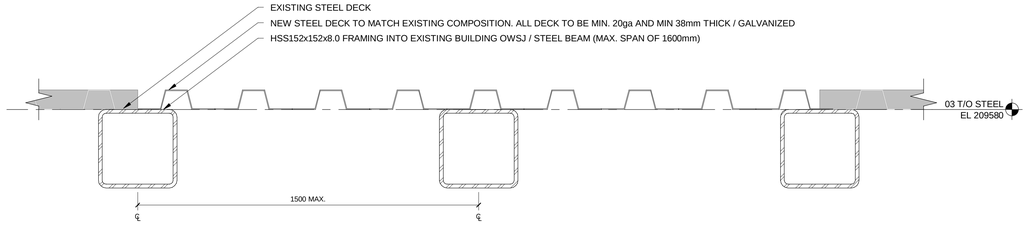


3 DOOR JAMB
S-501 | Scale: 1 : 10

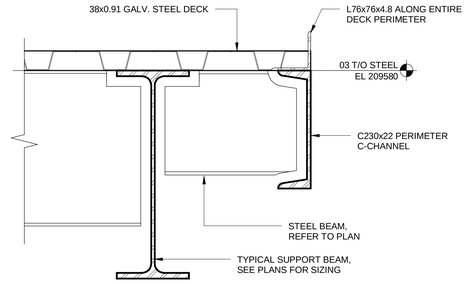


4 ROLLING DOOR JAMB
S-501 | Scale: 1 : 10

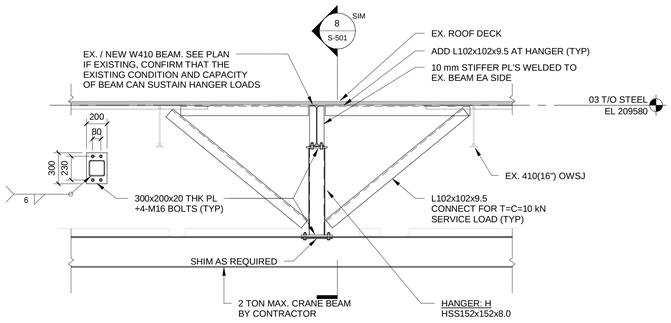


NOTE:
1. CONTRACTOR TO VERIFY LOCATION OF EXISTING OPENINGS AND REPORT ANY DISCREPANCIES TO CONSULTANT
2. PROVIDE ROOF ASSEMBLY TYPE R1 (CONFIRM WITH ARCH. PRIOR TO CONSTRUCTION) REFER TO ARCH. FOR ROOF TYPES.

5 ROOF INFILL
S-501 | REF: B / S-301 | Scale: 1 : 5



6 PERIMETER ANGLE DETAIL
S-501 | REF: A / S-301 | Scale: 1 : 5



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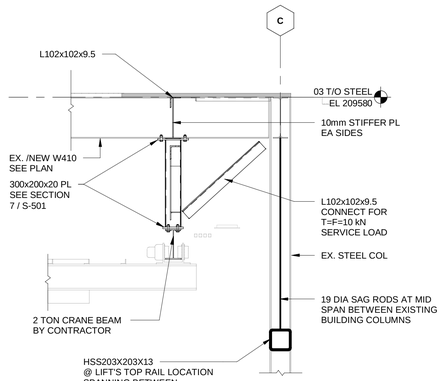
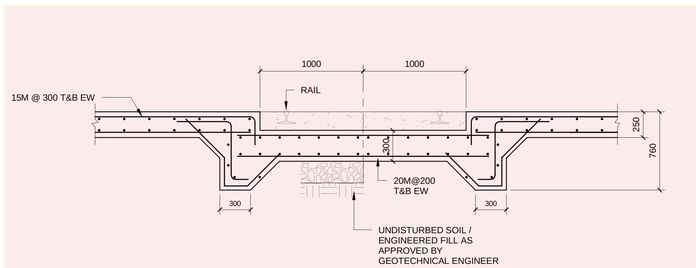
S-501 | REF: B / S-301 | Scale: 1 : 25



8 DETAIL
S-501 | REF: A / S-301 | Scale: 1 : 25



9 DETAIL
S-501 | REF: A / S-301 | Scale: 1 : 25

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Filename: BIM 360:/BP-AMER(CAN) 60678205 - ONTC Grit Blast Bay/60678205-ACM-R20-GRITBLAST-AE.rvt
Printed on ___% Post-Consumer Recycled Content Paper
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PROJECT

BLAST BAY UPGRADE
915/916 McINTYRE ST. E, NORTH BAY, ON

CLIENT

REGISTERED OWNER:
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KEY PLAN

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CHECKED: Checker
DESIGNER: Designer
PROJECT MANAGEMENT INITIALS:

1. GENERAL NOTES OF STRUCTURAL DEMOLITION:

1.1 DESIGN, FABRICATION AND ERECTION OF STRUCTURAL STEEL IN ACCORDANCE WITH CSA STANDARD - CAN/CSA-S16.1. DEMOLITION WORK TO BE READ IN CONJUNCTION WITH ALL ARCHITECTURAL STRUCTURAL, ELECTRICAL, MECHANICAL AND PROCESS DEMOLITION AND REFERENCE DRAWINGS, SPECIFICATIONS AND APPENDICES.

1.2 CONTRACTOR TO SITE VERIFY AND CONFIRM ALL EXISTING CONDITIONS INCLUDING DEMOLITION ELEVATIONS INDICATED ON CONTRACT DRAWINGS PRIOR TO DEMOLITION. REPORT ANY DISCREPANCIES TO CONSULTANTS.

1.3 REFER TO SPECIFICATIONS FOR DISMANTLING/REMOVAL/STORAGE AND REUSE OF EXISTING MATERIALS.

1.4 CONTRACTOR TO INSTALL INTERIOR/EXTERIOR INSULATION & WATERTIGHT HOARDING TO SEPARATE PUBLIC FROM CONSTRUCTION ZONES AND PROVIDE REQUIRED SAFE MEANS OF EGRESS FROM ALL ZONES OF THE EXISTING BUILDING AT ALL TIMES TO THE APPROVAL OF AUTHORITIES HAVING JURISDICTION.

1.5 PROVIDE DUST AND DEBRIS PROTECTION TO MATERIALS TO REMAIN & AREAS OUTSIDE THE ZONE OF WORK IN ACCORDANCE WITH SPECIFICATIONS.

1.6 MAKE PROVISIONS TO JOIN NEW WORK TO EXISTING AND TO INSTALL NEW SUPPORTING MEMBERS, ANCHORS, AND OTHER ITEMS NECESSARY FOR COMPLETION OF WORK. PROVIDE TEMPORARY BRACING FOR SUPPORT WHERE REQUIRED PRIOR TO DEMOLITION (CO-ORDINATE THIS ITEM WITH STRUCTURAL DRAWINGS).

1.7 MAINTAIN THE EXISTING BUILDING WATER-TIGHTNESS AT THE AREAS BEING ALTERED FROM WHERE EXISTING FLOOR, ROOF, OR WALL ASSEMBLES ARE EXPOSED TO THE OPEN.

1.8 CUT OFF, CAP, REROUTE, OR REMOVE EXISTING SERVICES WHICH ARE AFFECTED BY THE ALTERATIONS. RESTORE, ALL FIRE RATINGS TO EXISTING REMAINED WALLS/FLOOR/SLAB AFTER ANY ARCH. M/E & PROCESS REMOVAL/ALTERATION.

1.9 ALL EXISTING WALL OPENINGS AFTER ANY ARCH. M/E & PROCESS REMOVAL/ALTERATION TO BE FILLED WITH NON-SHRINK GROUT OR MATERIALS SIMILAR TO EXISTING WALLS.

1.10 CONTRACTOR TO IDENTIFY EXISTING FIRE RATINGS OF EXISTING FLOORS, WALLS AND ROOFS WHERE EXISTING OPENINGS TO BE COVERED OR INFILLED, AND IF REQUIRED, PROVIDE ULC APPROVED ASSEMBLIES TO COVER EXISTING OPENINGS TO MAINTAIN THE INTEGRITY OF THE FIRE RATED ASSEMBLY.

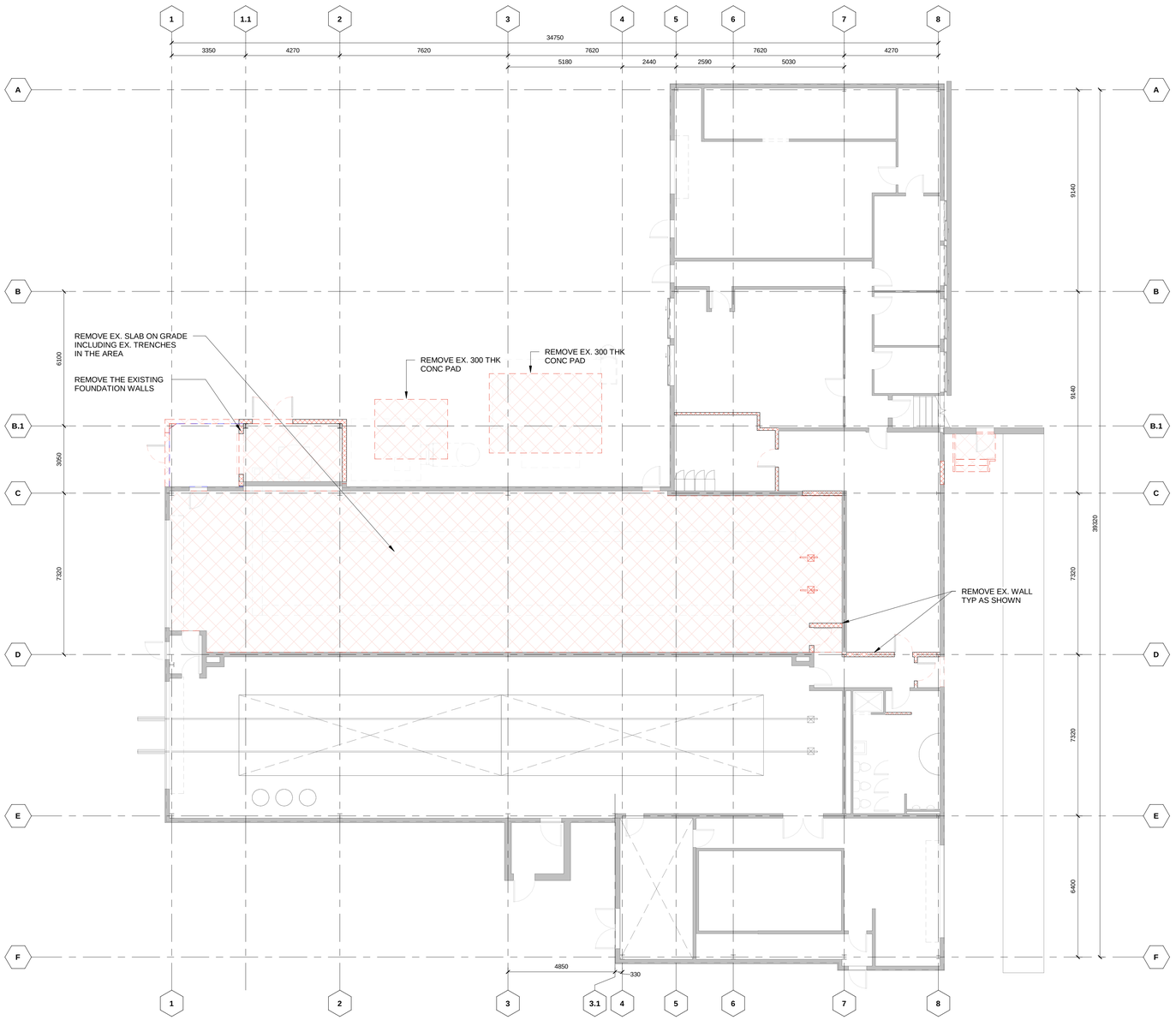
1.11 REPAIR AND MAKE GOOD ALL DAMAGED SURFACES WITH NEW MATERIALS TO MATCH EXISTING.

1.12 ALL DISCARDED UNDERGROUND BASEMENTS, CHAMBERS, OPENINGS, VOIDS OR PIPES IN THE DESIGNATED DEMOLITION AREAS, SHALL BE BACK FILLED WITH GRANULAR "B" AS SUB-BASE AND MINIMUM 600MM THICK PLANTING SOIL ON TOP, REFER TO SPECIFICATIONS FOR THE DETAIL PROCEDURES AND REQUIREMENTS.

1.13 AT NO TIME SHALL THE CONTRACTOR ALLOW HEAVY EQUIPMENT, TOOLS OR MATERIALS TO EITHER IMPACT OR REST ATOP THE EXISTING STRUCTURES BEYOND THE LOAD LIMITS AS INDICATED ON THE EXISTING DESIGN DRAWINGS. DEMOLITION OF LARGE, HEAVY ITEMS SHALL BE PLANNED IN COORDINATION WITH THE OWNER AND THE ENGINEER TO AVOID LOAD-BASED ISSUES.

1.14 AT NO TIME SHALL THE CONTRACTOR ALLOW HEAVY CRANES OR LIFTING EQUIPMENT APPROACH TO THE TOP OF RETAINING WALLS OR BASEMENT WALLS WITHOUT SUBMISSION OF A PLAN FOR THE APPROVAL OF THE OWNER AND THE ENGINEER.

1.15 MAKE PROVISIONS TO INSTALL NEW SUPPORTS FOR REMAINED PIPES, DUCTS & TRAY AFTER ANY ARCH. M/E & PROCESS REMOVAL OR ALTERNATION. SUGGESTED SEQUENCES OF STRUCTURAL DEMOLITION



1 | SD100 | REF: 2 / A-150

S-EX. GROUND FLOOR SHOWING REMOVAL

Scale: 1 : 100

NOTES:

1. REFER TO AS BUILT DRAWING 5473-S15 FOR DETAILS OF EXISTING BUILDING FOUNDATION AND SLAB ON GRADE

LEGEND:

DENOTES EXISTING TO BE REMOVED

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AECOM

PROJECT

BLAST BAY UPGRADE
915/916 McINTYRE ST. E, NORTH BAY, ON

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REGISTRATION

INTERIM

INTERIM

KEY PLAN

SEE DRAWING FOR SCALE

ISSUE/REVISION

No.	DESCRIPTION	DATE
4	ISSUED FOR BUDGET - VALUE ENG	05/03/2024
3	ISSUED FOR TENDER	29/09/2023
2	ISSUED FOR 100% CLIENT REVIEW	21/07/2023
1	ISSUED FOR 60% CLIENT REVIEW	31/03/2023

PROJECT NUMBER

60678205

SHEET TITLE

GROUND FLOOR DEMOLITION PLAN

SHEET NUMBER

SD100

SCRIPT: RVT_INTERIOR STRUCTURAL DEMO SDI00 GROUND FLOOR DEMOLITION PLAN
Last Plotted: 2024-03-08 10:21:49 AM
Filename: BIM 360:/BP-AMER(CAN) 60678205 - ONTC Gr4 Blast Bay/60678205-ACM-R20-GRITBLAST-AE.rvt
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PROJECT MANAGEMENT INITIALS: DESIGNER: CFL CHECKED: CC APPROVED: PDK ISO B1 707 x 1000mm
Last Plotted: 3/6/2024 10:33:06 AM
Filename: BIM 360://BP-AMER(CAN) 60678205 - ONTC Gill Blast Bay/60678205-ACM-R20-GRITBLAST-E.rvt
E-101 LEGEND AND GENERAL NOTES

ELECTRICAL ABBREVIATIONS

1PH	SINGLE-PHASE
1P	1 POLE (2P,3P,4P, ETC.)
2/C	2 CONDUCTOR (3/C, 4/C, ETC.)
2W	2-WIRE (3W, 4W, ETC.)
3PH	THREE-PHASE

A

AC	ALTERNATING CURRENT
A/C	AIR CONDITIONING
ACT	ACTUATOR
AFF	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
A,AMP	AMPERE
AODA	ACCESSIBILITY FOR ONTARIANS WITH DISABILITIES ACT
ASM	AMBIENT SENSING MICROPHONE
AUTO	AUTOMATIC
AUX	AUXILIARY
AWG	AMERICAN WIRE GAUGE

B

BAC	BUILDING AUTOMATION CONTROL
BAT	BATTERY
BKR	BREAKER

C

C	CONDUIT
CB	CIRCUIT BREAKER
cd	CANDELA
CL	CEILING
CU	COPPER

D

DC	DIRECT CURRENT
DG	DIESEL GENERATOR
DM	DIGITAL METERING
DN	DOWN
DO	DOOR OPENERS
DS	DOOR SWITCH

E

E	EXISTING DEVICE/EQUIPMENT TO REMAIN
E/R	EXISTING DEVICE/EQUIPMENT TO BE RELOCATED OR REPLACED (AS NOTED)
EC	EMPTY CONDUIT
EF	EXHAUST FAN
ELEC	ELECTRICAL
ELEV	ELEVATION
EXP	EXPLOSION PROOF

F

FA	FIRE ALARM
FC	FAN CONTROL
FCP	FAN CONTROL PANEL
FU	FUSE

G

GEN	GENERATOR
GFI	GROUND FAULT INTERRUPTING
GFCI	GROUND FAULT CIRCUIT INTERRUPTER
GND	GROUND
GRS	GALVANIZED RIGID STEEL

H

HH	HAND HOLE
HT	HEIGHT
HTR	HEATER
HVAC	HEATING, VENTILATION, AIR CONDITIONING
HZ	HERTZ

I

INST	INSTANTANEOUS

J

JB	JUNCTION BOX

K

kA	KILO AMPERE
KAIC	KILO AMPERE INTERRUPTING CAPACITY
kcmil	THOUSAND CIRCULAR MILS
kV	KILO VOLTS
kVA	KILOVOLT-AMPERES
kVAR	KILOVOLT-AMPERES REACTIVE

L

LP	LIGHTING PANEL

M

MTG	MOUNTING
MTD	MOUNTED

N

NC	NORMALLY CLOSED
NIC	NOT IN CONTRACT
NO	NORMALLY OPEN OR NUMBER
NTS	NOT TO SCALE

O

OBC	ONTARIO BUILDING CODE
OESC	ONTARIO ELECTRICAL SAFETY CODE
OL	OVERLOAD

P

P	POLE
PDO	POWER DOOR OPERATOR
PH	PHASE
PL	PLUG LOAD
PR	PAIR
PVC	POLYVINYL CHLORIDE

Q

QTY	QUANTITY

R

R	EXISTING DEVICES/EQUIPMENT TO BE REMOVED
REC	RECEPTACLE

S

SB	SOLAR LIGHT BOLLARD
SN	SOLID NEUTRAL
SW	SWITCH

T

TL	TWIST LOCK
TVSS	TRANSIENT VOLTAGE SURGE SUPPRESSOR
TW	TWISTED
TYP	TYPICAL

U

UG	UNDERGROUND
ULC	UNDERWRITERS LABORATORIES OF CANADA

V

V	VOLTS

W

W	WIRE
WG	WIRE GUARD
WP	WEATHER PROOF

X

XFMR	TRANSFORMER

LIGHTING

A #	CEILING MOUNTED LED FIXTURE. 'A' DENOTES TYPE, REFER TO SCHEDULE. '#' INDICATES CIRCUIT NUMBER
A #	CEILING MOUNTED LED FIXTURE. 'A' DENOTES TYPE, REFER TO SCHEDULE. '#' INDICATES CIRCUIT NUMBER
A #	BARE FLUORESCENT STRIP. 'A' DENOTES TYPE, REFER TO SCHEDULE. '#' INDICATES CIRCUIT NUMBER
A #	WALL MOUNTED LED FIXTURE. 'A' DENOTES TYPE. REFER TO SCHEDULE. '#' INDICATES CIRCUIT NUMBER
A #	WALL MOUNTED LIGHT FIXTURE. 'A' DENOTES TYPE, REFER TO SCHEDULE. '#' INDICATES CIRCUIT NUMBER
A #	STEP LIGHT. 'A' DENOTES TYPE, REFER TO SCHEDULE. '#' INDICATES CIRCUIT NUMBER
A #	CEILING MOUNTED LIGHT FIXTURE. 'A' DENOTES TYPE, REFER TO SCHEDULE. '#' INDICATES CIRCUIT NUMBER
WP #	WALL PACK OUTDOOR LIGHTING FIXTURE, 'WP' DENOTES TYPE, REFER TO SCHEDULE. '#' INDICATES CIRCUIT NUMBER
A A A	FIXTURE CONNECTED TO EMERGENCY LIGHTING CIRCUIT
A A A A	POLE MOUNTED LIGHT FIXTURE STANDARD TYPE, SINGLE, DOUBLE, THREE AND FOUR HEADS. 'A' DENOTES TYPE , REFER TO SCHEDULE
PC PC	PHOTOCELL - CEILING, WALL MOUNTED
V V	VISUAL SIGNAL FIXTURES - REFER TO SCHEDULE
$xx	120V, 15AMP SINGLE POLE TOGGLE SWITCH. XX INDICATES THE FOLLOWING: 3 = 3 WAY SWITCH 4 = 4 WAY SWITCH F = FAN SWITCH K = KEY SWITCH L = LOW VOLTAGE SWITCH M = MASTER PROOF P = PROJECTION SCREEN SWITCH T = TIMER SWITCH DIM = DIMMER MB = MOTORIZED BLINDS SWITCH OR = OVERRIDE 20 = 20 AMP EF = EXHAUST FAN SWITCH WITH RED PILOT LIGHT OS = OCCUPANCY SENSOR OSD = OCCUPANCY SENSOR WITH DIMMING WP = WEATHER PROOF
$ $ $	SWITCH - TWO, THREE & FOUR GANG
LC	LIGHTING CONTACTOR
	WALL MOUNTED EMERGENCY LIGHTING C/W SINGLE REMOTE HEAD CONNECTED TO EMERGENCY BATTERY UNIT AS INDICATED.
	WALL MOUNTED EMERGENCY LIGHTING C/W DOUBLE REMOTE HEADS CONNECTED TO EMERGENCY BATTERY UNIT AS INDICATED.
	EMERGENCY BATTERY UNIT C/W HEADS AS INDICATED
BU-1	EMERGENCY BATTERY UNIT C/W HEADS AS INDICATED & RECEPTACLE
	EMERGENCY BATTERY UNIT C/W HEADS AS INDICATED & RECEPTACLE & EXIT SIGN
	RECESSED CEILING MOUNTED EMERGENCY LUMINAIRES SINGLE REMOTE HEAD.
	EXIT SIGN, SINGLE FACE, WALL MOUNTED
	EXIT SIGN, SINGLE FACE, CEILING MOUNTED, C/W DIRECTIONAL ARROWS
	EXIT SIGN, DUAL FACE, WALL MOUNTED, C/W DIRECTIONAL ARROWS
	EXIT SIGN, DUAL FACE, CEILING MOUNTED, C/W DIRECTIONAL ARROWS
	CEILING MOUNTED EXIT LIGHT SIGN, WITH EMERGENCY HEADS. ARROWS DENOTE DIRECTION

DIGITAL LIGHTING CONTROL

$D	DIGITAL MANUAL SWITCH
$DDIM	DIGITAL MANUAL DIMMING SWITCH
$S	DIGITAL MANUAL SCENE SWITCH
$D	WALL MOUNTED DIGITAL SWITCH AND OCCUPANCY SENSOR
$DIM	WALL MOUNTED DIGITAL LIGHTING DIMMING SWITCH AND OCCUPANCY SENSOR
C O	C INDICATES - CLOSED LOOP SINGLE ZONE DIGITAL PHOTOSENSOR O INDICATES - OPEN LOOP SINGLE ZONE DIGITAL PHOTOSENSOR
PL 2	DIGITAL LIGHT MANAGEMENT PLUG LOAD CONTROLLER, 2 = TWO RELAY CIRCUITS
RC3-1 D	DIGITAL LIGHTING ROOM CONTROLLER RC3 = 3 RELAY CIRCUITS RC2 = 2 RELAY CIRCUITS RC1 = 1 RELAY CIRCUITS D = DIMMING CAPABILITY
OS IR OS US	WALL, CEILING MOUNTED OCCUPANCY SENSOR. X INDICATES: D = DUAL TECHNOLOGY DIGITAL OCCUPANCY SENSOR IR = INFRARED SENSOR US = ULTRASONIC
ZC	DIGITAL LIGHT MANAGEMENT ZONE CONTROLLER PANEL

LIGHTNING PROTECTION & GROUNDING

OR	20mm X 3000mm GROUND ELECTRODE
	GROUND ROD IN TEST WELL
	GROUND ROD W/C INSPECTION WELL
— — G — —	GROUNDING CONDUCTOR, SIZE AS INDICATED
— —	GROUNDING CONNECTION (TYPE AS SHOWN OR NOTED)
	GROUND BONDING POINT TO STEEL STRUCTURE, REBAR, PIPE, ETC.
	GROUND BAR
NGR	NEUTRAL GROUNDING RESISTOR
	DOWNLEAD CONDUCTOR LIGHTNING TERMINAL

POWER

A A	PANELS, RECESSED OR SURFACE MOUNTED. 'A' DENOTES PANEL NAME.
J	120V-1P CONNECTION TO EQUIPMENT AS NOTED C/W DISCONNECT SWITCH
	DIRECT CONNECTION TO EQUIPMENT
	THREE PHASE DIRECT CONNECTION TO EQUIPMENT
J	DISCONNECT SWITCH
J	COMBINATION MAGNETIC LOOSE STARTER
F J	FUSED DISCONNECT
J	COMBINATION MAGNETIC STARTER
	MANUAL STARTER
	LOOSE MOTOR STARTER
M	1-PHASE MOTOR CONNECTION
M	3-PHASE MOTOR CONNECTION
DO	ELECTRIC DOOR OPERATOR PUSHBUTTON
JB	JUNCTION BOX
JB	ARROW INDICATES CONDUIT & WIRING "HOME RUN". REFER TO SINGLE LINE OR SCHEMATIC
PB	PULL BOX
XX	20A, 120V, DUPLEX RECEPTACLE (CSA 5-20R) OR AS NOTED. XX INDICATES THE FOLLOWING: A ABOVE COUNTER TOP AC HVAC CONTROL CONNECTION ABOVE CEILING DW DISHWASHER M MICROWAVE MB MOTORIZED BLIND (HEIGHT TO BE CONFIRMED WITH THE BLINDS CONTRACTOR) P PRINTER REF REFRIGERATOR TV TELEVISION V VENDING XP EXPLOSION PROOF
XX	20A, 120V, GROUND FAULT INTERRUPTING DUPLEX RECEPTACLE (CSA 5-20R) OR AS NOTED. XX INDICATES THE FOLLOWING WP WEATHER PROOF EEMAC TYPE 4 ENCLOSURE
20	20A, 120V, DUPLEX RECEPTACLE (CSA 5-20R
	240V RECEPTACLE
	20A, 120V, DUPLEX RECEPTACLE, SPLIT CIRCUIT (CSA 5-20R) OR AS NOTED
	20A, 120V, QUAD RECEPTACLE (2X CSA 5-20R) OR AS NOTED
	WALL MOUNTED SINGLE RECEPTACLE. AMPS, VOLTS AND CSA CONFIGURATION AS NOTED
	RECEPTACLE IS TO BE OF L12-20R
CUNG	CEILING MOUNTED DUPLEX RECEPTACLE
	FLOOR MOUNTED QUAD RECEPTACLE
	FLOOR MOUNTED DUPLEX RECEPTACLE
	FLOOR MOUNTED DUPLEX RECEPTACLE
	WALL FEED FOR POWER AND COMMUNICATIONS TO SYSTEM FURNITURE
	RACEWAY COMPUTER RECEPTACLE
	RECEPTACLE IN 3 COMPARTMENTS RACEWAYS
	BASEBOARD OR FAN-FORCED WALL HEATER
T	THERMOSTAT
	DIGITAL CLOCK
	DIGITAL CLOCKS (BACK TO BACK)
HP	HYDRO POLE
	MANHOLE
MH	MAINTENANCE HOLE
	HYDRO UTILITY METER
	UNDERGROUND CONDUIT

TV / COMMUNICATION

	TELEPHONE OUTLET - WALL, FLOOR, CEILING MOUNTED. PROVIDE 27mmC (1"C) FROM WALL 1G OUTLET BACKBOX TO ACCESSIBLE CEILING SPACE UNLESS OTHERWISE NOTED.
	(2) DATA OUTLET - WALL, FLOOR, CEILING MOUNTED. PROVIDE 27mm C (1"C) FROM WALL 1G OUTLET BACKBOX TO ACCESSIBLE CEILING SPACE UNLESS OTHERWISE NOTED.
	DATA / TELEPHONE OUTLET - WALL, FLOOR, CEILING MOUNTED. PROVIDE 27mm C (1"C) FROM WALL 1G AND OUTLET BACKBOX TO ACCESSIBLE CEILING SPACE UNLESS OTHERWISE NOTED.
	CABLE TELEVISION OUTLET
	TELECOMMUNICATION CABLING TRAY
	TELECOMMUNICATION CABLING 'J-HOOKS' (INSTALLED AT MAXIMUM 1220mm O/C)
TV	TV OUTLET. PROVIDE 21mmC (3/4")C FROM WALL OUTLET TO ACCESSIBLE CEILING SPACE UNLESS OTHERWISE NOTED.

SECURITY

	SURVEILLANCE CAMERA (PTZ = PAN TILT ZOOM)
	PTZ CCTV CAMERA
SWITCH	ETHERNET SWITCH
KP	KEY PAD
CR	CARD READER
DC	DOOR CONTACT
ES	ELECTRIC STRIKE
IC	INTERCOM UNIT
C	CONTACTOR
MD	MOTION DETECTOR
TS	24HR, 7-DAY ELECTRONIC TIME SWITCH, 20A, 120V
WAP	WIRELESS ACCESS POINT
S S	PUBLIC ADDRESS SPEAKER - CEILING, WALL MOUNTED
S	PUBLIC ADDRESS HORN

SINGLE LINE DIAGRAM

	FUSE
	FUSED DISCONNECT
	DISCONNECT SWITCH
	CIRCUIT BREAKER
	DRAW-OUT CIRCUIT BREAKER
	TRANSFORMER
	PT - POTENTIAL TRANSFORMER
	CT - CURRENT TRANSFORMER
	GROUND CONNECTION
	TRANSFER SWITCH
XXX	PANEL BOARD
G	GENERATOR
AS VS	AMMETER & VOLTMETER SWITCHES
K E M	INTERLOCK: E = ELECTRIC INTERLOCK K = KIRK KEY INTERLOCK M = MECHANICAL INTERLOCK

FIRE ALARM

THIS IS A STANDARD LEGEND.
NOT ALL DEVICES MAY APPEAR ON THE DRAWINGS.
MTG HTG AS SHOWN UNLESS OTHERWISE NOTED.

		MTG HT.
	MANUAL PULL STATION	1200
	FIRE ALARM BELL	
	FIRE ALARM HORN	2300
	FIRE ALARM STROBE	2300
	FIRE ALARM HORN/STROBE	2300
	FIRE ALARM SPEAKER (WALL MOUNTED)	
	FIRE ALARM COMBINATION SPEAKER / STROBE (PENDANT, MOUNTED)	
	SMOKE DETECTOR (CEILING MOUNTED, UNLESS INDICATED OTHERWISE)	
	SMOKE DETECTOR - DUCT TYPE	
	SMOKE DETECTOR - BEAM TYPE	
	HEAT DETECTOR - CEILING, WALL MOUNTED - 135°F RATE OF RISE TEMPERATURE TYPE	
	HEAT DETECTOR - 190°F FIXED TEMPERATURE TYPE	
	HEAT DETECTOR - 285°F RATE OF RISE TEMPERATURE TYPE	
FACP	FIRE ALARM CONTROL PANEL	
ANNUN.	REMOTE FIRE ALARM ANNUNCIATOR PANEL	
	SPRINKLER FLOW SWITCH	
	SPRINKLER PRESSURE SWITCH	
	SPRINKLER TAMPER SWITCH	
	SPRINKLER SUPERVISORY SWITCH	
EOL	END OF LINE RESISTOR	
IM	ISOLATION MODULE	
WTM	WATER FLOW / TAMPER MODULE	
CM	CONTROL MODULE	
MM	FIRE ALARM DUAL MONITOR MODULE	
CO	CARBON MONOXIDE DETECTOR	

COMMON SYMBOLS

	EQUIPMENT OR DEVICE AS NOTED
AC1	EQUIPMENT TAG NO. MOUNTED ON WALL/FLOOR
AC-1	EQUIPMENT TAG NO. MOUNTED ON CEILING
1 & 1 & 1	ELECTRICAL NOTE TAGS
3 E03	DETAIL No.3 ON DRAWING E03

SITE SERVICE

FO FO	FIBER OPTIC
TC TC	TELECOM
IT IT	DATA
OH OH OH OH	OVER HEAD UTILITY POWER FEED
PWR-600V PWR-600V	600V POWER FEED
PWR-120V PWR-120V	120V POWER FEED
PWR-347V PWR-347V	347V POWER FEED
PWR-PF PWR-PF	TRANSFORMER PRIMARY FEED
PWR-SF PWR-SF	TRANSFORMER SECONDARY FEED

GENERAL NOTES

1. PERFORM ALL WORK IN ACCORDANCE WITH THE LATEST EDITION OF ALL APPLICABLE CODES, STANDARDS AND BULLETINS AND TO THE LOCAL AUTHORITIES REQUIREMENTS.
2. INFORMATION REPRESENTED ON THESE DRAWINGS IS FROM VISUAL FIELD REVIEW. AECOM AND ITS REPRESENTATIVES ARE NOT RESPONSIBLE FOR ANY DISCREPANCIES AND/OR ERRORS. THE CONTRACTOR SHALL VERIFY THE SCOPE OF WORK PRIOR TO PROCEEDING.
3. THE DRAWINGS SHALL BE READ IN CONJUNCTION WITH THE SPECIFICATIONS AND THE DOCUMENTS PERTAINING TO THE WORK OF OTHER TRADES.
4. OBTAIN EXACT DIMENSIONS FROM SITE MEASUREMENTS. DO NOT SCALE THESE DRAWINGS.
5. PENETRATIONS TO EITHER FIRE AND/OR SMOKE BARRIERS SHALL BE SLEEVED AND SEALED AGAINST THE PASSAGE OF FLAME AND/OR SMOKE WITH A SUITABLE NON-COMBUSTIBLE MATERIAL EQUAL TO THE CONSTRUCTION PENETRATED.
6. CHECK AND VERIFY THE LOCATIONS OF ALL PANELBOARDS, DISCONNECTS, RECEPTACLES, CONDUITS AND EQUIPMENT WITH THE WORK OF OTHER TRADES TO PREVENT INTERFERENCE. REMOVAL AND RELOCATION OF ANY SUCH WORK INTERFERING WITH THE WORK OF OTHER TRADES IS THE RESPONSIBILITY OF THE ELECTRICAL TRADE(S), UNLESS OTHERWISE APPROVED IN WRITING.
7. PROVIDE ACCESS DOORS AS REQUIRED FOR ALL CONCEALED SERVICEABLE COMPONENTS LOCATED ABOVE, BEHIND OR BELOW INACCESSIBLE CONSTRUCTION.
8. RESTORE ALL SURFACES TO PRE-CONSTRUCTION STATE OR AS SHOWN ON LANDSCAPE SITE PLANS, FOLLOWING TRENCHING AND UNDERGROUND DUCT WORK.

GENERAL DEMOLITION NOTES

1. AFTER RENOVATING EXISTING ELECTRICAL WORK, THE CONTRACTOR SHALL INSURE THAT ALL REMAINING EQUIPMENT WILL OPERATE PROPERLY.
2. DEMOLITION WORK SHALL BE SUBJECT TO DIRECTION AND APPROVAL OF THE OWNER OR THE OWNER'S REPRESENTATIVE, AND SHALL NOT INTERFERE WITH ACTIVITIES IN OTHER BUILDING AREAS. REMOVED MATERIALS, UNLESS OTHERWISE SPECIFICALLY DESIGNATED, SHALL BE PROMPTLY REMOVED. SHUTDOWNS OR SERVICE INTERRUPTIONS REQUIRED SHALL BE COORDINATED WITH AND APPROVED BY THE OWNER BEFORE THEY ARE IMPLEMENTED. SUFFICIENT ADVANCE NOTICE, A MINIMUM OF TEN (10) WORKING DAYS, MUST BE PROVIDED TO THE OWNER.
3. COORDINATE ELECTRICAL DEMOLITION WORK WITH OTHER DISCIPLINES AS SHOWN ON THE ASSOCIATED DISCIPLINE CONTRACT DOCUMENTS. REFER TO CONTRACT DOCUMENTS OF OTHER DIVISIONS FOR QUANTITIES AND LOCATIONS OF EQUIPMENT BEING ABANDONED OR REMOVED WHICH WILL REQUIRE DEENERGIZATION AND REMOVAL IN ANY AREA REQUIRING THE PERFORMANCE OF ANY TRADE'S WORK, CONTRACTOR SHALL CAREFULLY REMOVE AND STORE ANY ELECTRICAL ITEMS IN PATH OF WORK, REINSTALLING AND RECONNECTING SAME AS REQUIRED IN ACCORDANCE WITH THE PLANS AND/OR AS DIRECTED AFTER COMPLETION OF OTHER TRADE'S WORK IN THAT AREA.
4. MAINTAIN AND RESTORE, IF INTERRUPTED BY REMOVALS OR IN PATH OF NEW CONSTRUCTION, ALL CIRCUITS, CONDUITS AND FEEDERS PASSING THROUGH AND SERVING UNDISTURBED AREAS (SHOWN OR NOT SHOWN).
5. WHERE EXISTING ELECTRICAL OR COMMUNICATION SERVICES ARE TO BE ABANDONED IN PLACE, SERVICES SHALL BE TERMINATED IN ACCORDANCE WITH THE OESC.
6. INVENTORY MAJOR ELECTRICAL ITEMS THAT ARE REMOVED AND PROVIDE A LIST TO THE OWNER FOR THEIR SELECTION OF ITEMS TO BE RETAINED, UNLESS OTHERWISE NOTED. ALL ITEMS REJECTED BY THE OWNER SHALL BECOME THE PROPERTY OF THE CONTRACTOR AND SHALL BE REMOVED FROM THE SITE.
7. PROTECT ALL REMAINING DEVICES, FIXTURES, CIRCUITRY, ETC. DURING CONSTRUCTION.
8. COORDINATE DEMOLITION WITH THE INSTALLATION OF NEW WORK. WHERE EXISTING CIRCUITS MADE AVAILABLE DUE TO DEMOLITION ARE TO BE RETAINED FOR REUSE, THE CONTRACTOR SHALL PROTECT THESE CIRCUITS DURING CONSTRUCTION.
9. REMOVE EACH ITEM OF EQUIPMENT, DEVICE, AND FIXTURE INDICATED ON DEMOLITIONPLANS AND ASSOCIATED CIRCUITRY BACK TO THE PROTECTIVE DEVICE IN THE PANEL,SWITCHBOARD, OR CONTROLLER, EXCEPT AS OTHERWISE INDICATED.
   a. ASSOCIATED CIRCUITRY SHALL BE DEFINED TO INCLUDE ALL RACEWAYS, CONDUCTORS, BOXES, WIRING DEVICES, PLATES, LAMPS, FIXTURES, SWITCHES, STARTERS, ETC. WHICH ARE ASSOCIATED WITH THE ITEM TO BE REMOVED.
   b. THE PROTECTIVE DEVICE SHALL REMAIN AS AN INTEGRAL PART OF THE EXISTING PANEL OR SWITCHBOARD. LABEL AS SPARE OR USE FOR NEW CIRCUITS AS INDICATED.
   c. CONTROLLERS IN EXISTING MOTOR CONTROL CENTERS SHALL REMAIN. LABEL AS SPARE OR USE FOR NEW CIRCUITS AS INDICATED.
   d. WHERE CONDUIT ASSOCIATED WITH AN ITEM TO BE REMOVED IS IN AN INACCESSIBLE AREA, SUCH AS ENCASED IN CONCRETE, THE INACCESSIBLE CONDUIT ONLY SHALL BE ABANDONED IN PLACE, UNLESS INDICATED TO BE REUSED. ALL CONDUCTORS SHALL BE REMOVED AND CONDUIT SHALL BE CUT OFF FLUSH AND SEALED OR CAPPED.
   e. WHERE SUCH INACCESSIBLE CONDUIT ENDS OR MUST BE TERMINATED IN FINISHED SPACE, REMOVE THE CONDUIT OF BOX TO BELOW THE FINISHED SURFACE OF WALL, CEILING OR FLOOR, FILL VOID WITH NON-SHRINKING GROUT AND FINISH TO MATCH SURROUNDING SURFACES.
10. WHERE A PORTION OF A CIRCUIT'S LOAD IS SCHEDULED TO BE REMOVED, REMOVE ONLY THAT PORTION ASSOCIATED WITH THE DEMOLISHED DEVICE TO A POINT WHERE THE REMAINING LOAD IS ACTIVE; MAINTAIN IN A GOOD OPERATING CONDITION.
11. WHERE EXTENSION OF AN EXISTING CIRCUIT IS REQUIRED, RUN CONDUIT AND WIRE (CONCEALED WHERE INDICATED) FROM THE CIRCUIT'S EXISTING LOCATION TO ITS NEW LOCATION.
12. WHERE AN ITEM OF EQUIPMENT IS INDICATED TO BE REMOVED AND RELOCATED, ANY ASSOCIATED CIRCUITRY, SWITCHES, DEVICES, ETC. SHALL ALSO BE REMOVED WITH THE EQUIPMENT. RELOCATE THE EQUIPMENT TO THE NEW LOCATION AND PROVIDE CONNECTION OF ALL ASSOCIATED ITEMS TO NEW OR EXTENDED CIRCUITRY AS INDICATED.

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REGISTRATION

KEY PLAN

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No.	DESCRIPTION	DATE
2	ISSUED FOR BUDGET - VALUE ENG	2024/03/11
1	ISSUED FOR TENDER	2023/09/29

PROJECT NUMBER

60678205

SHEET TITLE

LEGEND AND GENERAL NOTES

SHEET NUMBER

E-101

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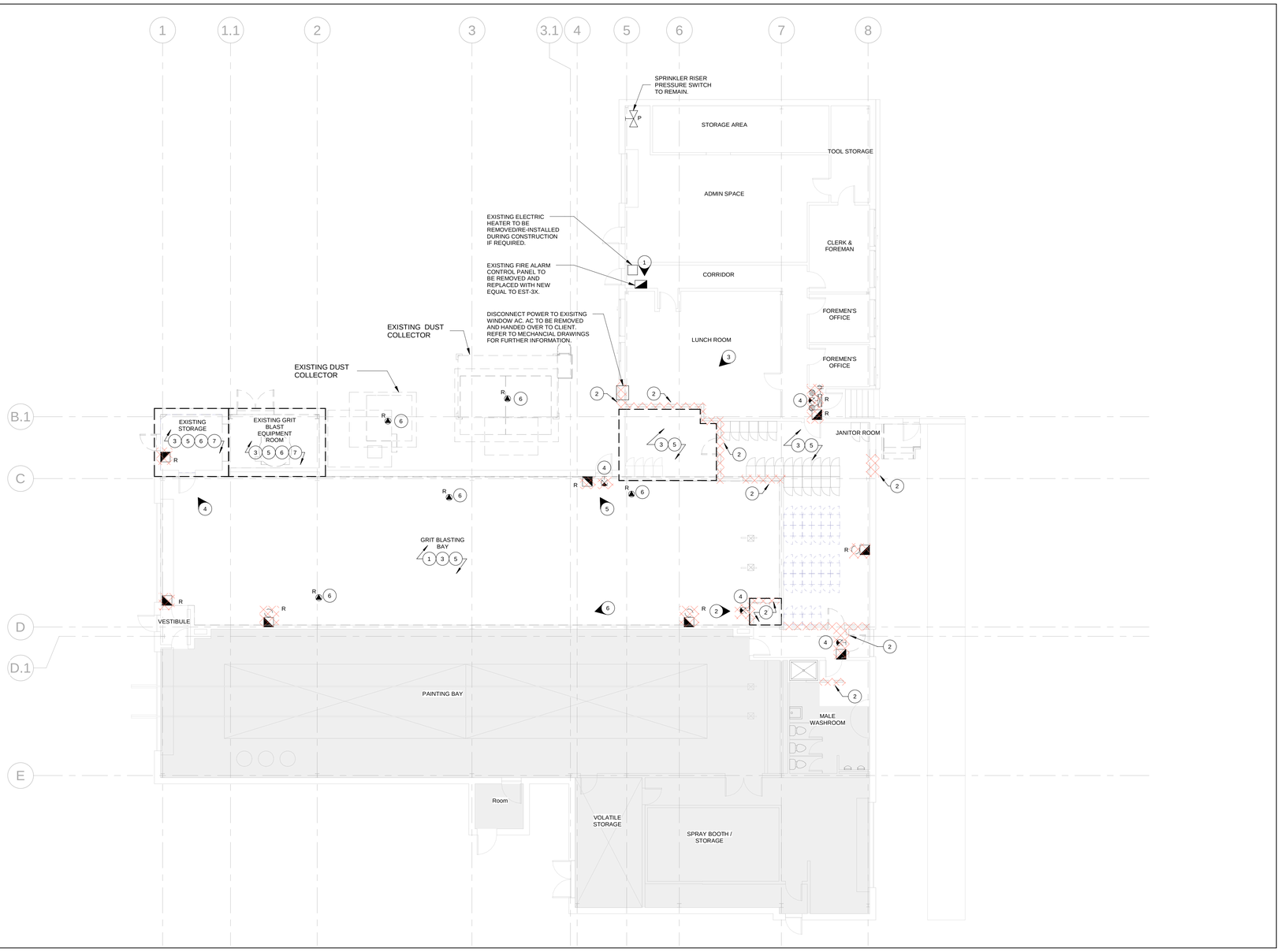


1 GROUND FLOOR POWER AND LIGHTING REMOVAL PLAN

E-201 | REF: 2 / E-302

Scale: 1 : 100

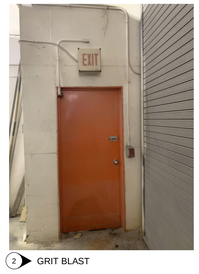
LEGEND

DENOTES EXTENT OF DEMOLITION

REMOVAL KEYNOTES

NUMBER	KEYNOTE
1	DISCONNECT AND REMOVE DEVICES WITHIN BLAST BAY, INCLUDING EXISTING LIGHTING FIXTURES AND FIRE ALARM DEVICES. TEST AND INSPECT EXISTING POWER OUTLETS AND MAKE GOOD AS REQUIRED.
2	TYPICAL: DISCONNECT AND REMOVE ELECTRICAL DEVICES AND WIRING TO SUPPORT DEMOLITION OF WALL.
3	DISCONNECT AND REMOVE EXISTING LIGHT FIXTURES, WIRING AND ASSOCIATED CONTROLS BACK TO SOURCE.
4	DISCONNECT AND REMOVE EXIT AND EMERGENCY LIGHT. TEST AND INSPECT EXISTING CIRCUIT. RETAIN CIRCUIT IF SUITABLE.
5	DISCONNECT AND REMOVE EXISTING FIRE ALARM DEVICES (BELLS, PULL STATION, ETC,), TO BE REPLACED WITH NEW. RETAIN WIRING IF SUITABLE, AND CONNECT TO NEW FIRE ALARM CONTROL PANEL.
6	DISCONNECT AND REMOVE WIRING FOR PROCESS AND MECHANICAL EQUIPMENT THROUGH CONTROL PANELS (INCLUSIVE OF DISCONNECTS AND MAINTENANCE RECEPTACLES WHERE APPLICABLE). COORDINATE REMOVALS WITH MECHANICAL TRADES.
7	NOTED AREAS ARE TO UNDERGO COMPLETE DEMOLITION. DISCONNECT AND REMOVE ALL ELELCTRICAL SYSTEMS AND DEVICES TO SUPPORT THIS DEMOLITION.

1 FIRE ALARM PANEL

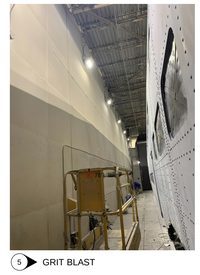


2 GRIT BLAST

3 LUNCH ROOM

4 GRIT BLAST

5 GRIT BLAST



5 GRIT BLAST

6 2ND FLOOR ELECTRICAL ROOM

PURPOSE, DESIGN INTENT AND SCOPE OF WORK:

EXISTING GRIT BLAST SHOP TO BE RENOVATED WITH NEW EQUIPMENT TO SUPPORT THE GRIT BLAST PROCESS, ALONG WITH REPLACEMENT OF EXISTING GRIT BLAST STORAGE AND EQUIPMENT ROOMS AND RENOVATIONS TO SUPPORT SPACES AROUND THE GRIT BLAST BAY. ELECTRICAL SCOPE OF WORK TO INCLUDE:

A. LIGHTING
- REMOVAL OF EXISTING LIGHTING AND LIGHTING CONTROLS WITHIN GRIT BLAST BAY AND OTHER NOTED AREAS OF WORK.
- PROVIDE NEW LIGHTING AND LIGHTING CONTROLS WITHIN GRIT BLAST BAY AND OTHER NOTED AREA OF WORK.

B. FIRE ALARM
- DISCONNECT AND REMOVE EXISTING FIRE ALARM DEVICES LOCATED WITHIN THE AREA OF WORK, TO BE REPLACED WITH NEW, AS INDICATED ON PLANS.
- DISCONNECT AND REMOVE EXISTING FIRE ALARM CONTROL PANEL AND REPLACE WITH NEW, EQUAL TO EST-3X. CONNECT EXISTING TO REMAIN, AND NEW DEVICES.
- PROVIDE COMPLETE FIRE ALARM TESTING AND VERIFICATION IN ACCORDANCE WITH THE LATEST EDITION OF ULC S537.
- PROVIDE INTEGRATED SYSTEMS TESTING IN ACCORDANCE WITH ULC S1001.

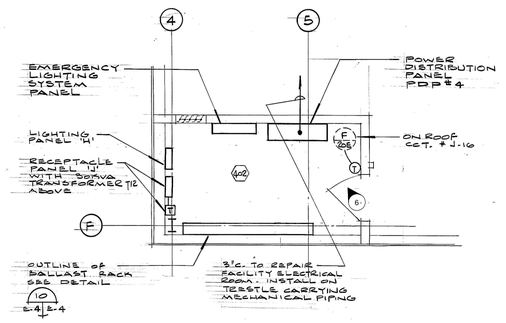
C. PUBLIC ACCESS
- DISCONNECT EXISTING PUBLIC ACCESS DEVICES TO SUPPORT CONSTRUCTION ACTIVITIES. RE-INSTATE PUBLIC ACCESS DEVICES ONCE CONSTRUCTION ACTIVITIES COMPLETE.

D. DISTRIBUTION
- PROVIDE NEW PANELBOARDS, TRANSFORMERS, STARTERS AND OTHER COMPONENTS AS ILLUSTRATED ON THE SINGLE LINE DIAGRAM.

E. POWER CONNECTION TO HVAC
- DISCONNECT POWER CONNECTION TO EXISTING HVAC UNITS BEING DEMOLISHED.
- PROVIDE CONNECTION TO NEW HVAC UNITS

F. POWER CONNECTION TO PROCESS EQUIPMENT
- DISCONNECT POWER CONNECTION TO EXISTING GRIT BLAST PROCESS EQUIPMENT BEING DEMOLISHED.
- PROVIDE POWER CONNECTION TO NEW GRIT BLAST EQUIPMENT.
- PROVIDE RECEPTACLES WITHIN AREA OF WORK SATISFYING OESC.
- ALL DEVICES INTENDED TO BE EXISTING TO REMAIN THAT ARE WITHIN THE AREA OF WORK SHALL BE TESTED, INSPECTED AND MADE GOOD AS REQUIRED.

G. POWER GENERAL/MISCELLANEOUS
- CARRY AN ALLOWANCE FOR ADDITIONAL RECEPTACLES (TO BE FED FROM SPARE BREAKERS AT PP-2A) AS FOLLOWS:
  - (2) IN RECLAIM ROOM
  - (2) IN M/E ROOM
  - (2) IN GRIT BLAST BAY



2 2ND FLOOR ELECTRICAL ROOM

E-201

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KEY PLAN

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No.	DESCRIPTION	DATE
2	ISSUED FOR BUDGET - VALUE ENG	2024/03/11
1	ISSUED FOR TENDER	2023/09/29

PROJECT NUMBER

60678205

SHEET TITLE

GROUND FLOOR POWER AND LIGHTING REMOVAL PLAN

SHEET NUMBER

E-201

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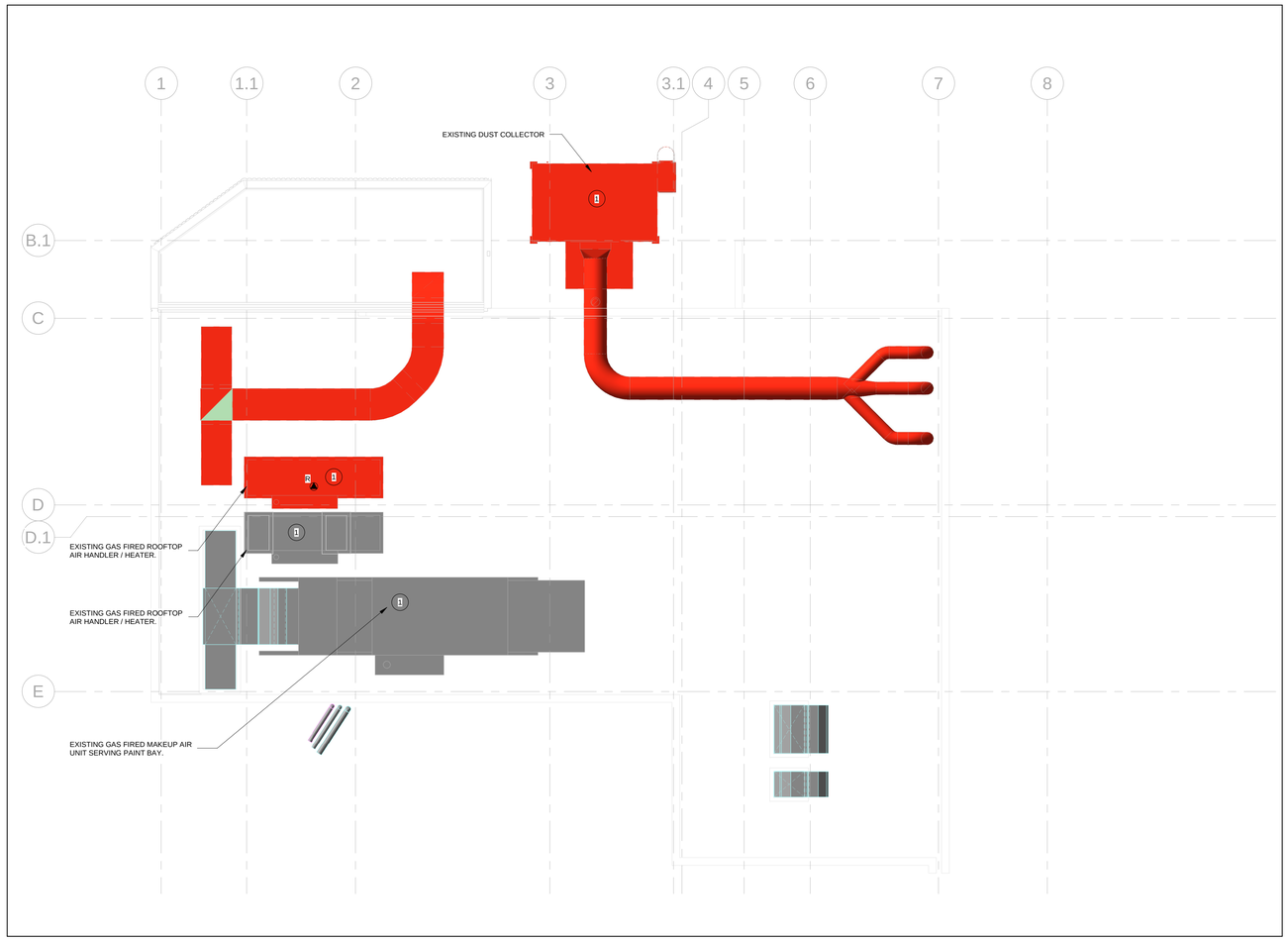

ROOF REMOVAL POWER PLAN KEYNOTES

NUMBER	KEYNOTE
1	DISCONNECT AND REMOVE WIRING FOR PROCESS AND MECHANICAL EQUIPMENT THROUGH CONTROL PANELS (INCLUSIVE OF DISCONNECTS AND MAINTENANCE RECEPTACLES WHERE APPLICABLE). COORDINATE REMOVALS WITH MECHANICAL TRADES.

1

ROOF REMOVAL POWER PLAN

E-202 | REF: 2 / E-302

Scale: 1 : 100

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PROJECT NUMBER

60678205

SHEET TITLE

ROOF REMOVAL POWER PLAN

SHEET NUMBER

E-202

E-202 ROOF REMOVAL POWER PLAN
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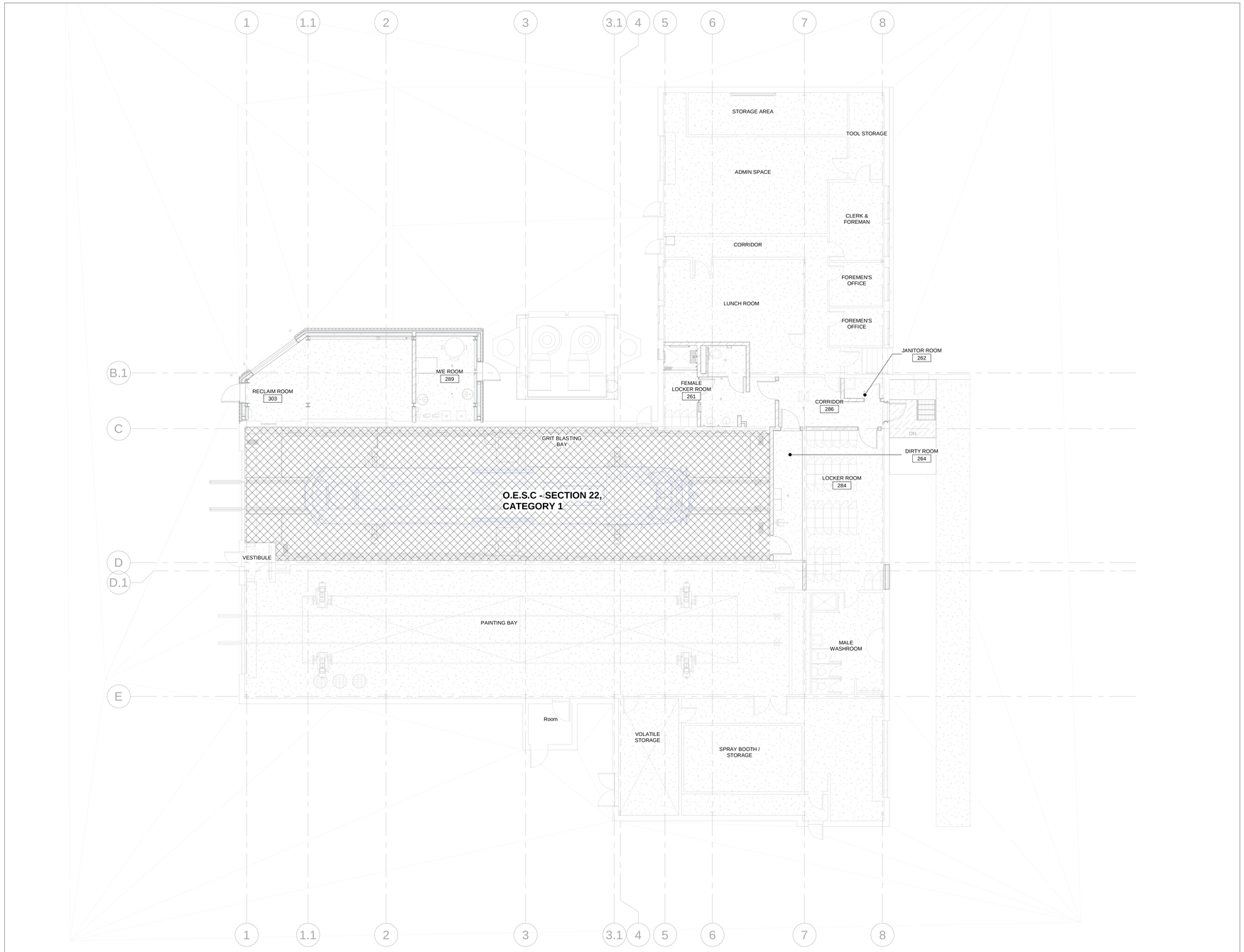

AREA CLASSIFICATION LEGEND

- O.E.S.C - SECTION 22, CATEGORY 1
- UNCLASSIFIED

1 | **GROUND FLOOR CLASSIFICATION PLAN**

E-301 | REF: 3 / E-302

Scale: 1 : 100

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SHEET TITLE

GROUND FLOOR CLASSIFICATION PLAN

SHEET NUMBER

E-301

E-301 GROUND FLOOR CLASSIFICATION PLAN
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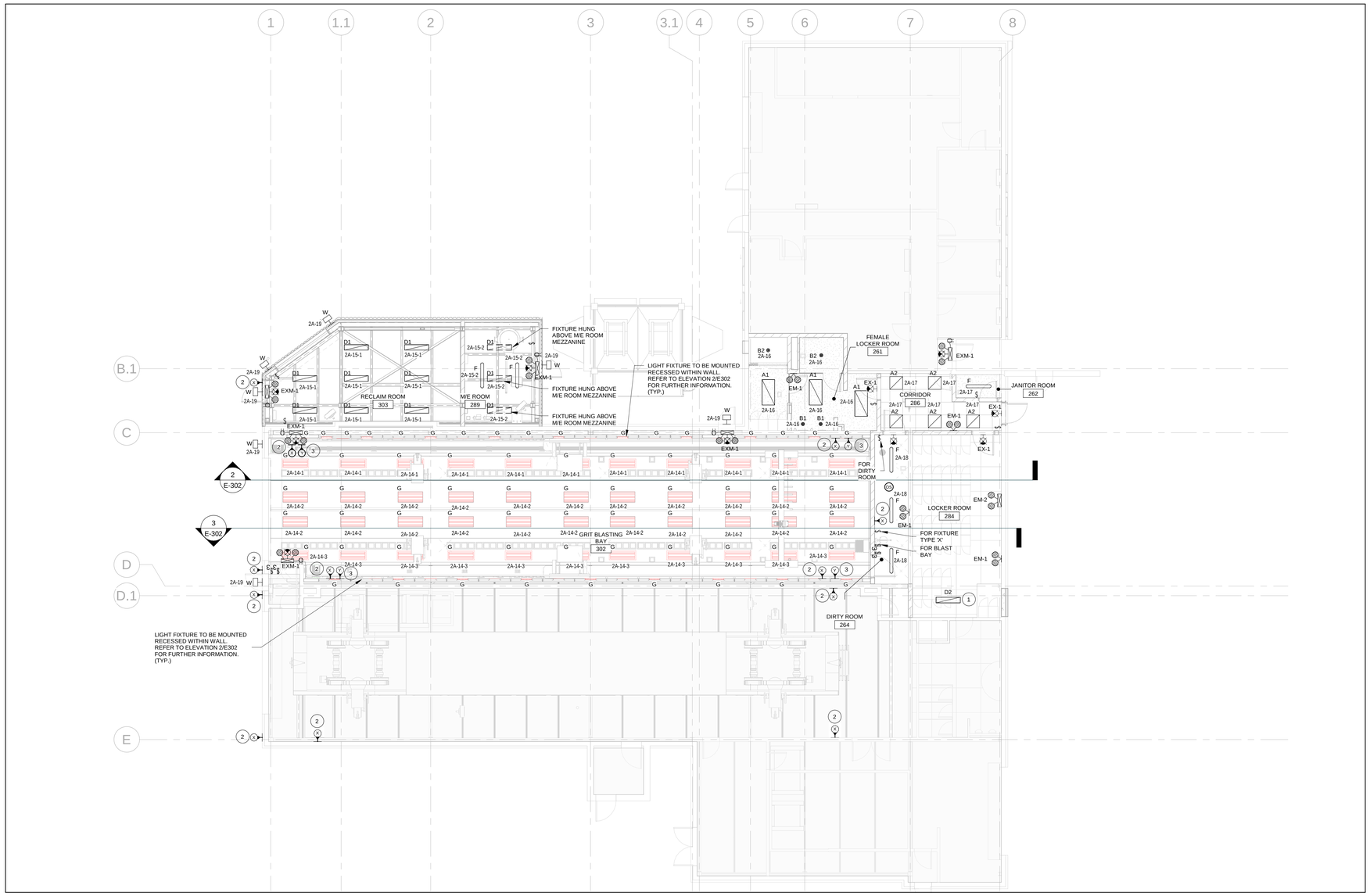
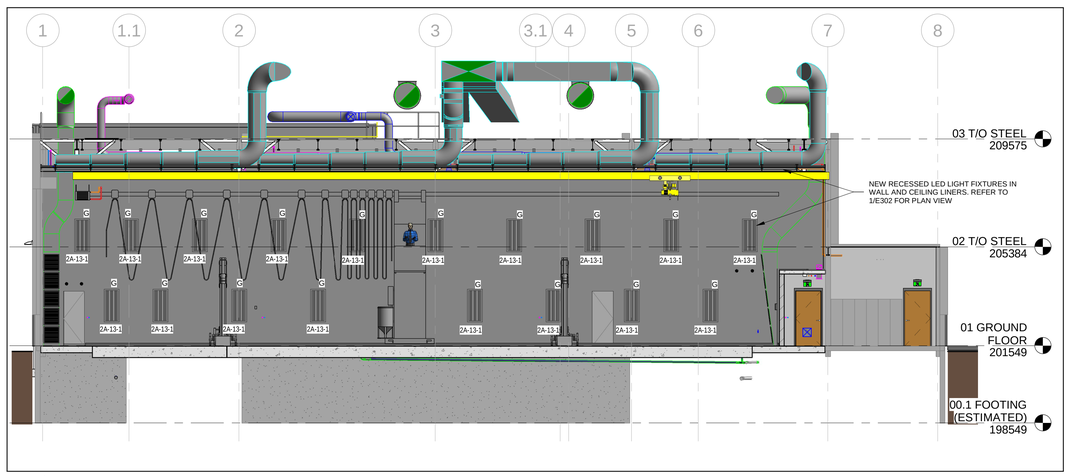


1 GROUND FLOOR LIGHTING PLAN

E-302 | REF: 2 / E-302

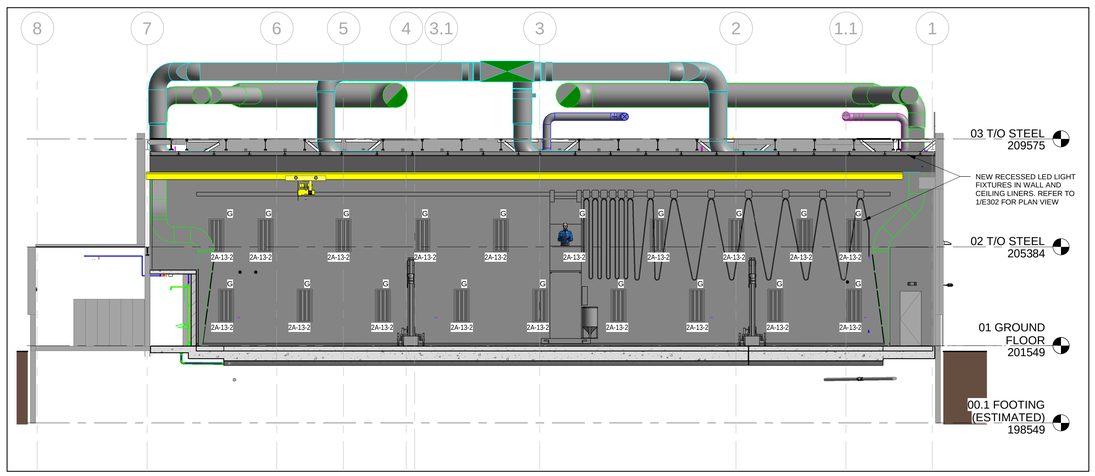
Scale: 1 : 96



2 ELEVATION 1- LIGHTING

E-302 | REF: 1 / E-302

Scale: 1 : 100



3 ELEVATION 2- LIGHTING

E-302 | REF: 1 / E-302

Scale: 1 : 100

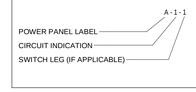
LIGHTING PLAN GENERAL NOTES:

1. REFER TO FIXTURE SCHEDULES AND LIGHTING CONTROL MATRIX FOR ADDITIONAL DETAILS.
2. PROVIDE ALL NECESSARY LIGHTING ACCESSORIES, POWER PACKS, EMERGENCY LIGHTING RELAY MODULES AND HARDWARE TO MAKE A COMPLETE LIGHTING SYSTEM AS ILLUSTRATED ON DRAWINGS.
3. ENSURE EXIT LIGHTS ARE VISIBLE BELOW ALL PIPING AND OBSTRUCTIONS.
4. COORDINATE ROUTING OF CONDUITS IN THE FIELD WITH OTHER TRADES TO SUIT SITE CONDITIONS.
5. COORDINATE FINAL FIXTURE LOCATIONS WITH MECHANICAL ELEMENTS ON SITE AND MAINTAIN CLEARANCES TO SUIT. ENSURE ADEQUATE LIGHTING PERFORMANCE THROUGHOUT.

LIGHTING PLAN KEYNOTES

NUMBER	KEYNOTE
1	INDICATED NEW LIGHT FIXTURE IS TO BE FED FROM SAME POWER SOURCE AS ADJACENT LIGHT FIXTURE WITHIN 'LOCKER ROOM 284'.
2	FIXTURE TYPE 'X' IS MANUALLY OPERABLE THROUGH A LINE VOLTAGE SWITCH, LOCATED IN THE DIRTY ROOM. COORDINATE FINAL LOCATIONS WITH ONTC REPRESENTATIVE. ALL FIXTURE TYPE 'X' SHALL BE FED FROM CIRCUIT 2A-48. PROVIDE LABEL ON SWITCH INDICATING INTENDED USE.
3	FIXTURE TYPE 'Y' SHALL ACTIVATE UPON OPERATION OF THE DUST COLLECTOR. CONNECT FIXTURE TO DUST COLLECTOR CONTROL PANEL SPARE "RUN STATUS" OUTPUT, THROUGH AN INTERPOSING RELAY. FEED FROM CIRCUIT 2A-50.

STANDARD CIRCUIT LABELING



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2	ISSUED FOR BUDGET - VALUE ENG	2024/03/11
1	ISSUED FOR TENDER	2023/09/29

PROJECT NUMBER

60678205

SHEET TITLE

GROUND FLOOR LIGHTING PLAN

SHEET NUMBER

E-302

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E-302 GROUND FLOOR LIGHTING PLAN
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APPROVED: PDK
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DESIGNER: CFL
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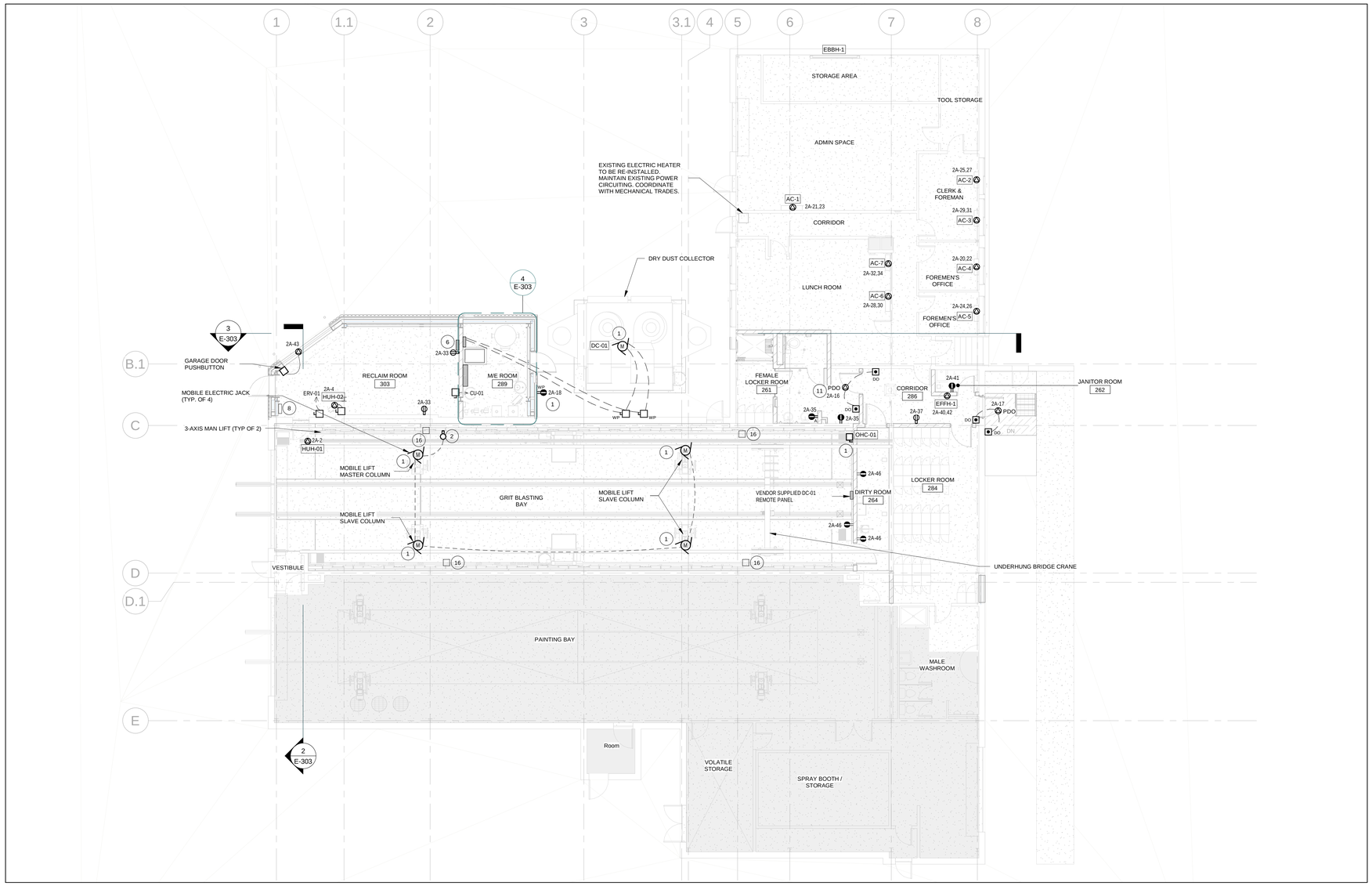


1 | E-303 | REF: 3 / E-302

GROUND FLOOR POWER PLAN

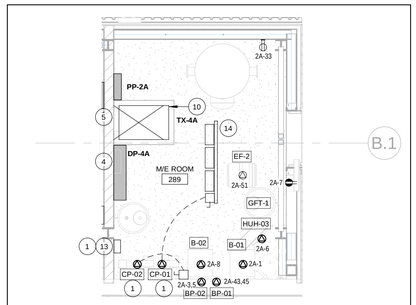
Scale: 1 : 100

POWER PLAN GENERAL NOTES

1. ALL CONDUIT PENETRATIONS THROUGH WALL MUST BE SEALED, SLEEVED, AND PROPERLY SUPPORTED ON EACH SIDE OF THE WALL.
2. COORDINATE ROUTING OF CONDUITS IN THE FIELD WITH OTHER TRADES TO SUITE SITE CONDITIONS.
3. ALL RECEPTACLES SHALL BE OF TYPE CSA 5-20R UNLESS NOTES OTHERWISE.

POWER PLAN KEYNOTES

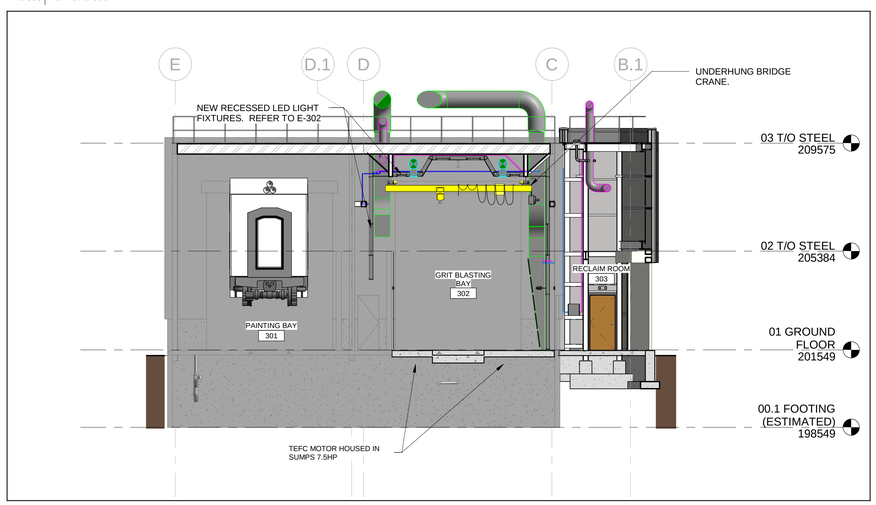
NUMBER	KEYNOTE
1	REFER TO ELECTRICAL SINGLE LINE DIAGRAM FOR 480V MECHANICAL EQUIPMENT CIRCUITING. TO BE FED FROM DP-4A. PRIOR TO ORDERING OF ELECTRICAL DISTRIBUTION, CONFIRM ALL POWER REQUIRMENTS WITH APPROVED SHOP DRAWINGS AND MECHANICAL TRADES.
2	PROVIDE L12-20R RECEPTACLE FOR LIFT JACK. COORDINATE REQUIREMENTS WITH APPROVED SHOP DRAWINGS AND MECHANICAL TRADES.
3	NOT IN USE
4	CP-01/CP-02 CONTROL PANEL WITH MOTOR STARTERS
5	DC-01 CONTROL PANEL
6	ERV-01 CONTROL PANEL
7	NOT IN USE
8	PROVIDE POWER CONNECTION TO PURIFIED BREATHING AIR ALARM SYSTEM. REFER TO MECHANICAL DRAWINGS FOR DETAILS. CIRCUIT: 2A-52.
9	NOT IN USE
10	PROVIDE A 100mm HOUSE KEEPING PAD FOR TX-4A
11	PROVIDE POWER CONNECTION TO POWER DOOR OPERATOR.
12	NOT IN USE
13	BOILERS AND PUMPS CONTROL PANEL
14	PROVIDE A C-CHANNEL UNISTRUT FRAMING FOR MOUNTING STARTERS IN THE CENTRE OF THE ROOM. MAINTAIN CLEARANCES PER OESC.
15	NOT IN USE
16	VENDOR SUPPLIED EMERGENCY STOP FOR VENDOR SUPPLIED EQUIPMENT 'DC-01'. PROVIDE WIRING FROM E-STOP BACK TO CONTROL PANEL. COORDINATE REQUIREMENTS WITH VENDOR.



4 | E-303 | REF: 1 / E-303

ENLARGED M/E ROOM

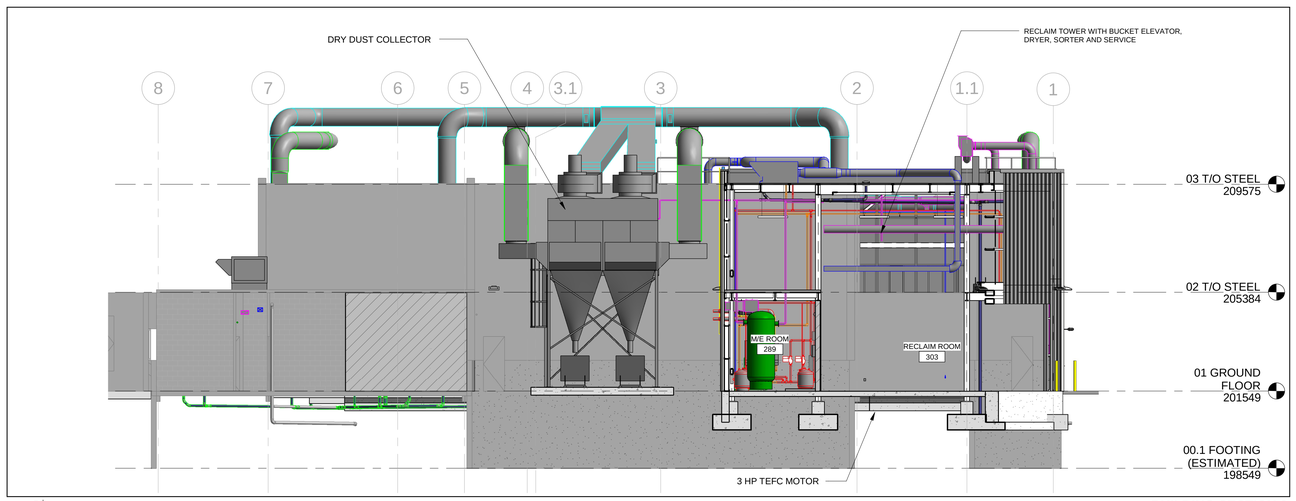
Scale: 1 : 50



2 | E-303 | REF: 1 / E-303

BUILDING SECTION 1

Scale: 1 : 100



3 | E-303 | REF: 1 / E-303

BUILDING SECTION 2

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PROJECT

BLAST BAY UPGRADE
915/916 McINTYRE ST. E, NORTH BAY, ON

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REGISTRATION

KEY PLAN

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ISSUE/REVISION

No.	DESCRIPTION	DATE
2	ISSUED FOR BUDGET - VALUE ENG	2024/03/11
1	ISSUED FOR TENDER	2023/09/29

PROJECT NUMBER

60678205

SHEET TITLE

GROUND FLOOR POWER PLAN

SHEET NUMBER

E-303

Filename: BIM 360://EP-AMER(CAN) 60678205 - ONTC Grit Blast Bay/60678205-ACM-R20-GRITBLAST-E.rvt
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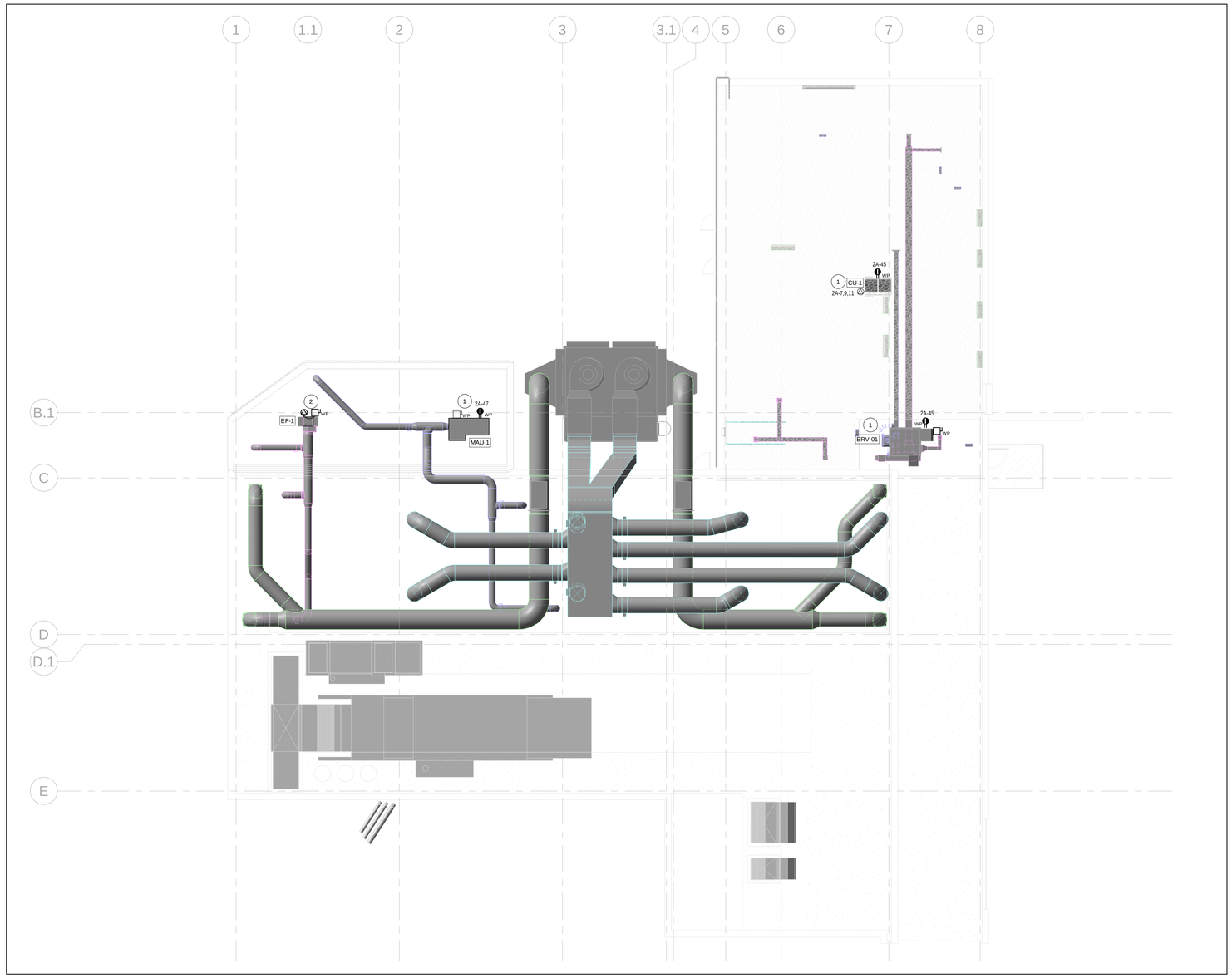

ROOF POWER PLAN KEYNOTES

NUMBER	KEYNOTE
1	PROVIDE WEATHER PROOF/ GROUND FAULT MAINTENANCE RECEPTACLE FOR MECHANCIAL UNITS ON ROOF TOP. CONTRACTOR TO ENSURE PROPER MOUNTING PROCEDURES OF RECEPECTACLE TO MECHANICAL UNITS.
2	MECHANICAL ITEM IS TO BE FED FROM 'DP-4A'. REFER TO SINGLE LINE DIAGRAM FOR FURTHER INFORMATION.

1 **ROOF POWER PLAN**

E-304 | REF: 2 / E-302

Scale: 1 : 100

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PROJECT

BLAST BAY UPGRADE
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2	ISSUED FOR BUDGET - VALUE ENG	2024/03/11
1	ISSUED FOR TENDER	2023/09/29

PROJECT NUMBER

60678205

SHEET TITLE

ROOF POWER AND FIRE ALARM PLAN

SHEET NUMBER

E-304

E-304 ROOF POWER AND FIRE ALARM PLAN
Last Plotted: 3/6/2024 10:33:48 AM
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DESIGNER: Designer
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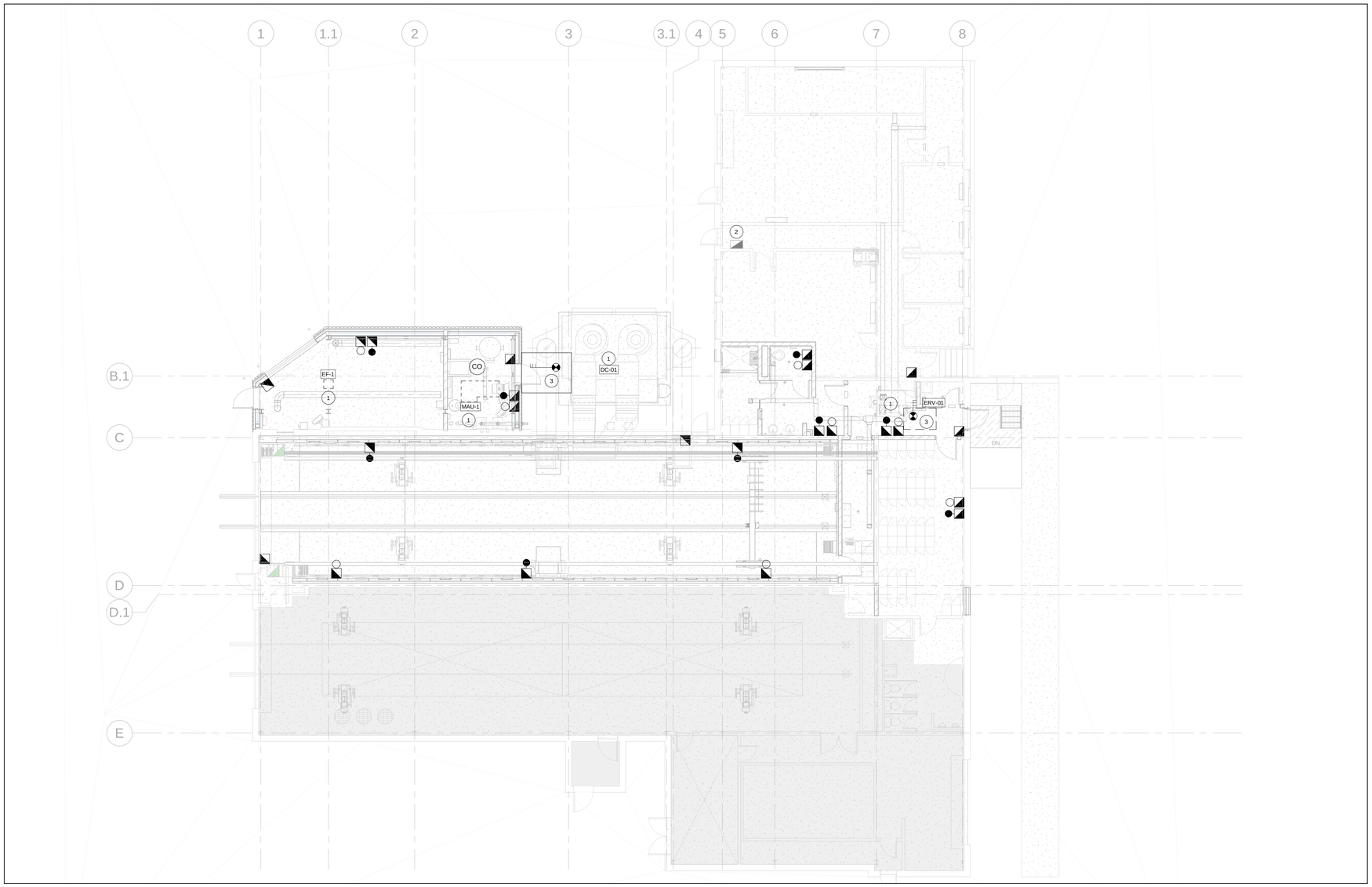

FIRE ALARM PLAN GENERAL NOTES

1. REFER TO E-201 FOR FIRE ALARM SYSTEM DESIGN INTENT.

FIRE ALARM PLAN KEYNOTES

NUMBER	KEYNOTE
1	DC-01, ERV-01, EF-1 AND MAU-1 SHALL BE TIED TO THE FIRE ALARM CONTROL PANEL. THIS EQUIPMENT SHALL SHUDOWN UPON A FIRE ALARM CONDITION.
2	REMOVE EXISTING FIRE ALARM CONTROL PANEL AND PROVIDE NEW EQUAL TO CAT #3X-SFS1B.
3	PROVIDE DUCT SMOKE DETECTORS ON RETURN DUCT OF ERV-01, HRV-01 AND DC-01

1 GROUND FLOOR FIRE ALARM PLAN

E-305 | REF: 3 / E-302

Scale: 1 : 100

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PROJECT

BLAST BAY UPGRADE
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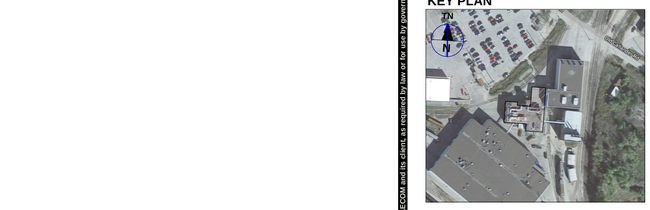
REGISTRATION

KEY PLAN



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No.	DESCRIPTION	DATE
2	ISSUED FOR BUDGET - VALUE ENG	2024/03/11
1	ISSUED FOR TENDER	2023/09/29

PROJECT NUMBER

60678205

SHEET TITLE

GROUND FLOOR FIRE ALARM PLAN

SHEET NUMBER

E-305

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FOR BACKGROUND FLOOR FIRE ALARM PLAN)
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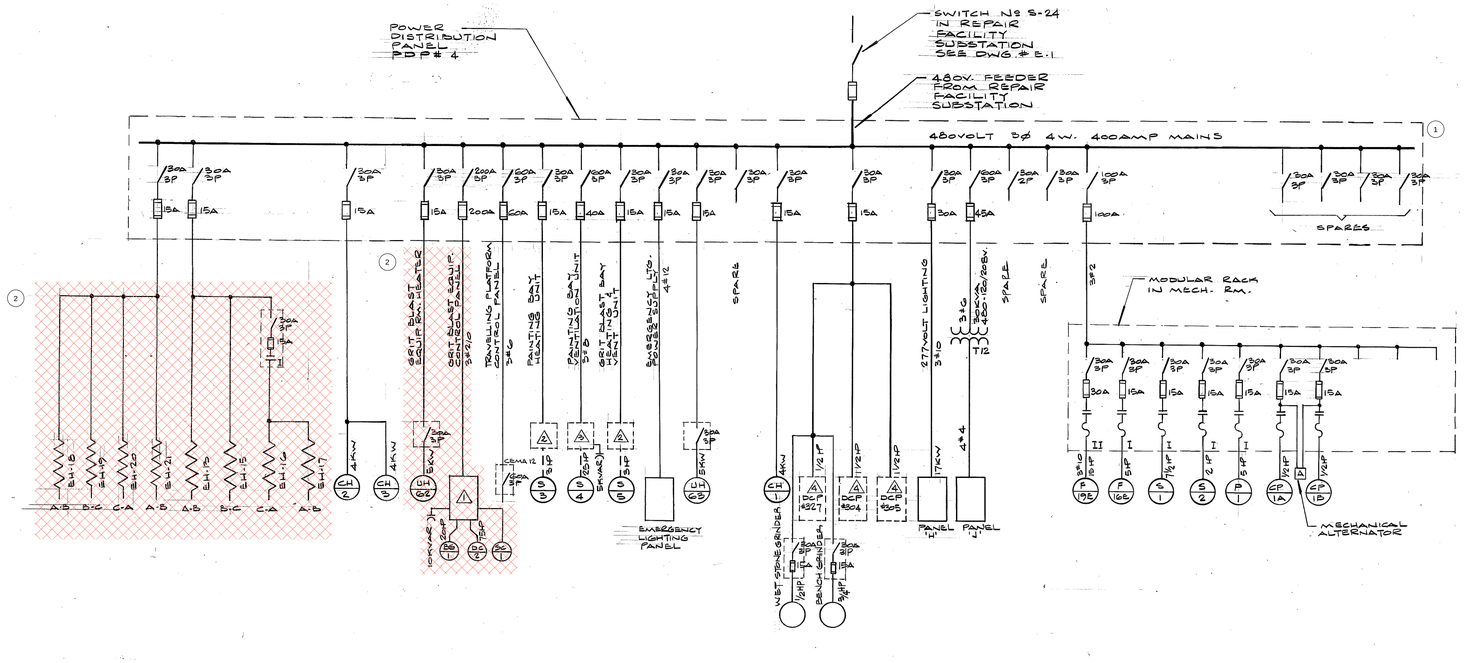
EXISTING SINGLE LINE DIAGRAM REFERENCED AS PREPARED BY COLE, SHERMAN & ASSOC. LIMITED, DWG 5473-E4, REV C, DATED: NOV-75



LEGEND

DENOTES EXTENT OF DEMOLITION

EXISITNG SINGLE LINE DIAGRAM KEYNOTES

NUMBER	KEYNOTE
1	EXISTING DISTRIBUTION PANELBOARD TO REMAIN. INSPECT, TEST AND MAKE GOOD AS REQUIRED.
2	DISCONNECT AND REMOVE LOAD. PRIOR TO DISCONNECTION, CONFIRM THAT LOAD IS NOT IN USE. MAKE SAFE.

AECOM

PROJECT

BLAST BAY UPGRADE
915/916 McINTYRE ST. E, NORTH BAY, ON

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REGISTRATION

KEY PLAN

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No.	DESCRIPTION	DATE
2	ISSUED FOR BUDGET - VALUE ENG	2024/03/11
1	ISSUED FOR TENDER	2023/09/29

PROJECT NUMBER

60678205

SHEET TITLE

EXISITNG / REMOVAL SINGLE LINE DIAGRAM

SHEET NUMBER

E-401

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EXISTING / REMOVAL SINGLE LINE DIAGRAM

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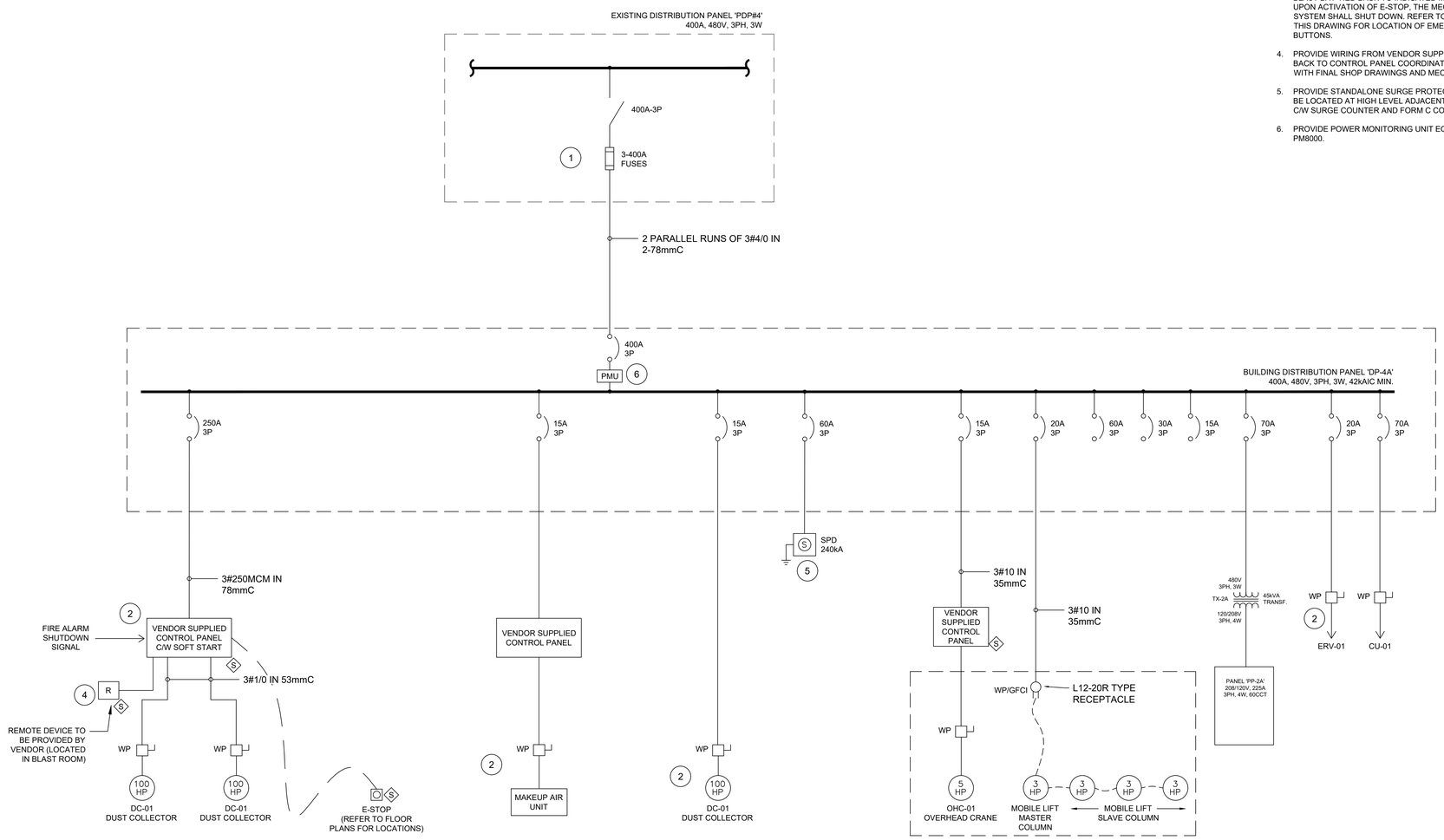

DISTRIBUTION RISER DIAGRAM

KEYED NOTES:

1. PROVIDE NEW FUSED DISCONNECT AT EXISTING PDP#4. EXISTING PDP#4 IS MAKE: ITE, CAT NO.: V7F3604FRS.
2. PROVIDE FIRE ALARM CONTROL WIRING INTERLOCK TO EQUIPMENT CONTROL PANEL. EQUIPMENT TO SHUTDOWN UPON FIRE ALARM CONDITION.
3. PROVIDE A REMOTE MAINTAINED EMERGENCY STOP PUSH BUTTON COMPLETE WITH WIRING TO BE LOCATED AT GRIT BLAST BAY TIED BACK TO INDICATED MECHANICAL ITEM. UPON ACTIVATION OF E-STOP, THE MECHANICAL ITEM SYSTEM SHALL SHUT DOWN. REFER TO FLOOR PLANS WITHIN THIS DRAWING FOR LOCATION OF EMERGENCY STOP PUSH BUTTONS.
4. PROVIDE WIRING FROM VENDOR SUPPLIED REMOTE PANEL BACK TO CONTROL PANEL COORDINATE REQUIREMENTS WITH FINAL SHOP DRAWINGS AND MECHANICAL TRADES.
5. PROVIDE STANDALONE SURGE PROTECTION DEVICE (SPD) TO BE LOCATED AT HIGH LEVEL ADJACENT TO PP-4A. SPD SHALL C/W SURGE COUNTER AND FORM C CONTACTS.
6. PROVIDE POWER MONITORING UNIT EQUAL TO SQUARE D PM8000.

GENERAL NOTES:

A. ALL ITEMS ARE NEW UNLESS NOTED OTHERWISE.

B. REFER TO STAGING DOCUMENTS FOR VARIOUS TRANSITIONS AND PROPOSED CONSTRUCTION SEQUENCING.

C. USE FLEXIBLE WIRING (RATED FOR THE LOCATION) FOR FINAL CONNECTIONS TO MOTORS, FIXTURES AND OTHER VIBRATING EQUIPMENT.

D. GROUND ALL NON-CURRENT CARRYING ELECTRICAL SYSTEMS TO GROUND BUS IN THE ELECTRICAL ROOM USING EITHER GROUND CONDUCTORS IN TECK CABLE OR GROUND CONDUCTORS IN CONDUITS AND RACEWAYS.

E. ALL WIRING METHODS AND DEVICES WITHIN GRIT BLAST BAY SHALL COMPLY O.E.S.C. SECTION 22 CATEGORY 1.

F. REFER TO INSTRUMENTATION BLOCK DIAGRAMS AND MOTOR CONTROL SCHEMATICS FOR ADDITIONAL WIRING REQUIREMENTS.

G. ALL WIRING SHALL BE XLPE RW90 CU UNLESS NOTED OTHERWISE.

H. PROVIDE ALL INTERCONNECTING WIRING BETWEEN CONTROL PANELS, END EQUIPMENT AND EMERGENCY STOPS.

(S) DENOTES VENDOR SUPPLIED EQUIPMENT.

PROVIDE NEW 400A FUSED DISCONNECT TO BE TIED INTO EXISITNG PDP-4.

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PROJECT

BLAST BAY UPGRADE
915/916 McINTYRE ST. E, NORTH BAY, ON

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No.	DESCRIPTION	DATE
2	ISSUED FOR BUDGET - VALUE ENG	2024/03/11
1	ISSUED FOR TENDER	2023/09/29

PROJECT NUMBER
60678205

SHEET TITLE
NEW SINGLE LINE DIAGRAM

SHEET NUMBER
E-402

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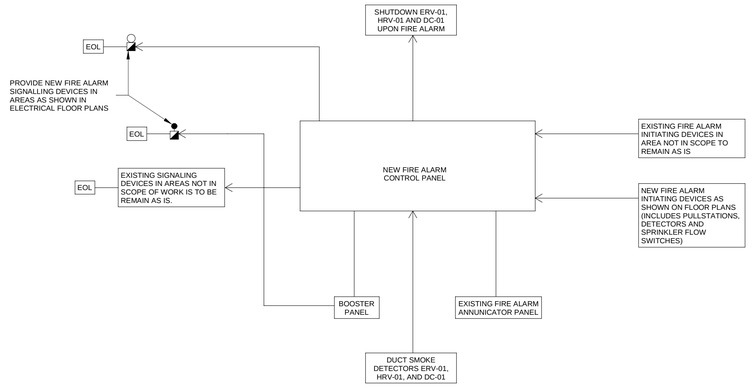

FIRE ALARM INTENT AND SCOPE OF WORK:

1. DISCONNECT AND REMOVE EXISTING FIRE ALARM DEVICES LOCATED WITHIN THE AREA OF WORK, TO BE REPLACED WITH NEW, AS INDICATED ON PLANS.
2. DISCONNECT AND REMOVE EXISTING FIRE ALARM CONTROL PANEL AND REPLACE WITH NEW, EQUAL TO EST-3X. CONNECT EXISTING TO REMAIN, AND NEW DEVICES.
3. PROVIDE COMPLETE FIRE ALARM TESTING AND VERIFICATION IN ACCORDANCE WITH THE LATEST EDITION OF ULC S537.
4. 4. PROVIDE INTEGRATED SYSTEMS TESTING IN ACCORDANCE WITH ULC S1001.

NOTES:

1. ENTIRE ALARM SYSTEM SHALL BE INSTALLED AND TESTED IN ACCORDANCE WITH CAN/ULC-S524 AND CAN/ULC S537, APPLICABLE EDITIONS. ALLOW FOR (2) TEST PERIODS TO SUIT PROJECT PHASING.
2. REFER TO FLOOR PLAN FOR ACTUAL QUANTITIES OF DEVICES.
3. REFER TO APPROVED SPRINKLER CONTRACTOR DRAWINGS FOR EXACT LOCATION AND QUANTITIES OF MONITORED SPRINKLER EQUIPMENT.
4. MOUNT MANUAL PULL STATIONS SO THAT THE CENTER IS 1200mm AFF.
5. MOUNT WALL MOUNTED AUDIBLE SIGNAL DEVICES SO THAT THE TOP IS NOT LESS THAN 150mm BELOW FINISHED CEILING AND LESS THAN 2300mm AFF.

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PROJECT

BLAST BAY UPGRADE
915/916 McINTYRE ST. E, NORTH BAY, ON

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1	ISSUED FOR TENDER	2023/09/29

PROJECT NUMBER

60678205

SHEET TITLE

FIRE ALARM RISER DIAGRAM

SHEET NUMBER

E-403

E-403 FIRE ALARM RISER DIAGRAM
Last Plotted: 3/6/2024 10:34:06 AM
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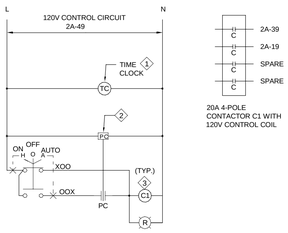
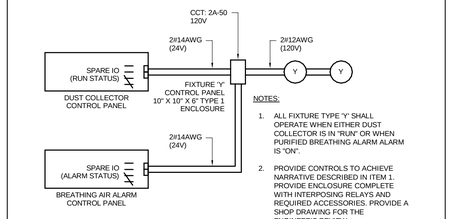


NOTES:

1. PROVIDE A 7-DAY 24-HOUR 120V TIMECLOCK EQUAL TO INTERMATIC, PART NO.: T1905. TIME CLOCK AND CONTRACTOR TO BE MOUNTED ABOVE ELECTRICAL PANEL UNLESS OTHERWISE SHOWN ON DRAWINGS.
2. PROVIDE A 120V PHOTOCELL EQUAL TO INTERMATIC PART NO.:K4136M. PHOTOCELL TO BE MOUNTED ON NORTH FACE OF BUILDING WITH WEATHERPROOF JUNCTION BOX.
3. PROVIDE 20A RATED CONTACTORS WITH 120V COILS. CONTACTORS TO BE MOUNTED BESIDE TIMECLOCK. PROVIDE SUFFICIENT CONTACT POLES FOR EACH LIGHTING CIRCUITS.

1 EXTERIOR LIGHTING CONTROL SCHEMATIC

E-501 Scale: N.T.S.



NOTES:

1. ALL FIXTURE TYPE 'Y' SHALL OPERATE WHEN EITHER DUST COLLECTOR IS IN "RUN" OR WHEN PURIFIED BREATHING ALARM ALARM IS "ON".
2. PROVIDE CONTROLS TO ACHIEVE NARRATIVE DESCRIBED IN ITEM 1. PROVIDE ENCLOSURE COMPLETE WITH INTERPOSING RELAYS AND REQUIRED ACCESSORIES. PROVIDE A SHOP DRAWING FOR THE ENGINEER'S REVIEW.

2 FIXTURE 'Y' CONTROL BLOCK DIAGRAM

E-501 Scale: N.T.S.

SITE LIGHTING FIXTURE SCHEDULE

TYPE	IMAGE	MANUFACTURER / MODEL	DESCRIPTION	INPUT WATTS	VOLT	CCT	LAMP	MOUNTING	CAT.#	NOTES
W		COOPER / GWC OR APPROVED EQUAL	4874 LUMEN	34W	120	4000	LED	WALL MOUNTED @ 9' (2743mm) UNLESS NOTED OTHERWISE	GWC-SA1A-740-U-SL2-AP-BPC-QA/RA1013	LED WALL MOUNT LIGHT FIXTURE C/W PHOTO CONTROL.

INTERIOR LIGHTING FIXTURE SCHEDULE

TYPE	IMAGE	MANUFACTURER / MODEL	DESCRIPTION	INPUT WATTS	VOLT	LAMP	MOUNTING	CAT.#	NOTES
A1		COOPER / METALUX 24AC OR APPROVED EQUAL	4620 LUMEN	40W	120	LED	CEILING RECESSED	24FPSL2SCT3 C/W DF-24W-U	2'x4' (609.6MMx1219.2MM) LED FLAT PANEL C/W DRYWALL FRAM KIT.
A2		COOPER / METALUX 22AC OR APPROVED EQUAL	2460 LUMEN	22W	120	LED	GRID RECESSED	22FPSL2SCT3	2'x2' (609.6MMx609.6MM) LED FLAT PANEL.
B1		COOPER / HALO COMMERCIAL OR APPROVED EQUAL	1271 LUMEN	15W	120	LED	RECESSED	SMD6R-12-9S-WH	6" (152.4MM) ROUND POT LIGHT. LIGHT FIXTURE IS WATER RESISTANT.
B2		COOPER / HALO COMMERCIAL OR APPROVED EQUAL	1271 LUMEN	15W	120	LED	RECESSED	SMD6R-12-9S-WH	6" (152.4MM) ROUND POT LIGHT. LIGHT FIXTURE IS WATER RESISTANT.
D1		COLUMBIA OR APPROVED EQUAL	5170 LUMEN	42W	120	LED	SUSPENDED	LXEM4-40ML-RA-EU C/W XEHC	4'x7" (1219.2MMx177.8MM) LED LIGHT FIXTURE C/W CHAIN HANGER KIT.
D2		COLUMBIA OR APPROVED EQUAL	5170 LUMEN	42W	120	LED	SUSPENDED	LXEM4-40ML-RA-EU C/W XEHC	4'x7" (1219.2MMx177.8MM) LED LIGHT FIXTURE C/W CHAIN HANGER KIT.
F		PEERLESS OR APPROVED EQUAL	4200 LUMEN	35W	120	LED	SUSPENDED	AP2W-4-42-40K-A1-LT-P-C6-N-MV	51.75"x6.75" (1314.45MMx171.45MM) LED LIGHT FIXTURE C/W 12FT POWER CORD.
G		LDPI	5450 LUMEN	43W	120	LED	RECESSED	LE485-43-V1-A-D1-4-WH-H	51.9"x13.06" (1318MMx332MM) LED RECESSED MOUNT FRONT ACCESS C/W TEMPERED GLASS LENS.

VISUAL FIXTURE SCHEDULE

TYPE	IMAGE	MANUFACTURER / MODEL	VOLT	LAMP	MOUNTING	CAT.#	NOTES
X		EDWARDS SIGNALING	120	LED	WALL MOUNTED @9'(2743mm)UNLESS NOTED OTEHRWISE	105XBRMB120A	
Y		EDWARDS SIGNALING	120	LED	WALL MOUNTED @9'(2743mm)UNLESS NOTED OTEHRWISE	105XBRMA120A	

LIGHTING CONTROLS MATRIX

SPACE TYPE	ROOM NAMES	MANUAL SWITCH	DIMMING	OCCUPANCY SENSING	PLUG LOAD CONTROL	SCHEDULE TIMER	NOTES
ENTRIES & CORRIDORS	CORRIDOR (286)			x		x	SCHEDULED DAY TIME FULL ON, SCHEDULED NIGHT TIME DIMMING TO 30%, AUTO FULL ON WITH OCCUPANCY SENSING OVERNIGHT.
LOCKER ROOM	LOCKER ROOM (284)	x		x			AUTO DIM TO 50% AFTER 150 SECONDS AND FULL OFF AFTER 5 MIN
DIRTY ROOM	DIRTY ROOM (264)	x					AUTO OFF AFTER 15 MIN, LOCAL CONTROL FOR RECESSED POT LIGHTS
JANITOR ROOM	JANITOR ROOM (262)	x		x			AUTO OFF AFTER 15 MIN, LOCAL CONTROL FOR RECESSED POT LIGHTS
FEMALE LOCKER ROOM	FEMALE LOCKER ROOM (261)	x		x			AUTO DIM TO 50% AFTER 150 SECONDS AND FULL OFF AFTER 5 MIN
SERVICE ROOM	M/E ROOM (289) RECLAIM (303)	x					
GRIT BLASTING BAY	GRIT BLAST BAY 302	x					(2) 3-WAY SWITCH BANKS AT ENTRY TO GRIT BLAST BAY

NOTES:
1. LIGHTING CONTROL DEVICES SHOWN ON NEW LIGHTING PLANS ARE DIAGRAMATIC. COORDINATE EXACT QUANITITIES AND LOCATION OF DEVICES AND EQUIPMENT WITH THE LIGHTING CONTROL SUPPLIER.
2. PROVIDE ROOM CONTROLLERS WITH APPLICABLE FEATURES TO MEET LIGHTING CONTROLS MATRIX REQUIREMENTS AND SPECIFICATIONS SECTION 26 09 24 - LIGHTING CONTROL DEVICES.
3. PROVIDE ONE (1) LIGHTING ZONE PER ROOM UNLESS INDICATED OTHERWISE ON THE LIGHTING PLANS.

EMERGENCY LIGHTING FIXTURE SCHEDULE

TYPE	IMAGE	MANUFACTURER / MODEL	DESCRIPTION	INPUT WATTS	VOLT	LAMP	MOUNTING	CAT.#	NOTES
EX-1		LUMACELL/ LD SERIES OR APPROVED EQUAL	SINGLE FACE EXIT SIGN	2.5W	120	LED	CEILING / WALL	LD1BAAC3	WALL OR CEILING MOUNTED AS PER SYMBOLS ON PLANS. TO BE CONNECTED TO EMERGENCY LIGHTING CURCUITS
EXM-1		LUMACELL/ LAC SERIES OR APPROVED EQUAL	SINGLE FACE COMBO EMERGENCY + EXIT LIGHT	12.5	120	LED	WALL	LAC1B12502LD9	TO BE CONNECTED TO EMERGENCY LIGHTING CURCUITS
EM-1		LUMACELL/ MQM SERIES OR APPROVED EQUAL	DOUBLE HEAD REMOTE LAMP	10W	120	LED	WALL	MQM2LD9	TO BE CONNECTED TO EMERGENCY LIGHTING CURCUITS
EM-2		LUMACELL/ RGC SERIES OR APPROVED EQUAL	DOUBLE HEAD REMOTE LAMP + BATTERY	10W	120	LED	WALL	RG12C722LD9ZD	TO BE CONNECTED TO EMERGENCY LIGHTING CURCUITS

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PROJECT

BLAST BAY UPGRADE
915/916 McINTYRE ST. E, NORTH BAY, ON

CLIENT

REGISTERED OWNER:
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REGISTRATION

KEY PLAN

SEE DRAWING FOR SCALE

ISSUE/REVISION

No.	DESCRIPTION	DATE
2	ISSUED FOR BUDGET - VALUE ENG	2024/03/11
1	ISSUED FOR TENDER	2023/09/29

PROJECT NUMBER

60678205

SHEET TITLE

SCHEDULES

SHEET NUMBER

E-501

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DESCRIPTION	Wire	BRK. LCK.	BREAKER	CONN. LOAD (W)	DIVER. FACTOR (%)	DEMAND LOAD (W)	CCT	PHASE	CCT	DEMAND LOAD (W)	DIVER. FACTOR (%)	CONN. LOAD (W)	BREAKER	BRK. LCK.	Wire	DESCRIPTION
B-01 GAS FIRED BOILER M/E RM.			20A-1P	120	0.75	90	1	A	2	100	1	100	20A-1P			HUH-01 HYDR. HEAT. BLAST BAY
BP-02			15A-2P	175	0.75	131.25	3	B	4	100	1	100	20A-1P			HUH-02 HYDR. HEAT. BLAST BAY
				175	0.75	131.25	5	C	6	100	1	100	20A-1P			HUH-03 HYDR. HEAT. BLAST BAY
GLYCOL FEEDER TANK REC.			20A-1P	300	0.75	225	7	A	8	120	1	120	20A-1P			B-02 GAS FIRED BOILER M/E RM.
BP-01			15A-2P	175	0.75	131.25	9	B	10	1200	1	1200	20A-1P			GRIT BLAST BAY LIGHTING
				175	0.75	131.25	11	C	12	1200	1	1200	20A-1P			GRIT BLAST BAY LIGHTING
GRIT BLAST BAY LIGHTING			20A-1P	1200	1	1200	13	A	14	500	1	500	20A-1P			FEMALE LOCKER RM. LTG.
MECH/ELEC RM. LTG.			20A-1P	400	1	400	15	B	16	500	1	500	20A-1P			DECONT. RM./LOCKER RM. LTG.
CORRIDOR LTG.			20A-1P	200	1	200	17	C	18	562.5	0.75	750	20A-1P			OUTDOOR MAINT. REC.
WALLPACK OUTDOOR LTG.			20A-1P	500	1	500	19	A	20	37.5	0.75	50	15A-2P			AC-04
AC-01			15A-2P	50	0.75	37.5	21	B	22	37.5	0.75	50				
				50	0.75	37.5	23	C	24	37.5	0.75	50	15A-2P			AC-05
AC-02			15A-2P	50	0.75	37.5	25	A	26	37.5	0.75	50				
				50	0.75	37.5	27	B	28	37.5	0.75	50	15A-2P			AC-06
AC-03			15A-2P	50	0.75	37.5	29	C	30	37.5	0.75	50				
				50	0.75	37.5	31	A	32	37.5	0.75	50	15A-2P			AC-07
M/E/RECLAIM RM. REC.			20A-1P	700	0.75	525	33	B	34	37.5	0.75	50				
FEMALE LOCKER RM. REC.			20A-1P	100	0.75	75	35	C	36	750	0.75	1000	15A-2P			EBBH-1 ELECTRIC HEATER
CORRIDOR REC.			20A-1P	300	0.75	225	37	A	38	750	0.75	1000				
OUTDOOR LIGHTING CONTROL			20A-1P	200	0.75	150	39	B	40	750	0.75	1000	15A-2P			EFFH-1
JANITOR RM. REC.			20A-1P	400	0.75	300	41	C	42	750	0.75	1000				
RECLAIM RM. MOTORIZED DOOR			60A-1P	5760	0.75	4320	43	A	44	90	0.75	120	15A-1P			BOILER CONTROLLER AND PUMP SEQUENCER
ROOFTOP MAINTENANCE RECEPTACLE			20A-1P	1200	0.75	900	45	B	46	562.5	0.75	750	20A-1P			DECONTAMINATION ROOM REC.
ROOFTOP MAINTENANCE RECEPTACLE			20A-1P	1200	0.75	900	47	C	48	900	0.75	1200	20A-1P			FIXTURE X
EXTERIOR LIGHTING CONTROL			20A-1P	700	0.75	525	49	A	50	900	0.75	1200	20A-1P			FIXTURE Y
EF-2			20A-1P	1500	0.75	1125	51	B	52	600	0.75	800	20A-1P			BREATHING AIR ALARM PANEL
CP-01			15A-2P	1000	0.75	750	53	C	54	750	0.75	1000	15A-2P			CP-02
				1000	0.75	750	55	A	56	750	0.75	1000				
						0	57	B	58	0						
						0	59	C	60	0						

PANEL ID:	PP-2A	**DEMAND LOAD A (W)**	11232.5	**NOTES:**
LOCATION:	ELEC/MECH. ROOM	**DEMAND LOAD B (W)**	7262.5	
PANEL SIZE:	60	**DEMAND LOAD C (W)**	7650	
MAINS:	225A	**TOTAL DEMAND LOAD (W)**	**26145**	
Main Breaker:	M.L.O.			
VOLTAGE:	120/208V			
PHASE:	3PH			
WIRE:	4W	**DEMAND CURRENT A (A)**	31.18	
LUGS:	LUGS	**DEMAND CURRENT B (A)**	20.16	
INT. RATING:	10 KA RMS SYS	**DEMAND CURRENT C (A)**	21.23	
MOUNTING:	RECESSED	**TOTAL DEMAND CURRENT (A)**	**72.57**	
ENCLOSURE:	NEMA 1			

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REGISTRATION

KEY PLAN

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60678205

SHEET TITLE

SCHEDULES

SHEET NUMBER

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PROJECT MANAGEMENT INITIALS: DESIGNER: Designer CHECKED: Checker APPROVED: Approver ISO B1 707 x 1000mm

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Ontario Northland Transportation Commission

Blast Bay Upgrade

Project No: 60678205
Issued for Budget Value Engineering – March 05, 2024

Project Manual

Delivering a better world

1.1 OWNER:

915 McIntyre Street East, North Bay, Ontario, P1B 1G2

1.2 PROJECT:

Ontario Northland Transportation Commission
Blast Bay Upgrade

1.3 PROFESSIONAL SEALS AND SIGNATURES

ARCHITECT (A) OF RECORD:

Gabriel Colombani OAA OAQ AAA
Architect of Record

September 29, 2023
Date

STRUCTURAL (S) ENGINEER OF RECORD:

Laith Hajsaid
Structural Engineer of Record

September 29, 2023
Date

MECHANICAL (M) ENGINEER OF RECORD:

Mechanical Engineer of Record

September 29, 2023
Date

ELECTRICAL (E) ENGINEER OF RECORD:

Electrical Engineer of Record

September 29, 2023
Date

TRACK (T) ENGINEER OF RECORD:

Civil Engineer of Record

September 29, 2023
Date

DIVISION 00	**PROCUREMENT AND CONTRACTING REQUIREMENTS**	
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DIVISION 01	**GENERAL REQUIREMENTS**	
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20 05 29	Hangers and Supports	M
20 05 33	Electric Pipe Tracing	M
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20 05 53	Labelling and Identification	M
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21 13 13	Wet Pipe Sprinkler Systems	M

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22 13 16	Drainage Wastes and Vent Piping	M
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23 05 16	Piping Expansion Compensation	M
23 05 17	Pipe Welding	M
23 21 13	Hydronic Piping	M
23 21 16	Hydronic Piping Specialties	M
23 21 23	Hydronic Pumps	M
23 30 00	HVAC Ducts and Plenums	M
23 30 01	Ducts – High Pressure Metal	M
23 33 00	Air Duct Accessories	M
23 34 00	HVAC Fans	M
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DIVISION 23	**HEATING, VENTILATING AND AIR CONDITIONING**	**DISCIPLINE**
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23 74 00	Custom Outdoor Makeup-Air Units	M
23 81 40	Heat Pumps Air Source	M
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DIVISION 26	**ELECTRICAL**	**DISCIPLINE**
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26 05 05	Basic Materials and Methods	E
26 05 21	Wires and Cables (0-1000V)	E
26 05 28	Grounding – Secondary	E
26 05 73	Electrical Systems Analysis	E
26 08 00	Electrical System Commissioning	E
26 09 24	Lighting Control Devices	E
26 12 16.01	Distribution Transformers (Dry Type)	E
26 22 18	Surge Protection Device	E
26 24 16.01	Panelboards Breaker Type	E
26 27 19	Multi-Outlet Assemblies	E
26 28 14	Fuses – Low Voltage	E
26 28 21	Moulded Case Circuit Breakers	E
26 28 23	Disconnect Switches Fused and Non-Fused	E
26 29 11	Motor Starters up to 600V	E
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26 50 00	Lighting	E
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DIVISION 28	**ELECTRONIC SAFETY AND SECURITY**	**DISCIPLINE**
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DIVISION 41	MATERIAL PROCESSING AND HANDLING EQUIPMENT	DISCIPLINE
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41 12 13	Used Blast Media Screw Conveyors	M
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41 22 10	Manual Chain Hoist and Trolley	M
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END OF SECTION

1 General

1.1 REFERENCE STANDARDS

.1 Conform to latest date of issue of referenced standards in effect on date of submission of bids, except where a specific date or issue is specifically noted.

1.2 SPECIAL PROJECT PROCEDURES

.1 Existing premises will maintain operation during business hours. Work may be performed during these hours. Carry out work in such a manner as to cause a minimum of noise and interference to the use of the existing building. Conform to the requirements of the building management. Be responsible for any overtime work required after business hours.

.2 Co-ordinate construction activities and use of premises with Owner and building management.

.3 Maintain operations of building services, data, telephone and alarm. Ensure no interruptions of these services during execution of the Work.

.4 Provide adequate protection against dust, water and other damages to Owner's electronic and computer equipment, fittings and furniture. Use covers acceptable to the Owner. Remove protection after each work period.

.5 Be responsible for temporary relocation and reinstatement of Owner's existing furniture and fittings required for the execution of the Work.

1.3 WORK PROVIDED BY OWNER OR PERFORMED UNDER SEPARATE CONTRACTS

.1 The term "NIC" means that work of this Project which is not being performed or provided by the Contract; the term means "Not In This Contract" or "Not a Part of The Work to be Performed or Provided by The Contractor".

.2 "NIC" work is specified and/or indicated on the Drawings as an aid to the Contractor in scheduling the amount of time and materials necessary for the completion of the Contract.

1.4 DIVISION OF WORK

.1 Work specified in the Specifications is divided into Sections for reference purposes only. Division of work between Contractor and Subcontractors is the Contractor's responsibility. The Owner and Consultant assume no responsibility to act as an arbitrator to establish subcontract limits between Sections or Divisions of the Work.

1.5 CASH ALLOWANCES

.1 Cash allowances, unless otherwise specified, cover net cost to Contractor of services, products, construction machinery and equipment, freight, handling, unloading, storage, installation and other authorized expenses incurred in performing the Work.

.2 The Contract Price, and not cash allowance, includes Contractor's overhead and profit in connection with such cash allowance.

.3 The Owner reserves the right to call competitive tenders for portions of the work to be paid for out of any or all cash allowances. The relationship of the Contractor and the trades performing portions of the work to be paid out of cash allowances shall be such as between the Contractor and his Subcontractors.

.4 Unexpended amounts of cash allowances maybe reallocated to other specific cash allowances at the sole discretion of the Consultant.

.5 Unexpended amounts of cash allowances shall be deducted from the Contract Price at completion of the Work.

.6 Amount of cash allowance of $35,000.00 (Thirty-Five Thousand Dollars) for the following Work:

.1 Supply and installation of door hardware.

.2 Testing and inspection for Owner's quality control, including but not necessarily limited to:

.1 Structural steel.

.2 Mechanical equipment.

.3 Electrical equipment.

.7 Amount of cash allowance of $30,000.00 (Thirty Thousand Dollars) for the following Work:

.1 Electrical items related to Process and Mechanical in the provision of additional control panels and associated wiring.

1.6 EXAMINATION OF EXISTING CONDITIONS

.1 Submission of bid shall be deemed evidence that Contractor has examined the site and is familiar with conditions under which work will be done and obtained all information which may be necessary for proper execution of Contract.

.2 Signing of Contract indicates acceptance by Contractor of conditions under which work will be done.

.3 Extra payments will not be authorized for work that could have been determined by a careful examination of site and existing conditions.

1.7 EXAMINATION OF SURFACES DURING CONSTRUCTION

.1 Before executing work against surfaces prepared by other Sections, examine such surfaces. Do not accept defective surfaces, or do any work to or on them, until the defects are remedied.

.2 Commencement of work shall indicate acceptance of surfaces and responsibility concerning the conditions of same.

1.8 EXISTING SERVICES

.1 Cut off, cap, divert or remove existing water, gas, electric and other services in areas being altered which are affected by the changes as required or as directed by the municipal authorities and the utility company concerned, and the Consultant. Protect and maintain active services to the existing building.

.2 If required by the Consultant, prepare interference and/or installation drawings showing the work of the various Sections as well as the existing installation, and submit these drawings to the Consultant for review before the commencement of work.

1.9 MAKING GOOD

.1 Make good materials and finishes which are damaged or disturbed during the process of demolition, additions and reconstruction under the Contract.

.2 Where existing work is to be made good, match new work exactly with the old work in material, form, construction and finish unless otherwise noted or specified.

.3 Protect work in the existing building, such as floors, finishes, trim, etc., as completely as possible to hold the replacing of damaged work to a minimum.

.4 Preparation for new finishes:

.1 Remove existing finishes, including painting.

.2 Fill cracks and depressions with suitable filler and finish smooth, as recommended by the manufacturer of the new finishes.

.3 Grind protrusions level with substrates and finish smooth.

.4 Remove all evidences of existing adhesive, grease, oil, soil and other encrustations of foreign material by washing, scraping and grinding if necessary.

.5 Clean and prepare substrates to receive new work.

1.10 CUTTING AND PATCHING

.1 Perform cutting, fitting, and patching to complete the Work.

.2 Remove and replace defective and non-conforming work.

.3 Perform work to avoid damage to other work.

.4 Prepare proper surfaces to receive patching and finishing.

.5 Cut rigid materials using power saw or core drill. Pneumatic or impact tools not allowed.

.6 Restore work with new products to match existing in accordance with Contract Documents.

.7 Fit work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

.8 At penetration of fire-rated wall, ceiling, or floor construction, completely seal voids with fire-rated material, full thickness of construction element to match rating of and compatible with adjacent construction.

.9 Refinish surfaces to match adjacent finishes; for continuous surfaces refinish to nearest intersection; for an assembly, refinish entire unit.

1.11 DISPOSAL OF WASTE

.1 General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

.1 Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.

.2 Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

.2 Burning: Do not burn waste materials.

.3 Disposal: Transport waste materials off Owner's property and legally dispose of them.

1.12 SALVAGING DEMOLITION WASTE

.1 Salvaged Items for Reuse in the Work:

.1 Clean salvaged items.

.2 Pack or crate items after cleaning. Identify contents of containers.

.3 Store items in a secure area until installation.

.4 Protect items from damage during transport and storage.

.5 Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.

1.13 RECYCLING CONSTRUCTION WASTE

.1 General: Separate recyclable materials by type from waste.

.2 Stockpile materials away from demolition area, do not intermix with other materials.

.3 Packaging:

.1 Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.

.2 Polystyrene Packaging: Separate and bag materials.

.3 Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.

.4 Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

.4 Wood Materials:

.1 Clean Cut-Offs of Lumber: Grind or chip into small pieces.

.2 Clean Sawdust: Bag sawdust that does not contain painted or treated wood.

1.14 FIRE SAFETY DURING CONSTRUCTION

.1 Provide fire prevention and protection measures to existing building as required by all authorities having jurisdiction.

.2 Maintain exits, including stairways and exterior doors to the outside. Provide acceptable alternative exits where an existing exit is blocked off or deleted due to construction activities.

.3 Where access to an exit through construction area is absolutely necessary, clearly define, protect and separate access from the construction area by a smoke tight fire separation equivalent to minimum 3/4 hour fire resistance rating.

1.15 SAFETY MEASURES

.1 Comply with the safety regulations of the Occupational Health and Safety Act and authorities having jurisdiction for the safety of the Work.

.2 Be responsible to provide full safety program for workers including management, labour, delivery drivers, service personnel and others involved for services on site. Arrange for pre-project meeting related to safety, joint safety inspections, site safety training and safety committees complete with accident investigation procedures.

.3 Prior to commencement of execution of Work, design fire safety plan in conjunction with local Fire Chief. Post fire plan throughout the Work. Do not allow accumulation of waste that may constitute fire hazard.

.4 Comply with requirements of Acts and Regulations with respect to health and safety. Before commencement of Work, and throughout Contract, maintain on site, and readily accessible to all those who may be exposed to hazardous materials, list of hazardous materials proposed for use on Site or Workplace together with current Materials Safety Data Sheet (MSDS).

.5 Ensure hazardous materials used and/or supplied on site are labelled in accordance with WHMIS requirements. Provide detailed written procedures for safe handling, storage and use of such hazardous materials including special precautions, safe clean up and disposal procedures. Conform to Environmental Protection Act for disposal requirements.

.6 Ensure that those who handle, and/or are exposed to, or are likely to handle or be exposed to, hazardous materials are fully instructed and trained in accordance with WHMIS requirements.

.7 Watch work area for minimum of 30 minutes after hot work is completed. Provide Site fire security when required by local building department and/or municipal fire department. Ensure that water supply is adequate for fire fighting.

.8 Provide and maintain in working order, suitable Underwriters' labelled fire extinguishers and locate in suitable positions, to approval of authorities having jurisdiction. Such extinguishers shall be maintained to requirements of ULC.

.9 Store all rags and waste containing oil, grease or other flammable materials in an approved metal container and remove from Site at end of each working day.

.10 Only fire resistant tarpaulins are permitted on Site.

.11 Notify Fire Department and Consultant immediately should a fire of any nature occur whether fire has been extinguished or not.

.12 If any claim is made by anyone against Contractor or any Subcontractor on account of any accident or damage, promptly report facts in writing to Owner, giving full details of claim.

1.16 PROJECT MEETINGS

.1 Schedule and administer project progress meetings throughout progress of work.

.2 Distribute written notice of each meeting four days in advance of meeting date to Consultant and Owner.

.3 Distribute agenda to attendees one day before meeting.

.4 Provide physical space and make arrangements for meetings.

.5 Record minutes. Include significant proceedings and decisions. Identify 'action by' parties.

.6 Reproduce and distribute copies of minutes within three days after each meeting and transmit to meeting participants, affected parties not in attendance, Consultant and Owner.

1.17 SUBMITTALS

.1 Administrative

.1 Submit to Consultant submittals listed for review. Submit with reasonable promptness and in an orderly sequence so as to not cause delay in the Work.

.2 Work affected by submittal shall not proceed until review is complete.

.3 Review submittals prior to submission to Consultant. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of the Work and Contract Documents.

.4 Verify field measurements and affected adjacent Work are co-ordinated.

.2 Shop Drawings and Product Data

.1 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connection, explanatory notes and other information necessary for completion of Work.

.2 Adjustments made on shop drawings by Consultant are not intended to change Contract Price.

.3 Make changes in shop drawings as consultant may require.

.4 Submit electronic copy of shop drawings for each requirement requested in specification Sections and as Consultant may reasonably request.

.5 Submit product data sheets or brochures for requirements requested in specification Sections and as Consultant may reasonably request where shop drawings will not be prepared due to standardized manufacture of product.

.3 Samples

.1 Submit samples for review as requested in respective specification Sections.

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

.4 Operating Maintenance Manuals

.1 Two weeks prior to Substantial Performance of the Work, submit to Consultant, three copies of operating and maintenance manuals.

.2 Manuals to contain operational information on equipment, cleaning and lubrication schedules, filters, overhaul and adjustment schedules and similar maintenance information.

.3 Bind contents in a three-ring, hard covered, plastic jacketed binder. Organize contents into applicable categories of work, parallel to specifications Sections.

.5 Record Drawings

.1 After award of Contract, Consultant will provide a set of transparency drawings for purpose of maintaining record drawings. Accurately and neatly record deviations from Contract Documents caused by site conditions and changes ordered by Consultant.

.2 Record locations of concealed components of mechanical and electrical services.

.3 Identify drawings as "Project Record Copy". Maintain in new condition and make available for inspection on site by Consultant.

.4 On completion of Work and prior to final inspection, submit record documents to Consultant.

1.18 OWNER'S QUALITY CONTROL

.1 Independent inspection/testing agencies may be engaged by Owner for purpose of inspecting and/or testing portions of Work. Costs shall be paid out of cash allowance.

.2 Provide equipment required for executing inspection and testing by appointed agencies.

1.19 SITE SIGNS

.1 Signs on the Project will be restricted to one sign showing the name of the Project and the names of Owner, Consultant and Consultants, as designed by the Consultant and supplied and erected by the Contractor.

.2 Do not exhibit on the site other advertisements or signs other than those required by authorities having jurisdiction, unless otherwise approved by the Consultant, in writing.

1.20 CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

.1 Co-ordination

.1 Co-ordinate with the building management use of temporary controls and facilities not provided under this Contract, including but not necessarily limited to material delivery, unloading and hoisting. Make prior arrangements and schedule use at times acceptable to the building management. Be responsible for payment for use of such facilities.

.2 Installation/Removal

.1 Provide construction facilities and temporary controls in order to execute work expeditiously. Remove from site all such work after use.

.1 Ensure no damage to finishes after the removal.

.3 Hoisting and Delivery

.1 Material unloading and hoisting will be restricted to after hours.

.2 Arrange for delivery and unloading of materials at areas designated by the building management. Do not interfere with vehicular traffic on the streets and pedestrian traffic on the sidewalks.

.4 Security Provisions

.1 Maintain and conform to existing security provisions required by the building management. Do not compromise such provisions.

.5 Guard Rails and Barricades

.1 Erect hoarding and barricades to protect public, workers, public and private property from injury or damage. Provide lockable doors within hoarding for access to site by workers.

.2 Provide secure, rigid guard rails and barricades around deep excavations, open shafts, open stair wells, open edges of floors and roofs.

.3 Provide as required by governing authorities having jurisdiction.

.6 Weather Enclosures

.1 Provide weathertight closures to unfinished door and window openings, tops of shafts and other openings in floors and roofs.

.2 Close off floor areas where walls are not finished; seal off other openings; enclose building interior work area for temporary heat.

.7 Access Road, Parking and Traffic Control

.1 Provide access roads as may be necessary to provide safe and adequate access for materials, products and other supplies. Provide and maintain access sidewalks, roadways, and similar facilities as may be required for access to the Work.

.2 Do not block public roads, or impede traffic during work of this Project and if required to temporary block traffic then provide flag person to direct traffic acceptable to Municipal authorities. Remove accumulations of ice and snow from areas providing access to Site. Ensure that access is available for emergency vehicles. Comply with fire plan for vehicular traffic.

.3 Provide roads, walks, ramps, stairs and other such means of access as necessary. Maintain temporary entrances to building(s) including enclosed hoarding as required. Maintain access to existing service entrance(s) at all times, including ready access for fuel oil trucks and delivery vehicles. Bridge excavations with construction to safely support any load that could be imposed or provide personnel to assist in deliveries to building(s) as required.

.4 Do not be nuisance to public traffic any time. Manage construction traffic by using designated roads and by providing trained flag persons to direct public traffic as appropriate.

.5 Construction Parking: Parking on site is limited to the space available. Owner will not be responsible for parking fines incurred by Contractor, Sub-Contractors or their employees.

.8 Dust Tight Screens

.1 Provide dust tight screens or partitions to localize dust generating activities, and for protection of workers, finished areas of Work and public.

.2 Maintain and relocate protection until such Work is complete.

.9 Site Storage/Loading

.1 Confine the Work and operations of employees to limits indicated by Contract Documents. Do not unreasonably encumber premises with Products.

.2 Do not load or permit to be loaded any part of the Work with a weight or force that will endanger the Work.

.10 Sanitary Facilities

.1 Provide sufficient sanitary facilities for workers in accordance with local health authorities.

.2 Maintain in clean condition.

.3 Existing facilities as designated may be used during construction period.

.11 Water and Power Supply

.1 The Owner will provide and pay for a continuous supply of water, power for construction use as available from the existing facilities. Provide hoses, extensions, connections, and transformers as required for execution of the Work. Provide extra supply if the existing facilities are insufficient or not suitable for construction use.

.2 Arrange for connection with appropriate utility company and pay costs for installation, maintenance and removal.

.12 Temporary Lighting

.1 Provide temporary lighting required during construction period, including attendance and maintenance.

.2 Maintain lighting at levels required by Sections doing the work.

.13 Temporary Heating

.1 Provide temporary heating required during construction period, including attendance, maintenance and fuel.

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

.3 Maintain temperatures at levels required by Sections doing the work.

.4 Ventilate heated areas and keep building free of exhaust or combustion gases.

.5 Permanent heating system of building, or portions thereof, may be used when available. Be responsible for damage thereto. Replace filters with new ones prior to Substantial Performance.

.14 Temporary Contractor's Office:

.1 Contractor's Office: Of sufficient size to accommodate needs of workers. Maintain office dry, clean, well lighted, properly ventilated and heated to 20 deg C (68 deg F) complete with telephone and facsimile services. Furnish office tables, chairs, racks for drawings, filing cabinets and shelves. Install electrical lighting system to provide approved lighted environment.

.2 .

.15 Equipment/Tool/Materials Storage

.1 Provide and maintain, in clean and orderly condition, lockable areas for storage of tools, equipment and materials.

.2 Locate materials on site in manner to cause least interference with work activities.

.16 Project Cleanliness

.1 Maintain the Work in tidy condition, free from accumulation of waste products and debris.

.2 Remove waste material and debris from site at end of each working day. Do not burn waste materials on site.

.3 Clean interior areas prior to start of finish work, maintain areas free of dust and other contaminants during finishing operations.

.17 Noise and Vibration Control

.1 Control noise and vibration generated by Work. Respond immediately to complaints of noise and vibration received from public, authorities, or Consultant.

1.21 MATERIAL AND EQUIPMENT

.1 Product and Material Quality

.1 Products, materials, equipment and articles incorporated in Work shall be new, not damaged or defective, and of best quality for purpose intended. If requested, furnish evidence as to type, source and quality of Products provided.

.2 Whenever Products are specified exclusively by trade name, manufacturer's name or by catalogue reference, use only those items, unless written approval for substitution is obtained from Consultant.

.3 Where the Specifications include "or other approved equivalents" clause, substitutions proposed with bid submission or after award of Contract will be considered only under the following conditions:

.1 if the materials and products specified are not available; or

.2 if substitute materials and products to those specified, which are brought to the attention of and considered by the Consultant as equivalent to those specified, will not change the Contract Price and Contract Time; or

.3 if substitute materials and products to those specified, which are brought to the attention of and considered by the Consultant as superior to those specified, will not change the Contract Price and Contract Time; or

.4 if a material or product is specified together with a requirement for performance and, in the opinion of the Contractor, the specified material or product will not produce the required results.

.4 There is no obligation on the part of the Consultant or Owner to accept proposed substitutions. Acceptance of proposed substitutions by Owner does not relieve the Contractor's responsibility under the Contract.

.5 Defective Products, 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.

.6 Should any dispute arise as to quality or fitness of Products, decision rests strictly with Consultant based upon requirements of Contract Documents.

.2 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 seals and labels intact.

.3 Manufacturer's Instructions

.1 Unless otherwise indicated in specifications, install or erect Products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with Products. Obtain written instructions directly from manufacturers.

.2 Notify Consultant in writing, of conflicts between specifications and manufacturer's instructions, so that Consultant may establish course of action.

.3 Improper installation or erection of Products, due to failure in complying with these requirements, authorizes Consultant to require removal and reinstallation at no increase to Contract Price.

.4 Workmanship

.1 Workmanship shall be best quality, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify Consultant if required Work is such as to make it impractical to produce required results.

.2 Do not employ any unfit person or anyone unskilled in their required duties.

.3 Decisions as to quality or fitness of workmanship in cases of dispute rest solely with Consultant, whose decision is final.

.5 Concealment

.1 In finished areas, conceal pipes, ducts and wiring in floors, walls and ceilings, except where indicated otherwise.

.2 Before installation, inform Consultant if there is a contradictory situation. Install as directed by Consultant.

1.22 CONTRACT CLOSEOUT

.1 Final Cleaning

.1 When the Work is Substantially Performed, remove surplus products, tools construction machinery and equipment not required for performance of remaining Work.

.2 Leave work broom clean before inspection process commences.

.3 Clean and polish glass, mirrors, hardware, wall tile, stainless steel, chrome, porcelain enamel, baked enamel, plastic laminate, mechanical and electrical fixtures. Replace broken, scratched or disfigured glass.

.4 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fitments, walls ceilings.

.5 Vacuum clean and dust building interiors, behind grilles, louvres and screens.

.6 Wax, seal, shampoo or prepare floor finishes, as recommended by manufacturer.

.7 Broom clean and wash exterior walks, steps and surfaces.

.8 Remove dirt and other disfigurations from exterior surfaces.

.2 Systems Demonstration

.1 Prior to final inspection, demonstrate operation of each system to Owner.

.2 Instruct personnel in operation, adjustment, and maintenance of equipment and systems, using provided operation and maintenance data as basis for instruction.

.3 Documents

.1 Collect reviewed submittals and assemble documents executed by Subcontractors, suppliers, and manufacturers.

.2 Submit material prior to final application for payment.

.3 Submit three copies of Project Record Manual consisting of operation and maintenance data and one set of record (as-built) drawings white prints.

.4 Provide warranties fully executed and notarized.

.5 Execute transition of Performance Bond to warranty period requirements.

.4 Inspection/Takeover Procedures

.1 Prior to application for certificate of Substantial Performance, carefully inspect the Work and ensure it is complete, that major and minor construction deficiencies are complete, defects are corrected and building is clean and in condition for occupancy. Notify Consultant in writing, of satisfactory completion of the Work and request an inspection.

.2 During Consultant inspection, a list of deficiencies and defects will be tabulated. Correct same.

.3 When Consultant considers deficiencies and defects have been corrected and it appears requirements of Contract have been performed, make application for certificate of Substantial Performance.

.4 Conform to OAA/OGCA Document No.100 for takeover procedures.

.5 Submit a final statement of accounting giving total adjusted Contract Price, previous payments, and monies remaining due.

.6 Consultant will issue a final change order reflecting approved adjustments to Contract Price not previously made.

2 Products

Not Used

3 Execution

Not Used

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 Sections of Division 01 apply to this Section.

1.2 SUMMARY

.1 Review drawings, site conditions, and other specification sections to ascertain the extent and nature of work of this section.

.2 The Work of this Section includes, but not limited to the following:

.1 Demolish and removal of portions of existing concrete slab, and roofing materials, as indicated on drawings.

.2 Disconnect/cap existing service in areas of demolition.

.3 Dispose of demolished materials except where required to be salvaged or reused.

.4 Refer to demolition notes indicated on drawings.

.3 Drawings contain details that suggest directions for solving some of the major demolition and removal requirements for this project; Contractor is required to develop these details further by submitting a demolition plan prepared by a professional engineer employed by the Contractor.

1.3 DEFINITIONS

.1 Demolish: Detach items from existing construction and legally dispose of them off site, unless indicated to be removed and salvaged or removed and reinstalled.

.2 Remove and Salvage: Detach items from existing construction and deliver them to Owner ready for reuse.

.3 Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.

.4 Existing to Remain: Existing items of construction that are not removed and that are not otherwise indicated as being removed, removed and salvaged, or removed and reinstalled.

.5 Hazardous Material: Product, substance, or organism that is used for its original purpose; and that is either dangerous goods or a material that may cause adverse impact to environment or adversely affect health of persons, animals, or plant life when released into the environment.

1.4 EXAMINATION

.1 Visit and examine the site and note all characteristics and irregularities affecting Work of this Section. Submit a pre-demolition inspection report. Ensure the Owner of premises being inspected is represented at inspection.

.2 Where appropriate prepare a photographic or video record of existing conditions, particularly of existing work scheduled to remain.

.3 Where applicable, examine adjacent tenancies not part of the scope of work. Determine extent of protection required to areas and related components not subject to demolition.

.4 Stop work and notify the Consultant should suspected hazardous materials are encountered during work of this Section.

1.5 SUBMITTALS

.1 Provide required information in accordance with Section 01 33 00 – Submittal Procedures.

.2 Action Submittals: Provide the following submittals before starting any work of this Section:

.1 Prepare schedule in conjunction with overall project schedule, and outline proposed methods in writing. Obtain approval before commencing demolition work, and indicate the following:

.1 Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity

.2 Interruption of utility services

.3 Coordination for shutoff, capping, and continuation of utility services

.3 Submit drawings for demolition of structural elements bearing the seal of a professional engineer licensed to design structures and registered in the Province of Ontario.

1.6 QUALITY ASSURANCE

.1 Conform to requirements of all authorities having jurisdiction.

.2 Comply with applicable requirements of CSA S350 Code of Practice for Safety in Demolition of Structures".

.3 Work of this Contract shall be executed by an approved company having a minimum of five (5) years continuous experience and able to deploy adequate equipment and skilled personnel to complete work expediently in an efficient and orderly manner.

.4 Perform cutting and coring, where applicable, by a firm specializing in this type of work, able to produce evidence of successful completion of similar work over a period of at least five (5) years immediately prior to date of contract.

.5 Apply for, secure, arrange and pay for all permits, notices and inspections necessary for proper execution and completion of work in this Section.

.6 Professional Engineer Qualifications: Procure the services of a professional engineer who is experienced in providing relevant engineering services to perform the following:

.1 Review portions of the Work requiring structural performance, prepare plan of action, engineer temporary shoring and bracing, and Provide site administration and inspection for work of this Section.

1.7 PROTECTION

.1 Prevent movement or settlement of adjacent work. Provide and place bracing or shoring and be responsible for safety and support of such work. Be liable for any such movement or settlement, and any damage or injury caused.

.2 Cease operations and notify Consultant if safety of any adjacent work or structure appears to be endangered. Take all precautions to support the structure. Do not resume operations until reviewed with the Consultant.

.3 Prevailing weather conditions and weather forecasts shall be considered. Demolition work shall not proceed when weather conditions constitute a hazard to the workers and site.

.4 Prevent debris from blocking surface drainage inlets and mechanical and electrical systems which remain in operation.

.5 Temporarily suspended work that is without continuous supervision shall be closed to prevent entrance of unauthorized persons.

1.8 REMAINING AND ADJACENT STRUCTURES

.1 Do not interfere with, encumber, endanger or create nuisance, from any cause due to demolition work, to public property or any adjacent attached and/or detached structures in possession of Owner or others, which are to remain, whether occupied or unoccupied during this work.

.2 Make good damage to such structures resulting from work under this Section at no cost to Owner. Make good adjacent building surfaces damaged by work of this Section.

1.9 PROTECTION OF SERVICES AND STRUCTURES

.1 Take necessary precautions to guard against movement, settlement or collapse of existing adjacent utility services, public property and/or structures, whether to remain or not. If these or other unforeseen conditions develop, take immediate emergency measures, report to Consultant, confirm in writing, and await instructions before proceeding with any further related demolition work.

.2 Prior to saw cutting or core drilling of existing concrete slabs, use ground penetrating radar (GPR) to detect utilities and structural reinforcing. Concrete X-Rays can be used when access to both sides of concrete slab is accessible for placement of required x-ray film.

1.10 EXISTING SERVICES

.1 Prior to start of demolition disconnect all electrical and telephone service lines in the areas to be demolished. Post warning signs on all electrical lines and equipment which must remain energized to serve other areas during period of demolition. Disconnect electrical and telephone service lines in demolition areas to the requirements of local authority having jurisdiction.

.2 In each case, notify the affected utility company in advance and obtain approval where required before commencing with the work on main services.

.3 Arrange with utility companies for locating of such services and for disconnection of existing services owned by utility companies and which will be disconnected by said utility companies, provided such services do not interfere with adjacent tenancy operators.

.4 Remove sewer and water lines where required within existing building as deemed necessary, and cap to prevent leakage, in accordance with authorities having jurisdiction.

.5 Existing services are to be maintained where required for normal tenant operation during regular hours of operation and/or as deemed necessary by Owner.

1.11 EXISTING WARRANTIES

.1 Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

2 Products

2.1 DEBRIS, SALVAGED MATERIAL AND EQUIPMENT DISPOSAL

.1 All materials and or equipment salvaged from demolition work becomes property of demolition Contractor unless designated otherwise.

.2 At no cost to Owner repair or replace material and/or equipment scheduled to remain which is damaged by demolition work. Do not sell any salvaged material or equipment directly from project site.

.3 Remove waste debris continually and entirely from project site during demolition work. Do not load vehicles transporting such debris beyond their safe capacity or in a manner which might cause spillage on public or private property. If spillage does occur, clean up immediately to prevent traffic hazards or nuisance.

2.2 PROTECTION

.1 Temporary Protection:

.1 Erect temporary hoarding protection, as indicated in Section 01 56 00, to enclose openings in exterior walls, and/or provide security to partially occupied interior spaces.

.2 Erect temporary dust screens, as indicated in Section 01 50 00 – Temporary Facilities and Controls, to prevent dust and debris to enter areas of the building which are not scheduled for demolition. Remove temporary dust screens when no longer required.

2.3 REPAIR MATERIALS

.1 Use repair materials identical to existing materials:

.1 If identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.

.2 Use a material whose installed performance equals or surpasses that of existing material.

.3 Comply with material and installation requirements specified in individual Specification Sections.

.2 Concrete Unit Masonry: Lightweight concrete masonry units, and mortar, cut and trimmed to fit existing opening to be filled. Provide standard hollow core units, square end units and bond beam units as indicated on drawings.

.3 Fireproofing: Patch and repair all fireproofing damaged during demolition of adjacent surfaces with compatible fireproofing materials. Provide test reports from fireproofing manufacture warranting installation, adhesion and compatibility between existing and new fireproofing materials.

2.4 EXISTING MATERIALS

.1 Items to be retained for re-use in new construction include, but are not limited to the following:

.1 Lockers to remain or to be relocated as indicated in the drawing.

3 Execution

3.1 GENERAL

.1 Exercise caution in dismantling, disconnecting of work adjacent to existing work designated to remain.

.2 Carry out demolition in a manner to cause as little inconvenience to the adjacent properties as possible.

.3 Carry out demolition in an orderly and careful manner.

.4 Demolition by explosives is not permitted.

.5 Selling or burning of materials on site is not permitted.

.6 Sprinkle exterior debris with water to prevent dust. Do not cause flooding, contaminated run-off or icing. Do not allow waste material, rubbish, and windblown debris to reach and contaminate adjacent properties.

.7 Lower waste materials in a controlled manner; do not drop or throw materials from heights.

.8 At end of each day's work, leave in safe condition so that no part is in danger of toppling or falling.

3.2 SAFETY AND SECURITY

.1 Maintain security of the building at all times during demolition work.

.2 Provide and maintain fire prevention equipment and alarms accessible during demolition.

3.3 ACCESS ROUTES

.1 Restrict operations to designated access routes.

.2 Do not obstruct roads, parking lots, sidewalks, hydrants and the like.

3.4 SELECTIVE DEMOLITION

.1 Provide necessary shoring and supports to assure safety of structure prior to cutting and coring.

.2 Where practical, sawcut and remove material as required.

.3 Where sawcutting is not appropriate, use suitable hand tools.

.4 Demolish, cut-out and remove from site all other work noted on drawings or required to permit new construction.

.5 Do not allow water to accumulate or flow beyond work area. Provide receptacles and mop-up as work proceeds.

.6 Fill all openings in concrete block walls with concrete masonry units, coursing to match existing, prepare ready to receive new finishes to match existing.

.1 Provide bond beams in new openings cut into existing concrete masonry unit walls.

.2 Provide finished end masonry units to patch and repair for new jamb sections in existing concrete masonry unit walls.

.7 Fill all openings in gypsum board walls with gypsum board and steel framing to match existing, skim coat to make wall smooth and even.

.8 Masonry:

.1 Demolish masonry walls in small sections of not more than 2 sq.m. Where only parts of a wall is to be demolished, install adequate support for adjacent parts. Do not permit masonry to fall in mass from one level to another.

.1 Clean and stack reusable masonry units.

.9 Cladding:

.1 Where only part or parts of cladding is to be demolished, dismantle, to prevent damage to adjacent cladding. Remove girts, channels, or cross bracing, unless otherwise indicated.

.2 Form openings in siding such that edges are left straight, clean and not ragged. Where openings abut flashings, ducts or similar items projecting through, or forming integral part of cladding system, preserve and support as required unless otherwise shown.

.10 Demolish completely all ceiling panels and grid as indicated.

.11 Patch and repair all walls, floor and ceilings damaged during demolition with material matching adjacent walls, prepare ready for new finishes.

.1 Prepare existing surfaces schedule to receive new finish by grinding, filling, over-coating, stripping, washing, etching, shot blasting or other chemical or mechanical means, as required to ensure satisfactory installation of new finish.

.12 Roofs:

.1 Where sections of roof are removed or where new roofing are required, remove overburden to expose membrane. Cut back minimum of 230 mm outside line of opening or removal area to facilitate future flashing.

.2 Remove membrane, insulation and vapour barrier over area to be demolished. Cut roof decking with power tools to ensure straight edges. Leave free ends 300 mm maximum in length, unless adequately supported.

.3 Supply and install plywood catchboard immediately under areas to be cut, to protect structure interior from falling debris. Install catchboard in combination with dust/weather protection.

3.5 PATCHING AND REPAIRING

.1 Floors and Walls:

.1 Where walls or partitions that are demolished extend from one finished area into another, patch and repair floor and wall surfaces in the new space.

.2 Provide an level and smooth surface having uniform finish colour, texture, and appearance.

.3 Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform colour and appearance.

.4 Patch with durable seams that are as invisible as possible.

.5 Provide materials and comply with installation requirements specified in other Sections of these Specifications.

.6 Patch any existing areas adjoining / adjacent to new construction in good workmanship, filling and finishing gaps between finishes to allow new work to blend seamlessly with existing work.

.7 Where patching occurs in a painted surface, apply primer and intermediate paint coats over patch and apply final paint coat over entire unbroken surface containing patch. Provide additional coats until patch blends with adjacent surfaces.

.8 Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.

.2 Ceilings: patch, repair, or re-hang existing ceilings as necessary to provide an even-plane surface of uniform appearance.

.3 Exterior Walls: Where existing doors and/or windows are schedule to be removed during demolition, patch and repair exterior walls using similar wall construction techniques as adjacent wall construction. Ensure compatibility between insulation, air barrier and vapour retarder, providing continuous air and vapour control and wall R-Value between existing and new construction. Provide exterior and interior finish materials, matching existing adjacent materials, to provide an even-plane surface of uniform appearance.

3.6 EXCESSIVE DEMOLITION

.1 Where excessive demolition occurs, be responsible for cost of replacing such work.

.2 Consultant shall determine extent of such 'over-demolition' and method of rectification.

3.7 COMPLETION

.1 Leave project site as directed, reasonably clean and presentable, free from above grade debris, any salvaged material and/or equipment except those designated to remain.

.2 Maintain access to exits clean and free of obstruction during removal of debris.

END OF SECTION

1 General

1.1 SUMMARY

.1 Supply all labour, materials, equipment, services and perform all operations required to complete concrete formwork and falsework installation.

1.2 RELATED REQUIREMENTS

.1 Section 03 20 00 - Concrete Reinforcing

.2 Section 03 30 00 - Cast-in-Place Concrete

.3 Section 07 92 00 - Joint Sealants

1.3 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CSA A23.1-09/A23.2-09, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.

.2 CAN/CSA O86-09, Engineering Design in Wood

.3 CSA O121-08, Douglas Fir Plywood.

.4 CSA O151-09, Canadian Softwood Plywood.

.5 CSA O153-M1980, Poplar Plywood.

.6 CSA O325-07 (R2012), Construction Sheathing.

.7 CSA O437 Series-93, Standards for OSB and Waferboard.

.8 CSA S269.1-1975 (R2003), Falsework for Construction Purposes.

.9 CAN/CSA-S269.3-M92 (R2013), Concrete Formwork.

.10 CSA-S413-07, Parking Structures

.2 American Concrete Institute (ACI):

.1 ACI 347-04, Guide to Formwork of Concrete.

.3 National Lumber Grades Authority (NLGA):

.1 Standard Grading Rules for Canadian Lumber, 2010.

1.4 DEFINITION

.1 Architectural Concrete — Concrete that is exposed as an interior or exterior surface in the completed structure that contributes to the visual character of the completed structure.

1.5 DESIGN REQUIREMENTS

.1 Design formwork in accordance with CSA S269.1, CAN/CSA S269.3-M and CSA A23.1 Clause 6.5 – Formwork. For Architectural Concrete, provide formwork that conforms to the requirements of CSA A23.1 Clause 8.3.4 – Formwork for Special Architectural Finishes.

.2 Design and engineer falsework and formwork including shoring and bracing to resist loads due to wet concrete, forms, wind, dead loads, construction live loads and forces arising from use of equipment to place concrete without differential settlement between them and to ensure finished concrete within the tolerances required by CSA-A23.1/A23.2.

.3 Design forms for concrete exposed to view or to carry finish, with maximum deflection of 1/400th of span.

.4 When high range water reducer (superplasticizer) is used in concrete mix, design forms for full hydrostatic pressure.

.5 Make joints in forms watertight.

.6 Design formwork to meet variations from a reference system specified in CSA A23.1 Clause 6.4.6.

1.6 SUBMITTALS

.1 Submit in accordance with Division 1 Sections – Submittal Procedures.

.2 Shop Drawings:

.1 Indicate the method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, special architectural exposed finishes, ties, liners, and locations of temporary embedded parts. Comply with CSA S269.1 for falsework drawings and comply with CAN/CSA S269.3-M for formwork drawings.

.2 Shop drawings shall indicate:

.1 Layout of panel joints, and tie hole pattern.

.2 Method of sealing form tie hole.

.3 Coordinate with details where shown on the Contract Drawings.

.3 Indicate formwork design data, such as permissible rate of concrete placement, and temperature of concrete, in forms.

.4 Indicate sequences of erection and removal of formwork/falsework.

.5 Include full details and locations of splices.

.6 Each shop drawing submission shall be stamped and signed by a qualified professional engineer licensed to practice in the each respective province.

.3 Product Data:

.1 Submit the manufacturer's Product data sheets including materials, allowable loading, installation, application and maintenance, and instructions for the applicable items listed:

.1 Proprietary scaffolding.

.2 Shoring beams.

.3 Lumber for formwork and falsework.

.4 Plywood for formwork and falsework.

.5 Tubular column forms.

.6 Form release agent.

.7 Form ties.

.8 Manufacturer's details and specifications for proprietary materials used in formwork liners and coatings.

.4 Submit one sample for each of the following items:

.1 Form ties.

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials.

.2 Place materials defined as hazardous or toxic waste in designated containers.

.3 Ensure emptied containers are sealed and stored safely for disposal away from children.

.4 Use sealers, form release and stripping agents that are non-toxic, biodegradable and have zero or low VOCs.

2 Products

2.1 MATERIALS

.1 For concrete with special architectural features, use formwork materials in accordance with CSA A23.1/A23.2.

.2 Plywood: CSA O121, G1S; Douglas Fir plywood, sheets as large as practical, minimum 19 mm thick, seven ply, exterior grade, waterproof glue, edges sealed with oil based sealer.

.3 Prefabricated steel forms: CSA S136; Free of irregularities, dents, sags, rust, and materials that can discolour concrete finish

.4 Steel forms: seamless, steel plates, internally treated with release material.

.5 Tubular column forms: Round, spirally wound laminated fibre forms free of dents and other irregularities, complete with seamless plastic liner, internally treated with form release agent.

.6 Form ties:

.1 For concrete not designated 'Architectural Concrete', use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm diameter in concrete surface.

.2 For Architectural Concrete, use snap ties complete with plastic cones and light grey concrete plugs.

.3 Wire ties shall not be permitted.

.7 Form release agent: Quick drying, sprayable, non-staining, non-toxic coating, compatible with paint and mortar, VOC compliant, containing compounds that react with free lime present in concrete forming water insoluble soaps, preventing concrete from sticking to forms.

.1 Eucoslip VOX by The Euclid Chemical Company;

.2 Clean Strip Ultra (J-3 VOC) by Dayton Superior Corp.;

.3 Sealtight Duogard II by W.R. Meadows of Canada Ltd.;

.4 Debond Form Coating by L&M Construction Chemicals Inc. Buffalo., N.Y.

.8 Chamfer strips: 20 x 20 mm triangular fillets milled from clear, straight grain pine, surfaced each side, or extruded vinyl type, with or without nailing flange.

.9 Falsework materials: in accordance with CSA S269.1.

.10 Sealant: in accordance with Division 1 Sections – Joint Sealants.

3 Execution

3.1 FABRICATION AND ERECTION

.1 Verify lines, levels and centres before proceeding with formwork/falsework and ensure dimensions are consistent with the Contract Drawings.

.2 Obtain approval from the Consultant for the use of earth forms framing openings not indicated on the Drawings.

.3 Hand trim sides and bottoms and remove loose earth from earth forms before placing concrete.

.4 Fabricate and erect formwork in accordance with CAN/CSA-S269.3 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within the tolerances required by CSA-A23.1/A23.2.

.5 Do not place shores and mud sills on frozen ground.

.6 Provide Site drainage to prevent the washout of soil supporting mud sills and shores.

.7 Align form joints and make watertight. Keep form joints to minimum.

.8 Use 20 mm chamfer strips on external corners and/or 20 mm fillets at interior corners, joints, unless specified otherwise in the Contract Documents.

.9 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated on the Contract Drawings.

.10 Construct forms for Architectural Concrete, and place ties as indicated and/or as directed. Joint pattern not necessarily based on using standard size panels or maximum permissible spacing of ties.

.11 Build in anchors, sleeves, and other inserts required to accommodate work specified in other sections. Assure that all anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.

.12 Clean formwork in accordance with CSA-A23.1/ A23.2, before placing concrete.

3.2 REMOVAL AND RE-SHORING

.1 Leave formwork in place for following minimum periods of time after placing concrete.

.1 4 Days for walls.

.2 7 Days for columns.

.3 Until concrete has reached 70% of its compressive strength and not before seven 7 Days for beams, slabs, decks and other structural members. Re-shore concrete with adequate shoring to standards specified for 14 additional Days.

.2 Provide all necessary re-shoring of members where early removal of forms may be required or where members may be subjected to additional loads during construction as required.

.3 Space re-shoring in each principal direction at not more than 3,000 mm apart.

.4 Re-shoring shall remain until concrete has reached its 28-Day designed compressive strength.

.5 Re-use formwork and falsework subject to requirements of CSA-A23.1/A23.2.

3.3 CONSTRUCTION JOINTS

.1 Obtain approval from the Consultant for location and details of construction joints shown a minimum of two weeks prior to start formwork.

3.4 EXPANSION AND CONTROL JOINTS

.1 Construct expansion and control joints at the locations indicated and in accordance with the details shown on the Contract Drawings.

.2 Construct clean expansion joints free of foreign material, likely to impair the proper operation of the joint.

.3 Provide a non-extruding joint filler in expansion joints for the full area between adjacent concrete members. Anchor the filler material to one of the adjacent members or between concrete members and adjacent members of other materials.

END OF SECTION

1 General

1.1 SUMMARY

.1 Supply all labour, materials, equipment, services and perform all operations required to complete concrete reinforcing installation.

1.2 RELATED REQUIREMENTS

.1 Section 03 10 00 - Concrete Formwork and Falsework

.2 Section 03 30 00 - Cast-in-Place Concrete

1.3 REFERENCES

.1 Canadian Standards Association (CSA):

.1 CSA A23.1-09/A23.2-09, Concrete materials and methods of concrete construction/Test methods and standard practices for concrete.

.2 CAN/CSA A23.3-04, Design of Concrete Structures.

.3 CAN/CSA G30.18-M92, Billet Steel Bars for Concrete Reinforcement.

.4 CSA S413-07, Parking Structures.

.5 CSA W47.1-09 Certification of Companies for Fusion Welding of Steel Structures.

.6 CSA W186-M1990 (R2012), Welding of Reinforcing Bars in Reinforced Concrete Construction

.2 ASTM International:

.1 ASTM A82/A82M-07, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

.2 ASTM A185/A185M-07, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.

.3 ASTM A497/A497M-07, Standard Specification for Steel Welded Wire Reinforcement, Deformed, For Concrete.

.3 Reinforcing Steel Institute of Canada (RSIC):

.1 RSIC, Reinforcing Steel Manual of Standard Practice (2004).

.4 International Conference of Building Officials (ICBO):

.1 ICBO Research Report.

1.4 QUALITY ASSURANCE

.1 Welder Qualifications: CSA W47.1 and CSA W186 certified.

1.5 SUBMITTALS

.1 Submit in accordance with Division 1 Sections – Submittal Procedures.

.2 Shop Drawings:

.1 Submit reinforcement drawings prepared in accordance with the RSIC Manual of Standard Practice.

.2 Design and detail lap lengths to CAN/CSA A23.3. Supply Class B splices unless shown otherwise on the Contract Drawings. Splices are to be staggered unless otherwise shown on the Contract Drawings.

.3 Submit placing drawings, bar lists, quantities and bar bending details. Bar bending details shall include details of standard bends. Indicate the name of the bent bar fabricator, name of bulk steel supplier and steel grade.

.4 On placing drawings, indicate bar sizes, spacing, location and quantities of reinforcement, splices, splice lengths, location of expansion, control and construction joints, with identifying code marks to permit correct placement without reference to structural drawings. Indicate the sequence of placing concrete. Indicate type, sizes, spacings and locations of chairs, spacers and hangers.

.5 If bar list and bending schedule contain details of bars of more than one reinforcing bar placement drawing, then arrange bar marks in separate groups for each placement drawing. Clearly indicate for each bar mark the corresponding reinforcing bar placement drawing number.

.6 For slabs, show a separate plan indicating concrete thicknesses, reinforcing bars, and dowels for walls and columns cast in slab.

.7 For walls, show separate elevations indicating concrete thicknesses, reinforcing bars, and dowels for slabs and adjacent walls cast in wall.

.8 Show position and size of openings in slabs and walls. Cooperate with trades requiring openings to ascertain necessary information.

.9 Do not add new information on previously reviewed shop drawings.

.10 Reinforcing bar placement shop drawings will be reviewed for bar sizes, locations, and spacing, and will be stamped and signed. Bar list and bending schedule will not be reviewed or stamped.

.11 Submit shop drawings of dowel bar splicers, detailing locations, sizes, and types.

.12 Substitution of different size bars may be permitted upon written acceptance of the Consultant.

.13 Reproduction of the Contract Drawings for use as shop drawings is not permitted. Do not use Contract CADD files.

.3 Product Data Sheets:

.1 Submit three copies of the manufacturer's Product data sheets including installation and maintenance instructions for: chairs, bolsters, bar supports, and side form spacers, dowel bar splicers, and mechanical splices.

.4 Test Reports:

.1 Submit certified copies of mill test reports for reinforcing steel and welded wire fabric, showing physical and chemical analysis, a minimum of 30 Days prior to commencing the Work. Determine physical and chemical properties of steel reinforcing in accordance with requirements of CSA-G30.18.

.5 Certificates:

.1 Submit welding certificate in accordance with CSA W47.1 and CSA W186-M.

.6 Information Submittals:

.1 Submit in writing the proposed source of reinforcement material to be supplied.

.2 Dowel Bar Splicers:

.1 Verification that device threads have been tested and meet the requirements for thread quality, in accordance with the manufacturer's published methods.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Division 1 Sections – Product Requirements and with the manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: Deliver materials to Site in original factory packaging, labelled with the manufacturer's name and address.

.3 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists. Clearly indicate mill run for which bars were fabricated.

.4 Storage and Handling Requirements:

.1 Store reinforcing steel off the ground and kept free of mud, dirt, oil and any contaminants which may adversely affect performance of reinforcing steel. Comply with CSA A23.1/A23.2.

.2 Store welded wire fabric sheets flat and off the ground.

.3 Deteriorated or contaminated materials will be rejected and shall be removed from site.

.4 Replace defective or damaged materials with new materials at no additional cost to the Owner.

2 Products

2.1 MATERIALS

.1 Substitution of different size bars may be permitted upon written acceptance of the Consultant.

.2 Reinforcing Bars:

.1 Reinforcing steel: CAN/CSA G30.18-M; Carbon-steel bars, deformed unless indicated otherwise in the Contract Documents, Grade 400R.

.2 Weldable reinforcing steel: CAN/CSA-G30.18-M; Weldable low alloy steel bars, where welding of reinforcing bars is indicated in the Contract Documents, deformed, Grade 400W.

.3 Plain round reinforcing steel: CAN/CSA G30.18-M; round, Grade 400R, for expansion joints.

.4 Do not substitute with epoxy-coated bars.

.3 Welded steel wire fabric: ASTM A82/A82M; Resistance welded in size and spacing shown for smooth wire fabric and ASTM A497/A497M for deformed wire fabric, in flat sheets only.

.4 Cold-drawn annealed steel wire ties: to ASTM A82/A82M, minimum 1.6 mm diameter, with coating for use with uncoated and coated reinforcing steel.

.5 Bar Supports and Spacers:

.1 Adequate for accurate placing and as required for construction loads.

.2 Provide non-conductive bar supports in contact with exposed surfaces that has geometry and bond characteristics that prevents moisture movement from the surface to the reinforcement.

.3 In beams, columns, walls, and slabs exposed to view after form removal: Small concrete blocks made up of same color and strength as concrete being placed around them.

.4 Do not use plastic or stainless steel bar supports or side form spacers.

.5 Design and fabricate special bar supports for top reinforcing bars in slabs where standard bar supports are not high or strong enough.

.6 Mechanical Splices:

.1 Mechanical Threaded Connections: Furnish metal coupling sleeve with internal threads engaging threaded ends of bars, capable of developing in tension or compression 125 percent of yield strength of bar.

.1 Conform to CSA A23.3.

.2 Provide a thread-in plastic plug to protect the threads.

.3 Wrap exterior with tape.

.4 Clip the mounting washer, if provided, to maintain cover without displacing the bar.

2.2 FABRICATION

.1 Fabricate and bend reinforcing steel in accordance with CAN/CSA-A23.1/A23.2, RSIC Manual of Standard Practice and in accordance with the accepted placing drawings.

.2 Reinforcing Bars:

.1 Use longest bar possible.

.2 Shear and bending Tolerances:

.1 Length: ±25 mm.

.2 Outside dimensions of stirrups, ties, and spirals: ±13 mm.

.3 Other bends: ±25 mm.

.4 Where increases cause interference with waterstop- plus 0 mm.

.5 Ensure cutting and bending tolerances are sufficiently accurate to comply with placing tolerances shown.

.3 Keep number of splices to a minimum.

.4 Do not weld chairs, bolsters, bar supports, or spacers to reinforcing bars.

.3 Reinforcing Splices:

.1 Lap Splices: Splice by lapping reinforcing bars, unless specified otherwise in the Contract Documents.

.2 Welded Splices: Full penetration direct butt splice welds in accordance with CSA W186 and as specified in the Contract Documents.

.3 Splices in Wire Fabric: Comply with CSA A23.3.

.4 Obtain prior written approval from the Consultant for locations of reinforcement splices other than those shown on the placing drawings.

.4 Bend bars cold, heating of bars will not be permitted.

.5 Verify elevations before cutting and bending reinforcing bars.

.6 Obtain written approval from the Consultant prior to welding reinforcement. Weld reinforcement in accordance with CSA W186-M.

3 Execution

3.1 PREPARATION

.1 Notify Consultant a minimum one week in advance of when reinforcing is ready for inspection.

.2 Clean reinforcing bars of loose rust, mill scale, dried cement paste, mud, oil, or other coatings that will affect adhesion in accordance with CSA A23.1/A23.2, Clause 6.1.5 – Surface Condition of Reinforcement, prior to placing concrete.

.3 Coat wire projecting from bar supports with dielectric material or plastic.

3.2 FIELD BENDING

.1 Do not field bend or field weld reinforcement without prior written approval by the Consultant.

.2 When field bending is authorized, bend without heat, applying a slow and steady pressure. Required radius of bend shall be provided in accordance with CSA A23.4.

.3 Replace bars which develop cracks or splits.

3.3 REINFORCEMENT BAR INSTALLATION

.1 Prior to installation of reinforcing steel, inspect installed Work of other trades and verify that Work is complete for installation of reinforcement.

.2 Place reinforcing steel as shown on reviewed placing drawings and in accordance with CSA A23.1/A23.2.

.3 Use plain round bars as slip dowels in concrete.

.1 Paint the portion of dowel intended to move within hardened concrete with one coat of asphalt paint.

.2 When paint is dry, apply a thick even film of mineral lubricating grease.

.4 Tie bars at least at every fourth intersection minimum. Make maximum untied length 1000 mm.

.5 Do not eliminate or displace reinforcement to accommodate hardware to be embedded in concrete.

.6 Do not field bend bars partially embedded in concrete except as shown on the Contract Drawings or as accepted by the Consultant.

.7 Prior to placing concrete or closing wall and column forms, obtain acceptance of reinforcing steel and position from Consultant.

.8 Ensure cover to reinforcement is maintained during concrete pour.

.9 Splicing:

.1 Use lap splices, unless otherwise shown on the Contract Drawings or permitted in writing by the Owner's Representative.

.2 Welded Splices: Accomplish by full penetration groove welds and develop a minimum of 125 percent of yield strength of bar in tension and compression.

.3 Stagger splices in adjacent bars.

.10 Dowel Bar Splicers:

.1 Use only in areas specifically approved in writing by the Owner's Representative.

.2 Install threaded rods as recommended by manufacturer with threads totally engaged into coupling sleeve and in accordance with ICBO Research Report.

.3 Install dowel bar splicers with plastic setting plugs.

.4 Lightly grease internal threads in accordance with manufacturers printed instructions.

.5 Maintain minimum edge distance and concrete cover as noted in the Contract Drawings.

.11 Mechanical Splices:

.1 Install mechanical splices in accordance with the manufacturer's written instructions. Request the presence of the manufacturer's representative to verify proper installation.

.12 Tying Reinforcing Bars:

.1 Bend tie wire away from concrete surface. Ensure that the cover for tie wires, form tie bolts, etc. are the same as the reinforcing bars. Do not let reinforcing tie wire touch formwork or be exposed in the finished concrete structure.

.13 Reinforcement Around Openings: On each side and above and below pipe or opening, place an equivalent area of steel bars to replace steel bars cut or disrupted for opening. Extend steel reinforcing a standard lap length beyond opening at each end.

.14 Welding Reinforcement:

.1 Only Type W bars may be welded.

.2 Do not perform welding until welder qualifications are approved.

.15 Do not field cut reinforcement except where indicated or authorized in writing by the Consultant.

3.4 PROGRESS CLEANING

.1 Leave the Work areas clean at end of each Working Day.

.2 Final Cleaning: Upon completion of reinforcing steel installation, remove surplus materials, rubbish, tools and equipment and verify that the area ready for placing concrete.

END OF SECTION

1 General

1.1 SUMMARY

.1 Supply all labour, materials, equipment, services and perform all operations required to complete cast in place concrete installation.

1.2 RELATED REQUIREMENTS

.1 Section 03 10 00 - Concrete Formwork and Falsework

.2 Section 03 20 00 – Concrete Reinforcing.

1.3 REFERENCES

.1 CSA International:

.1 CSA A23.1-09/A23.2-09, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.

.2 CSA A283-06 (R2011), Qualification Code for Concrete Testing Laboratories.

.3 CSA A3000-13, Cementitious materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

.4 CAN/CSA-G30.18-09: Carbon Steel Bars for Concrete Reinforcement.

.5 CSA S413-07, Parking Structures

.2 ASTM International:

.1 ASTM C260-06, Standard Specification for Air-Entraining Admixtures for Concrete.

.2 ASTM C309-11, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

.3 ASTM C494/C494M-11, Standard Specification for Chemical Admixtures for Concrete.

.4 .ASTM C1017/C1017M-07, Standard specification for Chemical Admixtures for Use in Producing Flowing Concrete.

.5 ASTM D1751-04 (2008), Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

.6 ASTM C1059/C1059M-99 (2008), Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete.

.7 ASTM D6690-07, Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements

.8 ASTM D1752-04a (2008), Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.

.9 ASTM D638-10, Standard Test Method for Tensile Properties of Plastics.

.10 ASTM D412-06, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers Tension.

.11 ASTM C109/C109M-13, Standard Test Method for Compressive Strength of Hydraulic Cement Mortars using 50-mm Cube Specimens

.12 ASTM C1315, Standard Specification for Liquid Membrane-Forming Compound having Special Properties for Curing and Sealing Concrete

.3 American Concrete Institute (ACI):

.1 304.2R Placing Concrete by Pumping Methods

.4 Canadian General Standards Board (CGSB):

.1 CAN/CGSB 37.2-M88, Emulsified Asphalt, Mineral Colloid-Type, Unfilled, for Dampproofing and Waterproofing and for Roof Coatings.

.2 CAN/CGSB 51.34-M86(R1988), Vapour Barrier, Polyethylene Sheet for Use in Building Construction.

1.4 ABBREVIATIONS AND ACRONYMS

.1 Cement: hydraulic cement or blended hydraulic cement (XXb - where b denotes blended).

.1 Type GU or GUb - General use cement.

.2 Type MS or MSb – Moderate sulphate-resistant cement.

.3 Type MH or MHb - Moderate heat of hydration cement.

.4 Type HE or Heb - High early-strength cement.

.5 Type LH or LHb - Low heat of hydration cement.

.6 Type HS or HSb – High sulphate-resistant cement.

.2 GGBFS - Ground, granulated blast-furnace slag.

1.5 DEFINITIONS

.1 Exposed Concrete: Concrete surfaces that can be seen inside or outside of structures including surfaces above water.

.2 Surface Defects: Surface areas that include honeycomb, rock pockets, indentations greater than 5 mm, cracks 0.25 mm wide and larger, spalls, chips, air bubbles greater than 20 mm in diameter, pinholes, bug holes, embedded debris, lift lines, sand lines, bleed lines, leakage from form joints, fins and other projections, form pop outs, texture irregularities, and stains and other colour variations that cannot be removed by cleaning.

.3 Defective concrete: As defined in subsection 1.5.6 – Defective concrete, below.

.4 New Concrete: Less than 60 Days old.

1.6 QUALITY ASSURANCE

.1 Quality Assurance: in accordance with Division 1 Sections – Quality Requirements.

.2 Ready Mixed Concrete Producer: Certified member in good standing of the Ready Mixed Concrete Association of the respective province.

.3 Inspection and tests:

.1 Materials: CSA A23.1/A23.2.

.2 Tests will be performed in accordance with CSA A23.1/A23.2.

.3 Cooperate with and assist the independent testing agency and the Consultant during inspections and tests.

.4 Remove defective materials and completed work which fails tests and replace as directed by the Consultant.

.5 Inspection or testing by the Consultant will not augment or replace the Contractor's quality control nor relieve the Contractor of its contractual responsibility.

.4 Test Panels

.1 Provide test panels 1.8 m x 1.2 m in size for the Consultant's approval before starting the work of the following schedule:

.1 Plain concrete:

.2 Number 2 finish for slabs.

.2 Show on panels the specified finish including formwork tie holes and plugs.

.3 Erect panels individually or build-in on site in areas selected by the Consultant.

.4 Form as many panels as necessary until written approval has been issued by the Consultant.

.5 Upon approval, maintain sample panels in place throughout the duration of the Contract as the standard of workmanship to be adhered to.

.6 Upon completion of the concrete work, remove and dispose of the test panels off Site.

.5 Defective concrete:

.1 Concrete strength:

.1 Strength acceptance criteria from cylinder tests will be in accordance with CSA A23.1/A23.2.

.2 Concrete shall be considered defective when a cylinder test fails to meet the performance requirements for the corresponding concrete type, as defined in subsection 2.2 – Concrete Mixes, below.

.3 In such cases, the Consultant may require further action or testing in accordance with CSA A23.1, Clause 4.4.6.7 – Failure of Standard-Cured Cylinder Test Results to Meet Requirements.

.2 Concrete may be considered defective if it is structurally unsound, lacks moisture resistance, has surface defects, the measured air content fails to meet performance requirements or is improperly finished, as determined by the Consultant.

.3 The Consultant has the right to require replacement, strengthening or correction of impacted portions of defective concrete structure, in accordance with Clause 4.4.6.7.2 of CSA A23.1.

.4 The Contractor shall bear all costs of rectifying defective concrete including inspections, design, coring, testing, strengthening, demolishing, and replacement. The Contractor shall also bear investigation and evaluation costs even if further evaluation of the design allows the unit to be classified as acceptable concrete.

.6 Concrete delivery:

.1 There shall be a maximum time limit of 120 minutes from the time of initial mixing to complete discharge, in accordance with CSA A23.1 Clause 5.2.4.3.1 – Time of Delivery.

.7 Records:

.1 Before unloading at Site, have the concrete producer submit to the Consultant a delivery ticket (with each batch of concrete) on which is printed, stamped or written the following information:

.1 Name and location of batch plant.

.2 Date and serial number of ticket.

.3 Name of Contractor.

.4 Contract Name and Contract number.

.5 Concrete Mix Design Submission Form number, specified strength, target slump and air content at end of chute.

.6 Amount of concrete in cubic metres.

.7 Truck number, cumulative total, and/or load number.

.8 Time loaded or time of first mixing of cement and water/aggregate.

.2 Include the following information, which is to be registered by the producer's representative on at least two copies of the delivery ticket, after discharge has been completed:

.1 Time that load arrived on Site.

.2 Time that discharge of load was started.

.3 Time that discharge of load was completed.

.4 Type and amount of admixtures. If added at Site, initialed by the Consultant.

.3 Maintain accurate records of cast-in-place concrete elements. Include in the records the following information:

.1 Date of placing concrete element.

.2 Location of concrete element.

.3 Specified strength of concrete.

.4 Air and form temperature when concrete was placed

.5 Temperature of concrete when placed in the form

.6 Test samples taken and results of test samples.

.8 The Owner, in consultation with the Consultant, will appoint an independent inspection and testing company to verify compliance with this Specification in accordance with Division 1 Sections – Testing and Inspection Services. Cooperate and coordinate with the inspector to facilitate inspection.

1.7 SUBMITTALS

.1 Provide submittals in accordance with Division 1 Sections – Submittal Procedures.

.2 Certificates:

.1 Submit a current, valid “Certificate of Ready Mixed Concrete Production Facilities” as issued by the RMCAO for plants supplying concrete to the Contract.

.2 Submit certification from the concrete producer that a Professional Engineer licensed in the each respective province has designed the mixes based on the requirements of the Specifications and that the concrete mixes will produce concrete meeting the performance requirements of the Specification Sections.

.3 Submit certification demonstrating that aggregates will not, nor have the potential to, react with cement to result in deleterious expansion in the concrete. Ensure these tests are current and represent the aggregates being supplied

.4 Submit certifications with the concrete mix design, that all concrete constituents are compatible.

.3 Quality Control Plan:

.1 Submit for review by the Consultant the Quality Control Plan which describes the material, equipment and procedures to be used for the following activities:

.1 Uniform and consistent concrete finishing.

.2 Cold weather protection when the air temperature is at or below 5 degrees Celsius.

.3 Hot weather protection when the ambient air temperature is at above 27 degrees Celsius.

.4 Concrete curing.

.5 Concrete placing.

.6 Temperature Management Plan including temperature monitoring and corrective measures.

.2 Submit concrete delivery records.

.4 Records

.1 Concrete pours: Maintain and submit accurate records of poured concrete items indicating date and location of pour, quality, air temperature and test samples taken, as described in subsection 3.8 - Field Quality Control, below.

.2 Concrete hauling times: Maintain and submit records of deviations from the maximum allowable time of 120 minutes for concrete delivery.

.5 Shop Drawings:

.1 Master Plan(s) of Concrete Placements:

.1 Before submitting shop drawings of formwork, falsework and reinforcing bars, submit master plan(s) showing separate concrete placements and the locations of all expansion, isolation, control and construction joints, including any proposed construction joints that are in addition to those indicated on the Contract Drawings.

.2 Show layout and location for each type of joint, including expansion and construction joints.

.3 Show elevation or section taken through the plane of the joint showing the walls and slabs at the joint.

.4 Show details of joint fillers, sealant, adhesives, and other appurtenances.

.5 Show details of concrete inserts, including location, size, type and surface treatments.

.2 Concrete Placing Schedule:

.1 Submit concrete placing schedule.

.6 Concrete Mix Designs:

.1 Submit proposed performance mix design data, and the Supplier's applicable standard deviations.

.2 Tabulate concrete mixes. Indicate the types of cement, size of coarse aggregate, water/cementing material ratio, admixtures used, air content, slump, and the locations of use for each mix.

.3 For high slump flowing concrete submit a mix that will not result in segregation.

.7 Test Panels

.1 Provide test panels as specified in subsection 1.5 – Quality Assurance.

.8 Trial Mix Design Prequalification Test Results:

.1 Submit specified trial mix test results with the mix design as performed by an independent laboratory in accordance with CSA A23.1/A23.2.

.2 Identify the course of action to be taken if the testing program indicates that the requirements of the Contract Documents have not been met.

.3 Submit test data three weeks prior to concrete placement showing that the concrete supplied meets the performance criteria stated for each concrete types listed in subsection 2.2 – Concrete Mixes, below:

.1 At a minimum, the prequalification mix design test data shall prove that the minimum compressive strength, chloride ion content penetrability (for C-1 class of exposure), density, shrinkage and air content of hardened concrete to be supplied meets or exceeds the performance criteria.

.2 Trial batching shall replicate the actual batching practices and placing procedures at the Site and the tests shall be based on the concrete samples taken from the point of discharge into the formwork.

.3 All prequalification testing of concrete and concrete constituents by the Contractor shall be done by a laboratory certified in accordance with CSA A283 for the appropriate category of testing.

.4 For standard mix (concrete mix that has been used before and is proposed to be used without any alterations of the mix design), historical test data that statistically demonstrates conformance to the Specification requirements may be submitted in lieu of mix design prequalification (trial batch testing), subject to review by the Consultant.

.9 Field Quality Control Test Results:

.1 Submit reports of results for each of the following field tests, and as described in subsection 3.8 – Field Quality Control, below:

.1 Concrete pours.

.2 Slump.

.3 Air content.

.4 Compressive strength at 7 and 28 Days.

.5 Air and concrete temperature.

.10 Product Data and Samples:

.1 Submit technical data and samples, where noted with quantities, of proposed materials including installation, application, and maintenance instructions for:

.1 Joint filler (100 mm length of each type).

.2 Curing compound.

.3 Evaporation retardant.

.4 Surface sealer.

.5 Floor hardener.

.6 Chemical hardener.

.7 Polyethylene sheet.

.11 Submit a Construction Waste Management plan as described in subsection 3.16 – Cleaning, below.

1.8 TRIAL MIXES

.1 Prior to the start of on-Site concrete construction, undertake trial mixes of each structural concrete mix design.

.2 Submit test results from trial mixes confirming workability and concrete strength.

.3 Undertake linear shrinkage testing of the trial mixes and submit test results.

.4 Adjust mixes that do not provide adequate performance, and re-test.

1.9 PRE-PLACEMENT MEETING

.1 Hold a meeting a minimum of 28 Days prior to the initial placement of concrete to review the detailed requirements for preparing the concrete design mixes, finishes, and procedures for concrete placement for the structures.

.2 Ensure key personnel, Site supervisor, Consultant, concrete formwork and finishing Subcontractors, concrete pumping and conveying equipment supplier, concrete producer and testing laboratories attend.

.3 Notify the Consultant a minimum of 10 Working Days prior to the scheduled date of the meeting.

.4 Provide an agenda for the meeting a minimum of 5 Working Days prior to the scheduled date of the meeting,

.5 Provide minutes of the meeting within 5 Working Days after the meeting. Circulate to all parties.

1.10 DELIVERY, STORAGE AND HANDLING

.1 Comply with the manufacturers' recommendations for delivery, storage, and handling.

.2 Store materials in a manner that will prevent deterioration or contamination. Deteriorated or contaminated materials will be rejected and must be removed from the Site.

.3 Concrete:

.1 Deliver and store materials on Site in accordance with CSA A23.1/A23.2.

.2 Site-mixed concrete shall not be permitted.

.3 Concrete, mixed off-Site:

.1 When the truck mixer or agitator is accepted for mixing or delivery of concrete, do not add admixtures or water to batch after the initial introduction of mixing.

.2 If measured slump or entrained-air content falls outside specified limits, ensure another portion of the same sample is tested immediately. If second failure occurs, concrete will be considered to have failed the requirements of the Specification and will be rejected.

.4 Packaging Waste Management: remove for reuse of pallets, crates, padding, and packaging materials.

1.11 SITE CONDITIONS

.1 Do not place concrete during or prior to rain.

.2 Prevent rain from reaching newly placed concrete in accordance with CSA A23.1/A23.2

.3 Cold weather protection:

.1 Maintain protection equipment, in a state of readiness, on Site. Use such equipment when the ambient temperature is at or below 5 degrees Celsius, or when, in the opinion of the Consultant the temperature may fall below 5 degrees Celsius before concrete has cured.

.2 Do not place concrete upon or against a surface that is at temperature lower than 5 degrees Celsius.

.3 Provide temperature-controlled enclosures for areas where concrete is placed whenever ambient air temperature is 5 degrees Celsius or lower.

.4 Protect concrete from the adverse effects of space-heated enclosures including local overheating and combustion products.

.5 Heat mix water and, if necessary, aggregates when air temperature is at or below, or predicted to go below, 5 degrees Celsius at any time during the next 24 hours.

.6 Maintain temperature of reinforcing bars and forms above 10 degrees Celsius prior to placing concrete.

.7 Maintain temperature of concrete when deposited in forms not less than 15 degrees Celsius but not higher than 25 degrees Celsius.

.8 Maintain temperature of concrete at surfaces at least 10 degrees Celsius for a minimum period of seven Days after placing and achieving minimum 75 percent of specified strength. Concrete temperature may then be lowered to ambient air temperature at a rate of 0.5 degrees Celsius per hour or 10 degrees Celsius per day.

.9 Use additional protection if full 28 Day compressive strength is required at an early age.

.10 Keep concrete continuously moist during the curing period.

.11 Obtain the Consultant's acceptance of the method of maintaining minimum temperatures.

.4 Hot weather protection:

.1 Maintain protection equipment in a state of readiness on Site. Use such equipment when the ambient temperature is at or above 27 degrees Celsius, or when, in the opinion of the Consultant the temperature may exceed 27 degrees Celsius before concrete has cured.

.2 When ambient temperature is at or above 27 degrees Celsius, protect concrete from direct sunlight and keep forms moist by sprinkling with cool water, applying wet burlap, or other accepted methods of cooling that will not adversely affect the concrete.

.3 Do not place concrete when the concrete temperature exceeds 27 degrees Celsius in the mixer.

.4 Concrete, which has a temperature in the mixer between 20 degrees Celsius.and 27 degrees Celsius shall:

.1 Contain a retarder which reduces mixing water requirements and increases strength.

.2 Not contain high early strength cement.

.5 Protect forms and equipment, including both mixing and placing equipment, from the rays of the sun and cool by wetting as necessary to maintain a temperature of not more than 5 degrees Celsius in excess of the ambient temperature nor more than 30 degrees Celsius.

.6 Prior to placing concrete, wet down forms and reinforcement and the area surrounding the work. Ensure that excess water is swept and drained away immediately before casting the concrete.

.7 Keep mixing time to the minimum, consistent with the production of the quality of concrete specified and place mixed concrete immediately.

.8 Use sufficient qualified personnel for rapid placing and finishing of concrete.

.9 Commence continuous wet curing as soon as the concrete has hardened sufficiently to prevent surface damage.

.5 Protection from drying:

.1 When the rate of surface moisture evaporation exceeds 0.50 kg/m2/h, take additional measures to prevent rapid loss of moisture from surface of concrete as accepted by the Consultant and in accordance with CSA A23.1 Clause 7.4.1.2 – Severe Drying Conditions.

.6 Frost Protection for Footings and Slabs on Grade:

.1 Protect subgrades below proposed concrete work. Ensure that subgrade temperatures are a minimum of 10 degrees Celsius when the concrete is placed.

.2 Provide continuous protection for footings and slabs on grade to prevent the sub-grade below from freezing during cold weather. Provide heated enclosures and insulation as required.

.7 Influence of Ambient Concrete Temperature on Concrete Crack Control:

.1 To minimize the formation of thermal cracks during placement and curing, maintain previously cured concrete and concrete that will be placed against it at the same temperature.

.2 Failure to minimize temperature differential between adjacent pours may result in temperature induced cracking. Repair such cracks as specified in this Section.

.8 Backfilling and Service Loads Restrictions:

.1 Obtain approval from the Consultant prior to backfilling around structures.

.2 Verify that the backfill is not higher than the finished grades indicated in the Contract Documents.

.3 Verify that equipment for backfilling and compaction on top of slabs will not impose loads greater than those indicated in the Contract Documents.

.4 Verify that concrete in walls, and slabs, struts, and cross walls, which frame into the walls providing lateral stability, has been placed and has attained the specified compressive strength before backfilling against walls or subjecting walls to service loads.

.5 Verify that concrete in slabs, including slabs on grade supported by piles or caissons, and support components, have reached the specified compressive strengths before backfilling or subjecting slabs to service loads.

2 Products

2.1 MATERIALS

.1 General:

.1 Use admixtures for concrete conforming to CSA A23.1/A23.2, unless otherwise acceptable to the Consultant.

.2 Have the concrete producer certify that admixtures are compatible.

.3 Use Products in accordance with the manufacturer's printed instructions unless otherwise acceptable to the Consultant.

.4 Fresh concrete to be normal density concrete (2350 kg/m^3 ± 100 kg/m^3), unless otherwise noted in Part 2.2 – Concrete Mixes.

.2 Cement and supplementary cementing materials: in accordance with CSA A3001:

.1 For use in general concrete construction, when the special properties of other cement types are not required, Portland cement Type GU or blended hydraulic cement type GUb shall be used.

.2 Should the Contractor choose to include silica fume cement in the concrete mix design, the substitution of silica fume shall not exceed 8% by mass of Portland cement.

.3 Should the Contractor choose to include fly ash in the concrete mix design, the substitution of fly ash shall not exceed 25% by mass of Portland cement.

.4 Should the Contractor choose to include a Ground Granulated Blast Furnace Slag (GGBFS) in the concrete mix design, the substitution of GGBFS shall not exceed 50% by mass of Portland cement, unless specifically accepted by the Consultant.

.3 Aggregates:

.1 Course aggregates: In accordance with CSA A23.1/A23.2. All aggregate sources as listed on the MTO's designated Source Materials (DSM) list.

.2 Fine aggregates: In accordance with CSA A23.1/A23.2.

.4 Water: in accordance with CSA A23.1/A23.2.

.5 Admixtures:

.1 Air entraining admixture: in accordance with CSA A23.1/A23.2 and ASTM C260/C260M.

.2 Chemical admixture: in accordance with CSA A23.1/A23.2, ASTM C260 and ASTM C494. The Consultant is to approve accelerating or set retarding admixtures during cold and hot weather placing.

.1 Water-reducing admixture: ASTM C494/C494M, Type A.

.2 Retarding admixture: ASTM C494/C494M, Type B.

.3 Accelerating admixture: ASTM C494/C494M, Type C.

.4 Water-reducing and retarding admixtures: Type D.

.5 Water-reducing and accelerating admixture: Type E.

.6 Water-reducing high range admixture (super plasticizers): Type F.

.7 Water-reducing, high range and retarding admixtures (super plasticizers): Type G.

.8 Specific performance admixtures: Type S.

.6 Curing compound: to CSA A23.1/A23.2 white.

.7 Non-shrink grout: Shrinkage compensating grout, pre-mixed compound consisting of non-metallic aggregate, Portland cement, water reducing and plasticizing agents to CSA A23.1/A23.2.

.1 Compressive strength: 40 MPa at 28 Days.

.8 Non premixed dry pack grout: composition of non-metallic aggregate Portland cement with sufficient water for mixture to retain its shape when made into ball by hand and capable of developing compressive strength of 40 MPa at 28 Days.

.9 Dry Pack Material: One part cement and three parts sand (fine aggregate) by volume. Add water to obtain a consistency that when a sample is squeezed, only enough water will come to the surface to moisten hand. Maximum water content shall be 4.5 L to 23 kg of cement.

.10 Dovetail anchors and slots: Minimum 0.64 mm thickness, Z275 zinc coated galvanized steel with fillers to prevent entry of concrete during pouring and minimum 2 mm overall thickness.

.11 Rigid insulation: In accordance with CAN/ULC S701 Type 4, extruded polystyrene:

.1 Low Density Insulation:

.1 Styrofoam brand, SM Extruded Polystyrene Foam Insulation by Dow Chemical Canada ULC.

.2 Foamular C-300 Extruded Polystyrene Rigid Insulation by Owens Corning Canada.

.2 High Density Insulation:

.1 Styrofoam brand, Highload 40 (Hi-40) Extruded Polystyrene Insulation by Dow Chemical Canada ULC.

.2 Foamular 600 High Density Extruded Polystyrene Rigid Insulation by Owens Corning Canada.

.12 Drilled Anchors:

.1 HIT-HY 200 System by Hilti (Canada) Corporation.

.2 HSL-3 Heavy Duty Expansion Anchor by Hilti (Canada) Corporation.

.13 Bond breakers: 810-07 Non-Fibered Asphalt Roof and Foundation Coating by Henry Company Canada Inc.

.14 Premoulded joint fillers:

.1 Bituminous impregnated fibre board: in accordance with ASTM D1751.

.2 Sponge rubber: in accordance with ASTM D1752, Type I, flexible firm grade.

.3 Self-expanding Standard cork: in accordance with ASTM D1752, Type III.

.15 Surface hardener:

.1 Factory premixed natural emery aggregates with Type GU normal Portland cement, superplasticizers and wetting agents:

.1 EmeriCrete SH by Sika Canada Inc.

.2 CPD Floor Hardener Pre-mix (Premium) by CPD Construction Products.

.3 MBT brand, Mastercron Ff by BASF – Building Systems.

.16 Sump Pit Waterproofing:

.1 Primer and Moisture Control: Penetrating two-component primer and moisture control system, standard colour, 3 mm to 4 mm dry film overall system thickness.

.2 Coating: Chemical resistant, semi-gloss finish, standard colour, 2.5 mm dry film overall system thickness; single application.

.3 Filler and Grout: Compatible with coating and as recommended by the coating manufacturer.

.4 Joint Backing: Preformed, compressible strips of closed cell polyethylene or urethane foam, rubber tubing or non-migrating plasticized vinyl, oversized 25%, compatible with sealant, primer, epoxy surfacing and substrate.

.5 Joint Sealant: CAN/CGSB-19.24-M, Type 1, Class B, multi-component modified urethane base chemical curing; material compatible with the coating and as recommended by the coating manufacture.

2.2 CONCRETE MIXES

.1 Performance Requirements:

.1 Proportion concrete for structures to create high performance concrete with improved durability, reduced shrinkage and reduced cracking.

.2 Density: Normal density.

.3 Linear Shrinkage:

.1 Limit linear shrinkage to 0.040% after 28 Days drying for 40 mm aggregate concrete and 0.045% after 28 Days drying for 20 mm aggregate concrete.

.4 Durability Design Life

.1 Provide concrete produced under this Section with an expected design life of at least 70 years for the service conditions defined by the usage, and the exposures specified in the Contract Documents.

.2 General:

.1 Establish proportions of cementing materials, aggregates, water, and admixtures required to produce consistent workable concrete with strength and other properties specified, in accordance with CSA A23.1/A23.2.

.2 Design concrete so that material will not segregate and excessive bleeding will not occur.

.3 Use same types and brand of cement throughout.

.4 Comply with and allow for the supplier's Standard Deviation as specified in CSA A23.1/A23.2, Clause 4.4.6.7 Compressive Strength Requirements.

.5 Admixtures plant added with the mix water.

.3 Mixes for Normal Density concrete:

.1 High performance concrete for foundations, footings and foundation walls:

.1 Class F-1 exposure.

.2 30 MPa at 28 Days.

.3 Maximum aggregate size 40mm for slab greater than 400mm thickness and 20mm unless the slab is less than or equal to 400 mm thickness.

.2 Concrete grout for starting structural walls below-grade at construction joint:

.1 Class F-1 exposure.

.2 30 MPa at 28 Days.

.3 Utilize mix 1 above without the coarse aggregate.

.3 High performance concrete for interior slabs, including slabs-on-grade and slabs-on-deck:

.1 Class N exposure.

.2 32 MPa at 28 Days.

.4 Exterior reinforced concrete slabs:

.1 Class C-1 exposure.

.2 35 MPa at 28 Days.

.3 Air content category 1.

.4 Maximum aggregate size 40mm for slab greater than 400mm thickness and 20mm for slabs less than or equal to 400 mm thickness.

.5 Exterior unreinforced concrete slabs, pavements, sidewalks and curbs:

.1 Class C-2 exposure.

.2 32 MPa at 28 Days.

.3 Maximum aggregate size 40mm for slab greater than 400mm thickness and 20mm for slabs less than or equal to 400 mm thickness.

.6 Lean fill, pipe bedding, duct banks, encasements, underpinning and skim slabs:

.1 Class N exposure.

.2 15 MPa at 28 Days.

.3 Maximum aggregate size 20mm.

.4 Mix for Pumped Concrete:

.1 Comply with the requirements of ACI 304.2R and this Section.

.2 Use coarse and fine aggregate with a uniform grading curve.

.3 Superplasticizing admixture may be used for pumped concrete.

.4 Do not use admixtures which promote bleeding.

3 Execution

3.1 RELEASES

.1 Obtain the Consultant's release:

.1 For reinforcement, formwork, falsework, and inserts as placed.

.2 To commence placing concrete.

.2 Provide the Consultant with written notice of the Contractor's intent to pour between 24 hours and 7 Days prior to the pour.

.3 Provide a completed Concrete Pour Release Form (attached as a supplement to this Section) prior to each pour and allow the Consultant 2 hours for their review.

.4 Do not order concrete until the Concrete Pour Release Form has been signed by the Consultant.

3.2 PREPARATION

.1 Obtain written approval from the Consultant before placing concrete. Provide 24 hours minimum notice prior to the placing of concrete.

.2 Place concrete reinforcing in accordance with Division 1 Sections – Concrete Reinforcing.

.3 Remove water, snow, ice, loose soil, laitance, curing compound, wood, and other debris from surfaces on or against which new concrete will be placed.

.4 Roughen and clean surfaces of previously placed concrete against which subsequent concrete will be placed.

.5 During concreting operations:

.1 The development of cold joints shall not be allowed.

.2 Ensure concrete delivery and handling facilitates placing with minimum re-handling, and without damage to the existing structure or Work.

.6 Pumping of concrete is permitted only after the approval of equipment and mix.

.7 Ensure reinforcement and inserts are not disturbed during concrete placement.

.8 Prior to placing of concrete, obtain the Consultant's approval of the proposed method for protection of concrete during placing and curing.

.9 Protect the previous Work from staining.

.10 Clean and remove stains prior to application for concrete finishes.

.11 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.

.12 In locations where new concrete is dowelled to existing work, drill holes in existing concrete.

.1 Place steel dowels of deformed steel reinforcing bars and pack solidly with non-shrink grout to anchor and hold dowels in positions as indicated in the design drawings.

.13 Do not place load upon new concrete until authorized by the Consultant.

3.3 MAXIMUM SIZE OF CONCRETE PLACEMENTS

.1 Limit the size of each placement to allow for strength gain and volume change due to shrinkage.

.2 Add construction joints as necessary to suit pour sizes. Confirm the joint location with the Consultant and adjust as necessary.

.3 Consider beams, girders, brackets, column capitals, and haunches as part of the floor or roof system above and place monolithically with the floor or roof system.

.4 Construction Joints in Unrestrained Slabs on Ground:

.1 Base Slabs placed on the ground may be placed continuously from outside edge to outside edge, outside edge to expansion joint, or from expansion joint to expansion joint, unless shown otherwise on the Drawings.

.5 Construction Joints in Suspended Slabs Restrained by Connecting Walls:

.1 Place slab in alternate strips with the larger dimension of any single placement no greater than 15,000 mm for slabs.

.2 Locate construction joints in suspended slabs near the middle quarter of the spans of slabs and beams, unless indicated otherwise on the Contract Drawings. If a beam intersects a girder at this location, offset the construction joint in the slab and girder by a distance equal to two times the depth of the beam.

.6 Construction Joints in Girders and Beams:

.1 Construct concrete beams and suspended slabs monolithically, unless indicated otherwise on the Contract Drawings.

.2 If vertical construction joints are required, provide shear key, and additional inclined shear reinforcing steel. The Consultant's review and acceptance is required for any joints added into girders and beams.

.7 Construction Joints in Walls:

.1 Limit pours to a maximum of 6.5 m vertically.

.2 Allow 3 Days between adjacent pours.

.3 Locate construction joints a minimum of 2,000 mm away from any junction of two or more walls, a column or beam supported on a wall, the nearest edge of an opening wider than 600 mm, and a construction joint in a slab on which the wall rests.

.4 Place wall in alternate portions with a distance between vertical construction joints not exceeding 15,000 mm for walls

3.4 INSTALLATION/APPLICATION

.1 Prevent damage to waterproofing where concrete is poured against waterproofing.

.2 Sleeves and inserts:

.1 Do not permit penetrations, sleeves, ducts, pipes or other openings to pass through joists, beams, slab drop panels, column capitals or columns, except where indicated or approved by Consultant.

.2 Where approved by Consultant, set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere in the Contract Documents.

.3 Sleeves and openings greater than 100 x 100 mm not indicated in design drawings must be reviewed by the Consultant.

.4 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain written approval of modifications from the Consultant before the placing of concrete.

.5 Confirm locations and sizes of sleeves and openings shown on the Drawings.

.6 Set special inserts for strength testing as indicated and as required by non-destructive method of testing concrete.

.3 Anchor rods:

.1 Prior to placing concrete, place anchor bolts in locations indicated on the reviewed shop drawings under the supervision of the trade supplying anchor bolts and templates in accordance with the manufacturer's printed instructions and in accordance with CSA A23.1/A23.2.

.4 Grout under base plates:

.1 Grout under base plates using procedures in accordance with the manufacturer's recommendations that result in 100% contact over grouted area. Thoroughly compact leaving no voids.

.5 Joint fillers:

.1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by the Consultant.

.2 When more than one piece is required for joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.

.3 Locate and form isolation, construction and expansion joints as indicated on the Drawings and as described in this Section.

.6 Horizontal Construction Joints in Reinforced Concrete Walls and Columns:

.1 Thoroughly clean and saturate the surface of the joint with water.

.2 For walls and columns, place grout onto the existing concrete before starting regular concrete placement. Limit wall and column grout placement to a maximum thickness of 50 mm and a minimum thickness of 30 mm.

.7 Dovetail anchor slots:

.1 Install continuous vertical anchor slots to forms where masonry abuts concrete wall or columns.

.2 Install continuous vertical anchor slots at 800 mm o.c. where concrete walls are masonry faced. Anchors shall project to within 20 mm minimum of masonry face.

.3 Do not install anchor slots in underground concrete walls cast against excavation support systems

3.5 PROTECTION AND CURING

.1 Protect and cure concrete in accordance with CSA A23.1, Clause 7.4 and Table 20.

.2 Protect freshly placed and finished concrete from adverse conditions such as premature drying, moisture loss, defacement due to building operations, and from excessive hot and cold temperatures, for the period of time corresponding to the required curing type of concrete.

.3 Commence protection immediately after placing to achieve the temperature and moisture conditions for the period of time necessary for the concrete to develop its required properties.

.4 Concrete elements shall be protected to limit the temperature differential between the concrete core and the concrete surface within 20°C.

.5 Protection shall not be removed until the concrete has cooled to the temperature differential given in the CSA A23.1, Table 21, in order to avoid cracking of the concrete due to the sudden temperature change near the end of the curing period.

.6 Removal of forms prior to the minimum curing period does not remove the Contractor's obligation to cure and protect the exposed concrete for the minimum time periods specified for curing and protection. Refer to CSA A23.1, Clause 7.4.1.5.3.4.

.7 Curing types based on CSA A23.1, Table 20, as modified in this Section:

.1 Type 1 – Basic curing: Three days at ≥10°C or for the time necessary to attain 40% of the specified strength.

.2 Type 2 - Additional curing: Seven days total at ≥10°C and for the time necessary to attain 70% of the specified strength.

.3 Type 3 - Wet curing: Seven days at ≥10°C and for the time necessary to attain 70% of the specified strength.

.4 Note: Silica fume concrete must be wet cured.

.8 Wet Curing of Concrete:

.1 When wet curing is required, start fog misting immediately after placing operations are completed, in order to prevent plastic shrinkage and cracking from taking place.

.1 Fog misting must be applied continuously from the time of screeding until concrete is covered with burlap or other moisture-retaining covering, in such a way as to maintain high relative humidity above the concrete and prevent drying of the concrete surface.

.2 When concrete has set, cover horizontal surfaces with at least one layer of wet burlap or other moisture-retaining covering.

.1 Strips must overlap 150 mm and must be held in place without marring the surface of the concrete.

.2 Provide suitable weights to prevent blow-off or displacement of protective cover.

.3 Burlap must be pre-soaked by immersing it in water for a minimum period of 24 hours prior to placing and must be maintained in a continuously wet condition throughout the curing period by means of a soaker hose.

.4 Do not permit intermittent drying.

.5 Remove burlap after a minimum of 7 consecutive Days and allow to air dry until the concrete has developed the specified design strengths.

.3 Water must not be allowed to drip, flow or puddle on the concrete surface during fog misting, when placing the burlap or at any time before the concrete has achieved final set.

.9 Use of Curing Compounds and Evaporation Reducers:

.1 Except where concrete wet curing is required, the use of pigmented curing compounds and evaporation reducers may be authorized by the Consultant.

.2 Apply curing compound/evaporation reducer after placing or finishing operations have been completed, in accordance with the compound manufacturer's printed instructions.

.3 Ensure the compound application is uniform and continuous over entire area being cured.

.4 Where surfaces are to be exposed to sunlight, use compound with white pigment.

.5 Do not use curing compounds on surfaces where a bond is required for additional concrete or where a bonded surface coating such as paint, tile, resilient flooring, and similar materials are to be applied.

.10 Curing Plan:

.1 Detailed curing plan containing (at minimum) the duration of curing, the manner in which the surface will be kept moist, type of curing material, and provisions to address potential problems (for example, high winds or extreme weather conditions) shall be prepared by the Contractor and submitted for review by the Consultant as part of the Work plan requested in subsection 1.6, above.

3.6 FINISHING

.1 Treat and finish exposed formed surfaces in accordance with CSA A23.1.

.2 Grout tie holes in concrete flush to the concrete surface. Grout with finishing cement mortar using the same sand and cement as used in the concrete.

.3 Pack grout into place to fill the tie hole and finish to match the adjacent concrete surface.

.4 After the removal of forms, strike off projections, and fill honeycombing and defects in accordance with CSA A23.1/A23.2.

.5 Refer to honeycombed areas for inspection and designation as structural or non-structural and repair as directed by the Consultant.

.6 Floor finish classification: Class A in accordance with Table 22 of CSA A23.1.

.7 Except where indicated otherwise in the Room Finish Schedule on the Contract Drawings or elsewhere in the Contract Documents or Architectural Drawings, follow the follow finishing schedule:

AREA	**Type of Finish**
Wall Surfaces – Exterior:	
1. Above grade/exposed (above a point 150 mm below finish grade)	Number 6 Finish
2. Above grade/covered with brick veneer or other finish material	Number 5 Finish
3. Backfilled (below a point 150 mm below finish grade)	Number 4 Finish
Slabs – Upper Surface:	
4. Firing Range floor slab and Shipping & Receiving floor slab	Number 2 Finish
5. Exterior roof slab/covered with roofing or waterproofing material	Number 1 Finish
6. Other exterior slabs	Number 2 Finish
7. Stairs and landings	Number 3 Finish
8. Top of interior buildings slabs	Number 2 Finish
9. Top of interior slabs to receive mortar setting bed for tile	Number 7 Finish
10. Top of interior slabs to receive resilient flooring or carpet, chemical resistant coating, special flooring, tiles on thin set mortar	Number 2 Finish
11. Equipment bases	Number 2 Finish
12. Where shake on hardener is applied	Number 2 Finish

.8 Finish type other than those indicated in the Room Finish Schedule on the Contract Drawings or elsewhere in the Contract Documents shall be as follows:

.1 Number 1 Finish (Wood Float):

.1 After screeding by accepted method to obtain required floor tolerances, work the surface by means of a wood float in such a manner that after concrete has hardened, no portion of surface shows a variation of more than that specified.

.2 Number 2 Finish (Trowelled):

.1 After screeding and compaction with a wooden float, bring the surface to a smooth level and dense finish free from trowel marks, ridges and depressions by means of steel trowels operated either by hand or by mechanical means.

.2 Do not sprinkle dry cement or sand on the surface during the trowelling process.

.3 Maintain ambient temperature at a minimum of 10°C, when steel trowelling is in progress.

.3 Number 3 Finish (Broomed):

.1 Before the floated surface has fully hardened, brush the surface with a stiff broom in one direction to leave a rough surface.

.4 Number 4 Finish (Formed):

.1 As soon as forms have been removed and directions given by the Consultant, remove projections and fill honeycombing and defects.

.5 Number 5 Finish (Smooth Formed):

.1 As soon as forms have been removed and directions given by the Consultant, patch formwork tie holes, grind off projections, irregularities and rough spots, patch surface defective areas and repair rough spots. Provide a smooth uniform appearance

.6 Number 6 Finish (Rubbed):

.1 As soon as forms have been removed and holes pointed, rub surface with an abrasive rubbing brick until form marks and blemishes are removed and the surface is smooth and of uniform texture and colour.

.2 Do not remove from a larger surface than can be rubbed to fine finish within 6 hours.

.7 Number 7 Finish (Floor to Receive Bonded Topping, Screed, Grout, or Porcelain Tile):

.1 Strike off and screed the concrete base slab to a level below the final floor surface equal to the specified thickness of the finish course as shown on the Drawings.

.2 Float the surface.

.3 Wire broom the surface to make 6 mm deep grooves at approximately 20 mm centres, running in one direction.

.9 Where the schedule of finishes requires painting, prepare surfaces for painting as specified in Division 1 Sections - Painting.

.10 Surface Hardener:

.1 In area(s) indicated to receive surface hardener, power screed the floor slab and float.

.2 Over freshly floated concrete apply surface hardener in accordance with the manufacturer's printed instructions.

.3 Distribute evenly, do not throw hardener.

.4 Float between applications of hardener and after second hardener application with power floats.

.5 Machine trowel to smooth, level, and dense surface of uniform colour, free from trowel marks, ridges, pinholes, and other defects.

.6 Have the manufacturer's representative on Site within 24 hours when requested by the Consultant.

.11 Ensure that the concrete finish is compatible with specified traffic topping or other applied finish.

.12 Production of smooth surfaces by means of cement plaster is not permitted

3.7 CONSTRUCTION TOLERANCE

.1 Concrete tolerances shall be in accordance with CSA A23.1/A23.2 clause 6.4 - Construction Tolerances for Cast-in-Place Concrete, and subsection 1.5 – Quality Assurance, above.

3.8 FIELD QUALITY CONTROL

.1 Site tests: Conduct tests as follows in accordance with CSA A23.1/A23 and submit results as described in subsection 1.6 – Submittals, above.

.1 Concrete pours.

.2 Slump.

.3 Air content.

.4 Compressive strength at 7 and 28 Days.

.5 Chloride ion content penetrability (for exposure class C-1 concrete).

.6 Air and concrete temperature.

.2 Inspection and testing of concrete and concrete materials will be carried out by testing laboratory designated by Consultant for review in accordance with CSA A23.1/A23.2.

.1 Ensure testing laboratory is certified in accordance with CSA A283.

.3 Ensure test results are distributed for discussion at the pre-pouring concrete meeting between the testing laboratory and Consultant.

.4 The Consultant will take additional test cylinders during cold weather concreting. Cure cylinders on Site under the same conditions as concrete which they represent.

.5 Non-Destructive Methods for Testing Concrete: in accordance with CSA A23.1/A23.2.

.6 Inspection or testing by the Consultant will not augment or replace the Contractor’s quality control requirements nor relieve Contractor of any of its responsibilities under the Contract.

3.9 LOADING OF STRUCTURE

.1 Do not load any portion of structure prior to achieving 70% of specified strength and only with the acceptance of the Consultant.

.2 Removal of forms prior to the minimum required curing period does not remove the Contractor’s obligation to cure and protect the exposed concrete for the minimum required time periods specified. Refer to subsection 3.5 of this Section above.

3.10 REPAIRING SURFACE CRACKS IN CONCRETE

.1 After concrete has set for a minimum of 28 Days, and before a maximum of 125 Days, examine surfaces carefully for cracks.

.2 Rout cracks larger than 0.3 mm at the discretion of the Consultant.

.3 Fill cracks with non-shrink grout.

.4 Match the surface to existing surfaces in quality, texture, colour, and elevation.

3.11 REPAIR OF TEMPERATURE AND SHRINKAGE INDUCED CRACKS

.1 Repair cracks in the completed structures employing a suitable polyurethane injection technique to make such cracks completely watertight after repair.

.2 Remove surface injection materials following the completion of the Work and finish the affected areas to match the surrounding concrete.

3.12 INJECTION OF CRACKS – POLYURETHANE GROUT

.1 Use materials in accordance with the manufacturer's printed instructions.

.2 Clean and prepare cracked areas in accordance with the manufacturer's recommendations.

.3 Inject polyurethane grout into cracks in accordance with the manufacturer's written instructions.

.4 Commence injection at the lowest injector on a vertical face and at one end on a horizontal surface. Continue injection until pure uncontaminated material flows out from adjacent injectors. Cap the injectors and proceed to adjacent injectors until all injectors have been filled.

.5 Upon completion, remove injectors and surface sealer. Thoroughly clean the concrete surfaces of excess grout material. Finish the surface to match the surrounding concrete.

.6 Patch injection holes.

3.13 PATCHING

.1 Carry out patching as specified in CSA A23.1/A23.2.

.2 Make good temporary openings left in concrete for pipes, conduits, ducts, shoring, and other Work during construction.

.3 Reinforce with welded wire fabric, as required, and finish to match the surrounding work.

3.14 SEALANT APPLICATION

.1 Do not fill joints sooner than 30 Days after concrete pours.

.2 Comply with the manufacturer’s printed instructions and curing and sawcutting requirements.

.3 Execute joint sealing during cool, dry ambient conditions when the slab is in a contracted state to minimize future joint separation at sealant filled joints.

.4 Fill sawn joints in concrete slabs full depth with sawcut joint sealant.

.5 Seal over pre-moulded joint filler with joint sealant.

.6 Comply with the sealant manufacturer's primer, application, and temperature requirements. Mask floor to edge of joints and fill joint with sealant.

.7 After initial set, prime sealant surface and refill joints with sealant as required to produce a slightly convex joint surface.

3.15 CLEANING

.1 Cleaning:

.1 Promptly as the Work proceeds and upon completion, clean-up and remove from the site, the rubbish and surplus material resulting from the Work of this Section.

.2 Leave the Work area clean at the end of each Day.

.3 Final Cleaning: upon completion, remove surplus materials, rubbish, tools and equipment.

.2 Waste Management:

.1 Prepare a Construction Waste Management plan in accordance with Division 1 Sections - Construction Demolition &Waste Management Plan.

.2 Separate waste materials for reuse and recycling.

.3 Divert unused concrete materials from landfill to local quarry or facility after receipt of written approval from Consultant.

.4 Provide an appropriate area on Site where concrete trucks can be safely washed.

.5 Divert unused admixtures and additive materials (pigments, fibres) from landfill to an official hazardous material collections site as approved by Consultant.

.6 Do not dispose of unused admixtures and additive materials into sewer systems, into lakes, streams, onto ground or in other location where it will pose health or environmental hazard.

.7 Prevent admixtures and additive materials from entering drinking water supplies or streams.

.8 Using appropriate safety precautions, collect liquid or solidify liquid with inert, non-combustible material and remove for disposal.

.9 Dispose of waste in accordance with applicable local, provincial and national regulations.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 Sections of Division 01 apply to this Section.

1.2 SUMMARY

.1 This Section includes supply and installation of unit masonry assemblies consisting, but not limited to the following:

.1 Concrete Masonry Units (CMU).

.2 Masonry accessories.

.3 Site quality control.

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Coordination:

.1 Coordinate with other work having a direct bearing on work of this Section.

.2 Coordinate the masonry work with anchor requirements at framed openings.

.3 Coordinate the masonry work with air barrier installation to achieve continuous monolithic air barrier.

1.4 SUBMITTALS

.1 Samples: Submit samples of concrete block, mortar, masonry reinforcement, ties and anchors, damp course/thru-wall flashing and adhesive, metal drip flashing, mortar dropping control device and weepholes for Consultant's approval before commencing work of this section.

.2 Shop Drawings: Submit shop drawings indicating the following:

.1 Indicate sizes, profiles, coursing, and locations of special shapes for concrete masonry units and stone masonry cladding.

.2 Indicate sizes, profiles, and locations of each stone trim unit required.

.3 Detail corner units, end dam units, and other special applications for fabricated flashings.

.3 Informational Submittals: Provide the following submittals when requested by the Consultant:

.1 Submit ULC Assembly Listings and Materials cut sheets for fire rated assemblies as follows:

.1 Not later than 30 working days following Award of Contract, submit copies of ULC Assembly and Materials Listing for indicating ULC Number and how assembly meets the rating criteria for assemblies listed on drawings or meets requirements of Supplementary Standard SB-3 of Ontario Building Code

.2 Use the same system and material as would be required for a tested assembly for the project; ULC Listings are tested with the specific materials indicated; substitutions will not be permitted unless evidence of equivalency is confirmed.

.3 Submit manufacturer's product data for materials and prefabricated devices, providing descriptions are sufficient for identification at job site; include manufacturer's printed instructions for installation.

.4 Certificates: Submit statements of material properties indicating compliance with specified requirements for each type and size of the following:

.1 Masonry Units:

.1 Include material test reports substantiating compliance with requirements.

.2 Include ULC Listings for fire resistance rated materials and construction equivalent to assemblies with indicated on drawings indicating fire resistance ratings.

.2 Cementitious Materials:

.1 Include brand, type, and name of manufacturer for site mixed mortar materials.

.2 Include description of type and proportions of ingredients for pre-blended, dry mortar mixes.

.3 Include description of type and proportions of ingredients for grout mixes.

.3 Accessories:

.1 Reinforcing bars

.2 Joint reinforcement

.3 Anchors, ties, and metal accessories

.4 Site Quality Control Submissions: Submit detailed description of methods, materials, and equipment used in accordance with cold or hot weather requirements; and proposed unit masonry cleaning techniques.

1.5 SITE CONDITIONS

.1 Protection of Masonry: Protect masonry and other work from marking and other damage and as follows:

.1 Cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work during construction until permanent flashings and membranes are completed.

.2 Cover partially completed masonry when construction is not in progress to prevent wetting of inside wythes of construction and contribution to efflorescence.

.3 Extend cover a minimum of 610 mm (24”) down both sides and hold cover securely in place.

.4 Secure cover a minimum of 610 mm (24”) down face next to un-constructed wythe and hold cover in place where 1 wythe of multi-wythe masonry walls is completed in advance of other wythes.

.5 Provide adequate bracing for masonry during construction and until permanent lateral supports are in place.

.6 Do not apply uniform floor or roof loads for a minimum of 12 hours and concentrated loads for a minimum of 3 days after building masonry walls or columns.

.2 Cold Weather Protection:

.1 Keep masonry materials completely free from ice and frost. Use approved smokeless heaters. Do not use scorched sand. Do not use salts, admixtures or antifreezes.

.3 Conform to the following construction requirements:

AIR TEMPERATURE	HEATING OF MATERIALS	PROTECTION
Above 5 deg C	Normal masonry procedures	Cover walls and materials

Below 5 deg C	Heating mixing water. Maintain mortar temperatures between 5 deg C and 50 deg C until placed	Cover walls and materials to prevent wetting and freezing.
Below 0 deg C	In addition to above heat sand. Thaw frozen sand and frozen wet masonry units before use.	With wind velocities over 35 km/h provide windbreaks during the workday and cover walls and materials at the end of each workday to prevent wetting and freezing. Maintain masonry above 0 deg C by using auxiliary heat or insulated blankets for 16 hours after laying masonry units.
Below -6 deg C	In addition to above heat dry masonry units to -6 deg C	Provide enclosure and supply sufficient heat to maintain masonry enclosure above 0 deg C for 24 hours after laying masonry units.

.4 Hot Weather Requirements

.1 Comply with hot weather construction requirements contained in reviewed submittals.

.2 Protect freshly laid masonry from drying too rapidly, by means of waterproof, non-staining coverings.

.3 Keep masonry dry using waterproof, non-staining coverings that extend over walls and down sides sufficient to protect walls from wind driven rain, until masonry work is completed and protected by flashings or other permanent construction.

1.6 DELIVERY, STORAGE, HANDLING AND PROTECTION

.1 Delivery and Acceptance Requirements: Deliver pre-blended, dry mortar mix in moisture resistant containers designed for lifting and emptying into dispensing silo; store dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.

.2 Storage and Handling Requirements: Store masonry units on elevated platforms in a dry location and as follows:

.1 Stack materials on floors of building so that structural design loads are not exceeded; coordinate with Consultant.

.2 Cover tops and sides of stacks with waterproof sheeting securely tied to pallets if units are not stored in an enclosed location; do not install masonry units that become wet until they are dry.

.3 Store cementitious materials on elevated platforms, under cover, and in a dry location; do not use cementitious materials that have become wet or damp.

.4 Store aggregates where grading and other required characteristics can be maintained; store to prevent contamination by substances deleterious to performance and appearance.

.5 Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

2 Products

2.1 CONCRETE MASONRY UNITS

.1 Standard concrete blocks shall be autoclave or bubble cure process, high pressure steam cured, modular, conforming to CSA A165, with lineal shrinkage and moisture movement not to exceed 0.035% and shall be as follows;

.1 Classification: S/15/A/M, 75% solid for all locations where structural members bear on concrete block.

.2 H/15/A/M, for all other block work.

.3 Size: Modular imperial to sizes indicated on Drawings.

.4 Special shapes:

.1 Provide square units for exposed corners.

.2 Provide purpose made shapes for lintels and bond beams.

.3 Provide additional special shapes required for project.

.4 Manufacture special shapes at same time and with the same batch as standard concrete block to be used.

.2 Precast Concrete Shapes: Precast suitably reinforced concrete units with uniform colour, accurate definition at corners and at angle changes and faces true, plane and well-defined. Minimum 15 MPa compressive strength. Exposed to view surfaces in dense and even finish, free of defects such as honeycombing, voids, loss of fines. Concealed surfaces in float finish.

.1 Sills and Lintels: Colour and texture to match adjacent masonry units.

.2 .

.3 Fire Resistant Concrete Masonry Units:

.1 CAN/CSA-A165 Series, same classification as non-rated block units except aggregate used in units and equivalent thickness of units to comply with applicable Code for fire-resistance ratings indicated. For fire rated walls requiring a fire-resistance rating of 3 hours or greater, use ULC certified units.

.4 Size: Modular to sizes indicated on Drawings.

.1 Where concrete block walls are required as fire separations or barriers, they shall conform to the National Building Code. With respect to equivalent thickness and type of concrete. Consult with Consultant for locations and special conditions.

.5 Exposed block shall all be made by one manufacturer and shall be uniform in colour, shade and texture.

2.2 MORTAR MATERIALS

.1 Mortar materials shall conform to CSA A179.

.2 Water: Potable (clean, exempt of ice, oils, acid, alkalis, organic matter, sediments or any other harmful matter). CSA A179.

.3 Aggregate:

.1 CSA A179.

.2 Use same brands of materials and source of aggregate for entire project.

.3 Use washed aggregate consisting of natural sand or crushed stone for mortar that is exposed to view.

.4 Cement: Normal portland, in accordance with CSA A3000, Type GU.

.5 Grout: In accordance with CSA A179, Table 3.

.6 Hydrated Lime: ASTM C207, Type S.

.7 Cold Weather Admixture:

.1 Non-chloride, non-corrosive, accelerating admixture as recommended by manufacturer for use in masonry mortar of composition indicated.

2.3 MORTAR MIXES

.1 Mixing:

.1 Prepare and mix mortar materials under strict supervision and in small batches for immediate use only. Mix proprietary mortars in strict accordance with CSA A179. Do not use re-tempered mortars for coloured mortars.

.2 For Masonry Below Grade and In Contact With Earth:

.1 Use premixed silo or bagged Type 'S' masonry cement mortar having minimum compressive strength of 8.5 MPa at 28 days, jobsite tested.

.3 Interior Reinforced or Non-Reinforced Block Walls:

.1 Use Type 'S', premixed Bloc Mix by Daubios Inc., or approved equal by Maxi-Mix.

.4 For All Other Masonry:

.1 Use Type 'N', premixed silo or bagged masonry mortar having a minimum compressive strength of 3.5 MPa at 28 days, jobsite tested as per property specification, Table 6, CSA A179.

2.4 MASONRY REINFORCEMENT, TIES AND ANCHORS

.1 Masonry Joint Reinforcement: In accordance with to CSA A371 and ASTM A496/A496M, with corrosion protection in accordance with CSA S304.1 and CSA A370, and as follows:

.1 Interior Walls: Hot dip galvanized, carbon steel.

.2 Exterior Walls: Stainless steel.

.3 Lengths: A minimum of 3050 mm (10') with prefabricated corner and tee units.

.2 Connectors: In accordance with to CSA A370 and CSA S304.1 with hot dip galvanized finish.

.3 Single Wythe Masonry Joint Reinforcement: Either ladder or truss type with single pair of side rods.

.4 Ties and anchors specified in this section shall be designed in accordance with CSA A370 for non-conventional masonry connectors as follows:

.1 Deflection: Maximum 1.6 mm (1/16") including free play, when acted upon by a lateral load of 0.45 kN, in all possible positions of adjustment.

.2 Positive restraint at position of maximum adjustment.

.3 Free play of multi-component ties maximum 0.8 mm (1/32") when assembled in all possible configurations.

.4 Anchors shall allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall.

.5 Lateral Partition Supports (Top of Wall Anchors):

.1 Angle Support: Fabricated from 3 mm (1/8") core metal thickness angled steel plate having 75 mm (3") long legs fastened to deck structure to allow vertical movement of

masonry assembly; hot dip galvanized; coordinate with Section 07 84 00 – Firestopping and Smokeseals for firestopping insulation and smoke seals.

.2 Plate Support: Fabricated from 3 mm (1/8") core metal thickness stainless steel plate with 9.5 mm (3/8") diameter metal 150 mm (6") long welded to plate having closed end plastic tube fitted over rod that allows rod to move in and out of tube.

.3 Anchor Bolts: Where required provide Headed or L-shaped steel bolts in accordance with ASTM A307, Grade A; with ASTM A563 hex nuts and, where indicated, flat washers; hot-dip galvanized in accordance with ASTM A153/A153M, Class C.

.4 Post Installed Anchors: Provide chemical anchors, with capability to sustain, without failure, a load equal to six times the load imposed when installed in solid or grouted unit masonry and equal to four times the load imposed when installed in concrete when tested in accordance with ASTM E488/E488M conducted by a qualified independent testing agency, and as follows:

.1 Indoor Locations: Carbon-steel components zinc-plated in accordance with ASTM B633, Class Fe/Zn 5.

.2 Outdoor and High Humidity Locations: Alloy Group 1 or 2 stainless steel bolts complying with ASTM F593 and nuts complying with ASTM F594.

.3 Fastening into Solid Concrete or Solidly Grouted Installation: Two component, injectable adhesive specifically manufactured for use in installing dowels or threaded anchor rods and inserts into new or existing concrete or grout. Basis-of-Design Materials: Hilti Inc., HIT HY150 System, no Substitutions Accepted.

.4 Fastening Trough Hollow Wall Installation: Two component, injectable adhesive specifically manufactured for use in installing dowels or threaded anchor rods and inserts, with cylindrical mesh screen tube into new or existing masonry cavity wall. Basis-of-Design Materials: Hilti Inc., HIT HY20 System, no Substitutions Accepted.

.6 Galvanizing for Masonry Reinforcement, Ties and Anchors:

.1 Hot Dip Hardware and Bolts: In accordance with ASTM A153/A153M, Class B-2 regardless of location.

.2 Hot Dip Sheet Steel: In accordance with ASTM A653/A653M, Coating Designation Z600, regardless of location.

.3 Structural Shapes and Pipes: In accordance with ASTM A123/A123, Grade 85, regardless of location.

2.5 MISCELLANEOUS MASONRY ACCESSORIES

.1 Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D2000, Designation 2AA-805 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

.1 Products: Subject to compliance with the requirements of this Section, provide:

.1 RS Series – Rubber Control Joints by Hohmann & Barnard, Inc.

.2 Firestopping: As specified under Section 07 84 00 – Firestopping and Smokeseals.

.3 Sealants: As specified under Section 07 92 00 – Sealants.

.4 Support Angle:

.1 Hot dip galvanized 458 g/m5/side in accordance with CSA A370 and ASTM A153/A153M.

.5 Fasteners: Galvanized fasteners meeting the requirements of ASTM A325, and as recommended by manufacturer.

.6 Joint Filler:

.1 Compressible Filler: Pre-moulded filler strips in accordance with ASTM D1056, Grade 2A1; compressible up to 35%; of width and thickness indicated; formulated from neoprene, urethane or PVC.

.7 Bond Breaker Strips: #15 asphalt saturated, organic roofing felt in accordance with CSA A123.3.

3 Execution

3.1 EXAMINATION

.1 Verify that field conditions are acceptable and are ready to receive work.

.2 Verify items provided by other sections of work are properly sized and located.

.3 Verify that built-in items are in proper location, and ready for roughing into masonry work.

.4 Verify walls including steel connections n walls to be grouted have been inspected by structural engineer, before grouting.

3.2 PREPARATION

.1 Direct and coordinate placement of metal anchors supplied to other Sections.

.2 Provide temporary bracing and shoring during installation of masonry work. Maintain in place until building structure provides permanent bracing.

.3 Protect materials and adjacent construction mortar droppings and damage during construction.

.4 Plug grouting clean-out holes with block masonry units. Brace masonry for wet grout pressure.

3.3 COURSING

.1 Build masonry plumb, level, and true to line, with vertical joints in alignment.

.2 Establish lines, levels, and coursing indicated. Protect from displacement.

.3 Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

.4 Concrete Masonry Units:

.1 Bond: Running; stack bond for walls indicated with vertical bar reinforcing.

.2 Coursing: One unit and one mortar joint to equal 200 mm (8”).

.3 Mortar Joints: Concave where exposed or where paint or other finish coating is indicated; flush for concealed joints. Cut mortar joints flush where resilient base, wall tile, parging, air barrier or insulation is scheduled.

3.4 PLACING AND BONDING

.1 Lay hollow masonry units with face shell bedding on head and bed joints.

.2 Reinforced Masonry: Lay masonry units with core cells vertically aligned clear of mortar and unobstructed. Place mortar in masonry unit bed joints back 6 mm (1/4”) from edge of unit grout spaces, bevel back and upward.

.3 Where indicated, provide special shape units.

.4 Exposed Faces: Lay face work from face side with exposed face flush.

.5 Buttering corners of joints or excessive furrowing of mortar joints are not permitted.

.6 Remove excess mortar as work progresses.

.7 Interlock intersections and external corners of walls with running bond.

.8 Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

.9 Perform job site cutting of masonry units with power-driven abrasive discs to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges. Allow 3 mm (1/8") clearance around items penetrating or built into walls.

.10 Isolate masonry from vertical structural framing members with a control joint.

.11 Isolate top joint of masonry from horizontal structural framing members and slabs or decks with compressible joint filler. Finish resulting joint with Sealant.

.12 Fill masonry cores with grout at:

.1 Ends of walls, both free and abutting other work.

.2 Jambs of openings, minimum 300 mm (12") from jamb face.

.3 Courses under plates and lintel requiring bearing.

.4 Attachment devices for fixtures and built-in items.

.5 Courses at tops of fire rated walls.

.6 Blocks of parapet walls, and in accordance with CSA-A371, Appendix G1.

.7 Anchors set in block cells.

.8 Install building paper below voids to be filled with grout; keep paper 25 mm (1") back from face of units.

3.5 CONTROL AND EXPANSION JOINTS

.1 General: Install control and expansion joint materials in unit masonry where indicated and not to exceed 6 metres (20') on center and 3 metres (10') from corners. Build-in related items as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

.2 Form control joints in concrete masonry as follows:

.1 Install preformed control-joint gaskets designed to fit standard sash block.

.2 Keep head joints free and clear of mortar for application of sealant.

3.6 PROVISION FOR MOVEMENT

.1 Leave space of dimension indicated between top of non-loadbearing wall and structural elements. Do not use wedges.

3.7 REINFORCEMENT AND ANCHORAGE

.1 Install reinforcement and anchorage to CSA-A370, CSA-A371 and CSA-S304.1 and as indicated.

.2 Install masonry joint reinforcement as indicated. Where not indicated provide as follows:

.1 Install horizontal joint reinforcement 400 mm (16") on centre. For stack bond, place joint reinforcement at every course.

.2 Place reinforcement in first and second horizontal joints above and below openings. Extend minimum 400 mm (16") each side of opening.

.3 Place reinforcement continuous in first and second joint below top of walls.

.4 Lap joint reinforcement ends minimum 150 mm (6").

.3 Bar Reinforcing Steel:

.1 Secure reinforcing steel in place. Provide bar sizes, laps and spacings as indicated. Maintain position within 13 mm (1/2") of dimensioned position.

.2 Unless otherwise indicated locate vertical reinforcing on centreline of units.

.3 Unless otherwise indicated, reinforce stack-bonded unit joint corners and intersections with strap anchors 400 mm (16") on centre.

.4 Secure reinforcing steel in place. Inspect steel connections before grouting.

.5 Provide cleanout openings at bottom of cores containing reinforcement.

.6 Fill cells containing reinforcement and anchor bolts solidly with grout.

.4 Anchorage:

.1 Provide lateral supports for masonry walls and partitions as required by applicable codes, perpendicular to wall faces and either horizontally or vertically to wall panel edges.

.2 Where lateral support at tops of walls is required, provide anchors or clip angles installed at spacings not exceeding 10 times the wall thickness, unless otherwise indicated.

.3 Where lateral support at sides of walls is required, provide anchors or clip angles installed at spacings not exceeding 4 times the wall thickness, unless otherwise indicated.

3.8 LINTELS

.1 Install steel lintels where indicated.

.2 Provide masonry lintels where shown and where openings of more than 610 mm (24") are shown without structural steel or other supporting lintels.

.3 Provide minimum bearing of 200 mm (8") at each jamb unless otherwise indicated.

3.9 LATERAL SUPPORT AND ANCHORAGE

.1 Unless otherwise indicated, attach strap anchors to building structural members abutting ends of walls. Embed in every second block joint.

.2 Provide other lateral support and anchorage as indicated.

3.10 GROUTING REINFORCED MASONRY

.1 Permit mortar to cure 7 days before placing grout.

.2 Unless otherwise indicated, reinforce masonry unit cores with reinforcing bars and grout as follows:

.1 Retain vertical reinforcement in position at top and bottom of cells and at intervals not exceeding 192 bar diameters. Splice reinforcement as indicated.

.2 Wet masonry unit surfaces, in contact with grout just prior to grout placement, when required, to reduce moisture suction from grout.

.3 Grout spaces less than 50 mm (2") in width with Fine grout using low lift grouting techniques. Grout spaces 50 mm (2") or greater in width with Coarse grout using high or low lift grouting techniques. Completely fill spaces of stack bonded masonry; attain minimum 50 percent grout filling of spaces in running bond masonry.

.4 When grouting is stopped for more than one hour, terminate grout 38 mm below top of upper masonry unit to form a positive key for subsequent grout placement.

.3 Low Lift Grouting: Place first lift of grout to a height of 400 mm (16") to three masonry unit courses and rod for grout consolidation. Place subsequent lifts in 200 mm (8") increments and rod for grout consolidation.

.4 High Lift Grouting:

.1 Provide cleanout opening no less than 100 mm (4") high at the bottom of each cell to be grouted by cutting one face shell of masonry unit.

.2 Clean out masonry cells with high pressure water spray. Permit complete water drainage.

.3 Request inspection of cells. Allow 3 days advance notice of inspection.

.4 After cleaning and cell inspection, seal openings with masonry units.

.5 Pump grout into spaces. Maintain water content in grout to intended slump without aggregate segregation.

.6 Limit grout lift to 1500 mm (5') and mechanically vibrate. Wait 45 minutes before placing next lift.

3.11 CONTROL JOINTS

.1 Provide continuous control joints as indicated.

.2 Do not continue horizontal joint reinforcement through control joints, unless otherwise indicated.

.3 Break vertical mortar bond with control joint filler, full depth of unit. Fill adjacent core with grout fill. Rake joint at exposed unit faces for placement of backer rod and sealant.

.4 Size control joint as specified in Division 07 Section Sealants, for sealant performance.

.5 Where joint locations are not indicated, space joints 6 m (20') on centre, and one adjacent to corner at each change of direction.

3.12 BUILT-IN WORK

.1 As work progresses, install built-in items to be built into the work and furnished by other sections.

.2 Install built-in items plumb and level.

.3 Build chases; cutting not permitted. When openings require cutting after walls are in place, saw cut only; breaking of block not permitted.

.4 Where masonry encloses conduit or piping, place to required level to permit inspection and testing. Cover items when directed.

.5 Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill hollow metal door frame voids solid with grout or insulation as indicated.

.6 Do not build in organic materials subject to deterioration.

3.13 ERECTION TOLERANCES

.1 Maximum Variation from Plane of Wall: 6 mm/3 m (1/4" per 10') and 13 mm/6 m (1/2" per 20') or more; 3 mm/3m (1/8" per 10') for walls to receive thin-set tile.

.2 Maximum Variation from Plumb: 6 mm (1/4") per story non-cumulative; 13 mm (1/2") in two stories or more.

.3 Maximum Variation from Level Coursing: 3 mm/m (1/8" per 36") and 6 mm/3 m (1/4" per 120").

3.14 CUTTING AND FITTING

.1 Cut and fit neatly for conduit, sleeves, recessed or built-in objects. Coordinate with other sections of work to provide correct size, shape, and location.

.2 Make cuts straight, clean and free of uneven edges.

.3 Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.15 SITE QUALITY CONTROL

.1 Inspections:

.1 Engage a professional structural engineer experienced in design and installation of this work and licensed in the Province where the Project is located, to perform inspections.

.2 Perform timely and regular inspections.

.3 Verify installation conforms to applicable building Code.

.4 Prepare and submit inspection forms required by applicable building code.

.2 Testing:

.1 Owner will engage qualified independent testing agency to inspect and test engineered masonry work and prepare reports.

.2 Allow testing agency access to scaffolding and work areas as needed to perform tests and inspections. Retest materials that fail to meet specified requirements.

.3 Tests Prior to Construction: One set of tests.

.4 Tests During Construction: One set of tests for each 300 sq. m (3300 sq.ft.) of wall area or portion thereof.

.5 Mortar and Grout Compressive Strength and Air Content Tests: For each mix provided, according to ASTM C780 for mortar; ASTM C1019 for grout.

3.16 CLEANING

.1 Clean installed work.

.2 Remove excess mortar and mortar smears as work progresses.

.3 Replace defective mortar. Match adjacent work.

.4 Clean soiled surfaces with cleaning solution.

.5 Use non-metallic tools in cleaning operations.

3.17 PROTECTION OF FINISHED WORK

.1 Protect installed work.

.2 Without damaging completed work, provide protective boards at exposed external corners which may be damaged by construction activities.

.3 Cover unfinished walls to prevent moisture infiltration.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 General Conditions, Supplementary Conditions and Division 01 apply to this Section.

.2 Conform to the National Building Code of Canada, the Construction Safety Act, CSA Standard S16.1-M (latest edition) and applicable Provincial building code. All codes and standards shall be current editions with all revisions to date.

.3 Co-operate with other trades for satisfactory completion of the Work.

.4 Where structural steel members specified on the drawings are not available to the Contractor, the Structural Steel Contractor shall provide members having all section properties equal to or better than the specified members at no additional cost. Contact Engineer for acceptance of any and all substitutions.

1.2 RELATED WORK SPECIFIED ELSEWHERE

.1 Contractor shall be responsible for co-ordinating this section with all related sections.

1.3 QUALITY ASSURANCE

.1 Execute work of this Section only by a structural steel fabricator who is fully accredited and a current member of the Canadian Institute of Steel Construction, or who has received approval, in writing, from the Consultant no less than one (1) week before Tender closing.

.2 Any organization undertaking to weld under this contract shall be fully approved by the Canadian Welding Bureau under the requirements of CSA W47.1 (latest edition), W55.3 (latest edition) and CSA W59 (latest edition).

1.4 SUBMITTALS

.1 Shop Drawings:

.1 Prepare and submit shop and erection drawings which conform to the requirement of the General Conditions and Division 1 Sections – Submittal Procedures, CAN/CSA S16.1-M (latest edition), and as specified herein.

.2 Show the size, spacing and location of structural steel connections, attachments, reinforcing and anchorage. Include necessary plans, elevations and details. Indicate size and type of fastening. For welded connections, use welding symbols in compliance with AWS and indicate clearly net weld lengths.

.3 Submit typical details of connections and any special connections for review by the Consultant before preparation of shop drawings.

.4 Review of shop drawings by the Architect and Engineer will not absolve the Contractor from his responsibility of providing materials and equipment to complete and finish his work in accordance with the Contract Documents. Departures or differences from the reference drawings shall be approved, in writing, by the Architect/Consultant.

.5 The Subcontractor shall include in his delivery schedule a minimum of two (2) weeks for Consultant review of shop drawings.

.6 All connections to be designed by a qualified Engineer registered to practice in the Province of construction.

.7 All shop drawings are to be signed and sealed by a qualified Engineer registered to practice in the Province of construction, who shall take responsibility for the design of all connections.

.8 Do not use Contract Documents as shop drawings or erection drawings. Contract Documents used for this purpose will not be reviewed. Delays resulting from this procedure will be the responsibility of the Contractor.

1.5 INSPECTION AND TESTING

.1 Qualified inspectors will be employed by the Owner for this Work. Inspection organization undertaking to inspect welding shall be qualified in accordance with the requirements of CSA W178.1 (latest edition) 'Qualification Code for Welding Inspection Organizations' and approved by the Canadian Welding Bureau.

.2 Provide free access for inspectors to all places where Work is being done.

.3 Inspectors are to ensure that materials conform with the requirements of this Specification.

.4 Mill test reports, properly correlated to the materials, will be accepted in lieu of physical tests.

.5 Inspection shall include:

.1 Shop inspection of fabrication in the plant.

.2 Identification of material grades.

.3 Check of overall dimensions.

.4 Check of cambers.

.5 Check of workmanship regarding layout, punching and reaming of holes.

.6 Shop and field inspection of bolted connections.

.7 Shop and field inspection of welded joints.

.8 General inspection of field cutting and alterations.

.9 General inspection of shop priming and field touch-up. spandrel

.6 The installation and testing of bolts shall conform to the requirements CAN/CSA S16.1-M (latest edition). Inspector shall check one (1) representative connection in ten (10) by torque testing each bolt, and shall check each bolt in every connection with a tap of a hammer for soundness. Inspectors shall enforce the requirements of the connection type.

.7 Inspector shall examine visually all welded joints for inclusions, porosity, lack of fusion, penetration, contour, under-cuts and cracks. Root passes shall be checked for penetration and cracks from the back of the joint. When directed by the Consultant, have one (1) representative weld in ten (10) and every weld in direct tension tested ultrasonically.

.8 Inspector shall make full prompt written report to the Architect of all inspections and tests. Circulate reports to the Architect (two (2) copies), Engineers (one (1) copy), General Contractor (two (2) copies), Owner (one (1) copy) and Authorities having jurisdiction.

.9 Steel materials and workmanship not conforming to this Specification will be rejected. Remove and replace defective materials without unnecessary delay and without extra cost.

1.6 DESIGN

.1 Design connections in accordance with the Handbook of Steel Construction by the Canadian Institute of Steel Construction for loads shown or required.

.2 Conform to the National Building Code of Canada (latest edition) and applicable Provincial Building Codes and subsequent updates, CAN/CSA S16.1 (latest edition), local by-laws and regulations.

.3 Top of beam elevations given in relation to the underside of steel deck levels shall be:

.1 Beams support joists: Underside of joist shoe

.2 Beams not Supporting joist: 0

.3 Other: As noted on plans/sections

1.7 DELIVERY, STORAGE AND HANDLING

.1 Co-ordinate deliveries to comply with Construction Progress Schedule and arrange ahead for off-the-ground storage location. Do not load any area beyond the design limits.

.2 Adequately protect steel against rust and damage during manufacturing, delivery and storage.

.3 Store material on planks on a dry area and protect from damage. Make good immediately any damage done, clean scratches and the like, touch-up with specified primer.

2 Products

2.1 MATERIALS

.1 Structural Steel: New stock (not weathered or rusted); to conform to CAN/CSA-G40.20/G40.21 (latest edition), Grade 350W.

.2 Hollow Structural Sections: (HSS); New stock; to conform to CAN/CSA-G40.20/G40.21 (latest edition), Grade 350W, Class H, stress relieved.

.3 Provide high strength bolts in compliance with ASTM Standard A325 (latest edition) - High Strength Bolts for Structural Steel Joints, including suitable nuts and plain hardened washers.

.4 Provide welding electrodes in compliance with CSA W48-Series - Mild Steel Covered Arch Welding Electrodes. Welding materials shall conform to CSA W59 (latest edition).

.5 Structural Steel Primer: CAN/CGSB-1.40-M (latest edition), Structural Steel, Oil Alkyd Type or CAN/CGSB-140-M (latest edition): Red Lead, Iron Oxide, Oil Alkyd type and zinc rich paint to approved manufacturer's specifications containing 85% zinc in dry film for exterior exposed members. Shop coat and on-site touch-up shall be no less than 0.5 mils thickness.

.6 Touch-Up Primer: CAN/CGSB-1.181 (latest edition), zinc rich organic primer, 'Gild Zinc 100' by ICI Paints Canada Inc., or other approved manufacturer.

.7 Commercial galvanizing to conform to CSA Standard G164-M (latest edition).

.8 Welded studs shall be by an approved manufacturer such as TRW Nelson and shall conform to CSA Standard W59 (latest edition).

3 Execution

3.1 PREPARATION RELATED TO OTHER TRADES

.1 As the work of other trades progresses, supply anchor bolts, adjustable lintel inserts, bearing plates, lintels and other members required to be built-in with the work of other trades.

.2 Give necessary instructions to other trades for setting bearing plates, anchor bolts and other members to be built-in with the work of other trades.

.3 Verify the locations and elevations of concrete foundations and anchor bolts for column bases before standing columns, or commencement of erection will be deemed to represent acceptance of the previous work and conditions.

3.2 FABRICATION

.1 Fabrication of structural members shall comply with CSA S16.1-M (latest edition) and as specified below.

.2 Use only clean and straight material. If straightening or flattening is necessary, do it only by a process and in a manner that will not injure the material. Material having kinks or bends not called for on the drawings will be rejected.

.3 Shop or field connections shall be bolted with high strength bolts or welded. Connections shall be made with due regard for Architectural drawings and appearance. **DO NOT** interfere with clearance lines or architectural finishes.

.4 Minimum size of welds to be 5mm.

.5 Beam connections shall be adequate to resist the reactions produced by the framing or load conditions.

.6 Provide double angle header connections where practical. Otherwise use seat connections with top clip angles for lateral support.

.7 Header connections shall be used at all expansion joints for structural steel.

.8 Minimum length of double angle header connections shall not be less than half of the depth of the beams.

.9 Do not use one-sided or fish plate type connections.

.10 Provide top and bottom flange angle clips for all spandrel beams.

.11 Provide punched holes 11mm to 27mm in diameter for convenience of other trades in attaching wood or other materials to steel work, when so directed by the Architect. Holes shall be so placed as not to cause any appreciable reduction in the strength of the member.

.12 Provide holes for pipes and ducts and the reinforcing for same as indicated on drawings. Cutting of holes in steel beams in the field will not be permitted, without the written approval of the Consultant.

.13 Provide separators at approximately 1200mm O.C. for double beams and channels as follows:

.1 Beams and channels 200mm or less in depth: One (1) or two (2) rows of pipe separators.

.2 Beams and channels over 200mm in depth: Channel separators unless otherwise detailed on the drawings.

.14 Mill column bearing plates under column bearing.

.15 Structural steel members shall not be spliced unless approved by the Structural Engineer in writing.

.16 Provide 50mm clear space between structural steel at expansion joints.

.17 Provide adjustable galvanized steel anchors 40mm x 6mm on columns that abut masonry for anchoring every 400mm in height.

.18 Provide adjustable galvanized steel anchors 40mm x 6mm on beams that abut masonry at 400mm O.C. vertically and 2000mm O.C. horizontally.

.19 Welding shall comply with CSA W59 (latest edition).

.20 Fabricator shall be approved by the Canadian Welding Bureau under the requirements of CSA W47.1 (latest edition).

3.3 SHOP PAINTING AND PROTECTION

.1 Clean steel by shot-blasting or power wire brushing to remove rust, mill scale, oil, dirt and other foreign matter before commencing shop painting. The quality of cleanliness shall be of standard

stated in SSPC-SP6 Commercial Blast Cleaning, or SSPC-SP3 Power Tool Cleaning, as may be required to satisfy final paint finish requirements.

.2 Clean welds by wire brushing and wash down with clean water, to remove the chemical residues left by the electrodes, prior to painting.

.3 All steel work shall receive one (1) shop coat of exterior grade primer.

.4 Steel work shall be painted and shall remain under cover until the paint protection has dried.

.5 Give the parts which are inaccessible after assembly two (2) coats of primer coat paint, of different colours, when members are noted to be painted.

.6 Provide sandblasting before finish painting for steel members at edge of openings, as shown on drawings.

.7 Steel work shall be left installed in a clean state ready to receive applicable finishes.

.8 Where steel is to be covered with sprayed fireproofing, ensure that paint primer used is compatible with sprayed fireproofing.

.9 The following surfaces shall not be painted:

.1 Surfaces and edges to be field welded, except joist surfaces to receive steel decking. IF painted, remove paint for field welding for a distance of at least 50mm on all sides of the joint.

.2 The contact surfaces of friction-type connections assembled by high strength bolts.

.3 Portions of steel members which are to be encased in, or in contact with, concrete slabs cast-in-place.

.4 All exterior exposed steel shall be galvanized or painted with approved rust inhibitive paint.

3.4 ERECTION

.1 Make adequate provision for horizontal and vertical erection loads and for sufficient temporary bracing to keep structural steel plumb and in true alignment until the completion of erection and installation of concrete work and roof decks which provide the necessary permanent bracing. Any failure to make proper and adequate provisions for erection stresses shall be entirely at the risk and responsibility of the Contractor.

.2 When temporary steel members are required for erection purposes, such members shall be provided and removed when no longer required.

.3 Handle and store structural steel on the job site in such a manner that no damage shall be caused to the material, or the structure.

.4 Erect individual members of the structural steel to the following tolerances:

.1 Exterior columns, spandrel beams and angles: 1 to 1000.

.2 All other pieces: 1 to 500.

.3 Adjustable Shelf Angles attached to steel frame: 3mm plus or minus, with abutting ends of members at the same level. These elements shall be welded in place after final adjustment and galvanizing shall be touched-up with zinc rich paint.

.4 A variation of 1.5mm is permissible in the overall length of members with both ends milled. Members without milled ends which are to be framed to other steel parts of the structure may have a variation from the detail length not greater than 2.5mm for members 9000mm or less in length, and not greater than 3mm for members over 9000mm in length.

.5 Execute all field assembly and welding in accordance with the requirements for shop fabrication excepting such as manifestly apply to shop conditions only.

.6 Provide bearing plates and standard government wall anchors for beams bearing on masonry or concrete.

.7 Provide 150mm bearing for angle lintels and bolt or weld together upstanding legs. Maximum spacing of bolts or welds shall be 600mm.

.8 Paint field bolts, field welds and any abrasions or damage to the shop coat or primer, after erection.

.9 Provide C100 x 8 structural members for framing at perimeter of holes through metal decking where openings between 450mm and 1200mm in roof deck and between 300mm and 1200mm in floor deck measured across flutes. Connect to main framing members.

3.5 ARCHITECTURALLY EXPOSED STEEL

.1 Where finished surfaces of steel are to be left exposed to view, fabricate as specified in AISC Specification for Architecturally Exposed Steel, including specified straightness.

.2 Continuously weld connection joints where exposed to view, and grind them smooth and flush with adjacent surfaces.

.3 Remove mill marks, identification and surface imperfections by grinding smooth and flush with adjacent surfaces.

.4 Clean, prime and protect all steel as specified in this Section. Apply one (1) coat of primer compatible with finish specified in Division 1 Sections – Painting.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 Sections of Division 01 apply to this Section.

.2 All references standards specified herein imply the latest edition of the standard.

1.2 SUMMARY

.1 Supply and install all miscellaneous metal work indicated on drawings and not included in the work of other Sections in addition to items listed in this Section.

1.3 QUALITY ASSURANCE

.1 All Codes and Standards referred to in this Specification shall be current editions including all latest revisions and addenda.

.2 Conform to requirements of CSA-S16, Design of Steel Structures and CAN/CSA-S136, Cold Formed Steel Structural Members.

.3 Architectural metals work shall be of the highest architectural quality, free of scratches, pitting, roughness, marring, discolouration, staining and other imperfections.

.4 Work of this Section to be executed by firm thoroughly conversant with laws, by-laws and regulations which govern, and capable of workmanship of best grade of modern shop and field practice known to recognized manufacturer's specializing in this work.

.5 Work of this Section shall be executed by workers especially trained and experienced in this type of work. Have a full time, senior, qualified representative at the site to direct the work of this Section.

.6 Where required by authorities having jurisdiction, have work of this Section designed by a professional engineer licensed to design structures and registered in the Province of the Work.

1.4 SUBMITTALS

.1 Provide submittals bearing stamp or seal and signature of the Professional Engineer responsible for the design of the work of this Section.

.2 Shop Drawings:

.1 Make thorough examination of drawings and details, determine the intent, extent, and materials, and be fully cognizant of requirements when preparing shop drawings.

.2 Submit shop drawings showing and describing in detail all work of this Section including large scale detail of members and materials, of connection and interfacing with work of other Sections, jointing details, and of anchorage devices, dimension, gauges, thicknesses, description of materials, metal finishing, as well as other pertinent data and information.

.3 Digital files of design drawings shall not be used in the preparation of shop drawings.

1.5 STORAGE, DELIVERY, HANDLING AND PROTECTION

.1 Coordinate deliveries to comply with construction schedule and arrange ahead for strategic off the ground, under cover storage locations. Do not load any area beyond the design limits.

.2 Adequately protect and crate all components against damage, dirt, disfigurement and weather during delivery and storage. Damaged materials shall not be used and shall be replaced by approved material.

.3 Cover and protect the work of other Sections in the area of work from damage. Make good all damage to the satisfaction of the Consultant.

.4 Protect the installed work of this Section and on completion the work shall be examined and damage shall be remedied to the complete satisfaction of the Consultant.

2 Products

2.1 MATERIALS

.1 Structural Steel Sections and Steel Plate: New stock (not weathered or rusted); to conform to CAN/CSA-G40.21, Grade 300W (44W) and Grade 350W (50W) for wide flange shapes.

.2 Hollow Structural Sections (HSS): New stock; to conform to CAN/CSA-G40.21, Grade 350W (50W), Class C, stress relieved.

.3 Sheet Steel (Structural Quality): Conforms to ASTM A1011/A1011M.

.4 Sheet Steel (Commercial Quality): Conforms to ASTM A653/A653M, stretcher levelled or temper rolled.

.5 Tube: Conforms to ASTM A53.

.6 Galvanized Sheet Steel (Commercial Quality): Galvanized coating G90 (Z275) in accordance with ASTM A653/A653M, minimized spangle, stretch levelled or temper rolled. Specially treat by phosphate conversion process conforming to CGSB 31-GP-105Ma ready to receive prime paint finish.

.7 Steel Pipe: Hot-dip galvanized, zinc coated, welded and seamless type steel pipe conforming to ASTM A53/A53M.

.8 Non-Shrink Grout: Premixed, high strength, maximum bearing, impact resistant, non-shrink non-metallic aggregate grout having minimum 55 MPa 28 day compressive strength and conforms to ASTM C939 and ASTM C1107/C1107M, MasterFlow 816 by Master Builders Solutions, or Sika Grout 212 HP by Sika Canada Inc.

.9 Galvanizing: All uncoated steel specified to be galvanized shall be galvanized after fabrication by the hot dip process according to CAN/CSA-G164, with minimum coating of 600 g/m^2 (2 oz./sq.ft.) Galvanize after all welding is complete. Welding of galvanized material will not be permitted. Specially treat by phosphate conversion process conforming to CGSB 31-GP-105Ma ready to receive prime paint finish.

.10 Primer Paint: CISC/CPMA 2-75.

.11 Bolts, Nuts, Washers: Conforms to ASTM A325.

.12 Welding Materials: Conforms to CSA W59.

.13 Metal Filler: Polyester based type.

.14 Shop Applied Structural Steel Primer: Steel Spec Universal Primer (B50RV6227 Red), by Sherwin Williams Company of Canada Ltd., or approved equal. Apply a minimum of 2 mils dft./coat. Grey coloured primer is acceptable.

.15 Touch-up Primer (On Site): Procryl Universal Acrylic Primer by Sherwin Williams Company of Canada Ltd, or approved equal. Touch-up primer shall be no less than 3 mil dft.

.16 Zinc Rich Paint For Touch-up of Galvanized Metals: Ready mixed, zinc-rich primer conforming to CAN/CGSB-1.181, Zinc Clad No. 5 Organic Zinc Rich Primer by Sherwin Williams Company of Canada Ltd., or approved equal.

.17 Refer to Section 09 90 00 – Painting for site finish paint requirement.

.18 Bituminous Paint: Acid and alkali resistant bituminous isolation coating.

.19 Butyl Tape: Extruded, High grade macro-polyisobutylene tape of width and shore hardness to suit conditions.

.20 Building Paper: No.15 asphalt saturated, organic felt in accordance with CSA A123.3.

2.2 FABRICATION

.1 Fit and assemble work in shop where possible. Execute work according to details and reviewed shop drawings.

.2 Take measurements at the building for work which is to fit or be connected to steel or concrete before commencing fabrication.

.3 Where shop fabrication is not possible, make trial assembly in shop.

.4 Do all welding in accordance with requirements of CSA W59, CSA W55.3 and CSA W47.1 including all supplements. Weld stainless steel electric arc process. Grind welds smooth and flush with surface of parent metal, where exposed to view and where specifically indicated on drawings. Welds shall be continuous seam welds unless specified otherwise. Maintain sharp arises.

.5 Fit joints and intersecting members accurately in true planes, square, plumb, straight with tight joints and intersections.

.6 Provide adequate reinforcing, fastenings, anchors, accessories required for fabrication and erection of work of this Section. Such items occurring on or in an exterior wall or slab shall be hot-dip galvanized. Make thread dimensions such that nuts and bolts will fit without rethreading or chasing threads.

.7 Fabricate, drill and tap members to accommodate attachments, anchorage and work of other Sections where located and directed by them.

.8 Exposed steel surfaces shall be smooth and free from imperfections such as warping, buckling, weld marks, burrs, rust and scale.

.9 Gauges and sizes of metal shall be adequate for various conditions.

.10 Make exposed metal fastenings and accessories of same material, texture, colour and finish as base metal on which they occur unless otherwise shown or specified. Keep exposed fastenings to an absolute minimum evenly spaced and neatly laid out. Make fastenings of permanent type unless otherwise indicated.

2.3 SHOP PAINTING AND PROTECTION

.1 As per SSPC2 Hand Tool Clean and SSPC1 Solvent Clean, clean welds by wire brushing and wash down with clean water, to remove the chemical residues left by the electrodes, prior to painting.

.2 Prepare steel as per SSPC-3 Power Tool Cleaning for Interior or SSPC-6 Commercial Blast Cleaning for exterior members. Remove rust, mill scale, oil, dirt, and other foreign matter before commencing shop painting.

.3 Apply shop coat of primer to all surfaces except areas requiring field welding. Apply by brush, working paint well into surfaces, interstices and cavities.

.4 Primer is to be free of runs, sags, or other collections of primer due to dipping of members into primer.

.5 Steel work shall be painted under cover, and shall remain under cover, until the paint protection is dry.

.6 Prime field welded areas after erection and touch up shop coat where damaged and barred by erection and handling.

.7 Prime steel with two full coats of paint in strict accordance with paint manufacturer's directions.

.8 Give the parts which are inaccessible after assembly two coats of primer coat paint, of different colours, when members are noted to be painted.

2.4 HOT DIP GALVANIZING

.1 Hot dip galvanize, after fabrication, steel metal fabrication items. Straighten shapes and assemblies true to line and plane after galvanizing. Repair damaged galvanized surfaces with brush or spray-applied anti-corrosion coating containing 92-95% zinc, in accordance with manufacturer's printed directions.

.1 Members exposed to elements when in final location.

.2 Members embedded on exterior side of exterior walls.

.3 Members imbedded in concrete.

.4 Members specified in this Section or indicated on Drawings.

.2 Hot-dip galvanize members in accordance with CAN/CSA G164 and requirements of the following ASTM standards, with minimum coating weights or thicknesses as follows:

.1 Rolled, Pressed and Forged Steel Shapes, Plates, Bars and Strips: ASTM A123/A123M; average weight of zinc coating of actual surface

.1 4.8 mm (3/16”) and less member thickness: 600 g/sq.m (2 oz./sq.ft.).

.2 6 mm (1/4”) and heavier members: 640 g/sq.m (2.1 oz./sq.ft.).

.2 Iron and Steel Hardware: ASTM A153/A153M; minimum weight of zinc coating, in gram per square meter of surface, in accordance with Table 1 for the various classes of materials used in the Work.

3 Execution

3.1 GENERAL

.1 Verify at site that the Work to receive the work of this Section is free of irregularities detrimental to the installation and performance of the work and that it is located correctly and at proper levels before delivery and installation.

.2 Erection: To meet specified requirements of CAN/CSA-S16.

.3 Bearing Plates and Anchors: Standard.

.4 Anchors: Anchors to structural concrete shall be approved inserts set into concrete or approved self-drilling expansion insets drilled and placed afterwards.

3.2 INSTALLATION

.1 Assemble and erect work plumb, true, square, straight, level and accurate to sizes detailed, to reviewed shop drawings, free from distortion and defects detrimental to appearance and performance.

.2 Isolate contact surfaces to prevent electrolysis due to metal contact with masonry, concrete or dissimilar metal surfaces. Use bituminous paint, building paper, butyl tape or other approved means.

.3 Supply adequate instructions, templates, and if necessary, supervise installation of the fastenings or accessories requiring to be built-in by other Sections of the Work.

3.3 SCHEDULES

.1 Where items are required to be built into masonry, concrete or other work, supply such items to respective Sections with all anchors and accessories for building in.

.2 Itemized List: Supply and install metal work listed below unless specifically designated to be supplied only. Each item shall be as shown on drawings and as detailed on reviewed shop drawings.

.3 Miscellaneous Steel Framing, Channels, Angles, Plates and Brackets: As required and indicated on drawings.

.4 Loose Lintels:

.1 Provide and install loose lintels if not by structural steel.

.2 Finish: Hot-dip galvanized after fabrication.

.5 Bollards:

.1 Concrete fill steel pipe of diameters as indicated on drawings, having minimum 6 mm (1/4") wall thickness. Dome cap. Height above grade/floor shall be as indicated on drawings.

.1 In Grade Installation: Extend bollards 1500 mm (5’-0”) below grade.

.2 Co-ordinate with Section 03 30 00 – Cast-in-Place Concrete for concrete fill. Ensure that top of concrete shall be smooth and rounded.

.2 Finish:

.1 Bollard Sleeves: Extruded, high density polyethylene plastic bollard cover,

.1 Sureguard Shields, colour yellow by Sureguard Security Products.

.2 Bollard Covers, colour yellow by Ontario Bollards.

.6 Masonry Lateral Supports:

.1 Install deflection space and lateral support for non-load-bearing masonry walls and partitions in accordance with specified requirements of CAN3-S304-M, where not provided by Section 05 12 00 – Structural Steel.

.2 At walls with concealed tops:

.1 75 mm x 50 mm x 6 mm (3" x 2" x 1/4") angles 203 mm (8") long on both sides of walls. Anchor to structure above wall.

.3 At walls with tops exposed to view:

.1 75 mm x 50 mm x 6 mm (3" x 2" x 1/4") angles, continuous on both sides of wall. Anchor to structure above wall.

.4 Finish: Prime paint.

.7 Frames for Overhead Doors:

.1 Supply and install 6 mm (1/4") thick bent steel plate around openings at heads and jambs to suit wall thickness and return 75 mm (3") on either side of wall face. Provide extensions on interior side at head to accommodate track and operators to suit doors specified.

.2 Co-ordinate installation with Sections 04 20 00 – Masonry. Provide proper anchors for solid installation.

.3 Finish: Hot-dip galvanized after fabrication, ready for painting by Section 09 90 00 – Painting.

.8 Overhead Doors Track Protection Guards:

.1 Provide 6 mm (1/4") thick x 1525 mm (60") high "Z" shaped bent steel plate track protection guards at overhead door tracks.

.2 Co-ordinate installation with work of other Sections. Provide proper anchors for solid installation.

.3 Hot-dip galvanized after fabrication, ready for painting by Section 09 90 00 – Painting.

.9 Support Framing for Suspended Toilet Partitions:

.1 Structural channel and angle framing continuously welded and securely anchored to structure above. Design framing and anchorage to support assembly dead loads and live loads, and lateral loads attributable to misuse and vandalism. Finish: Prime painted.

.10 Under-Counter Steel Supports:

.1 Framing: Continuous channel / angle welded construction.

.2 Drill 6 mm diameter holes at each cross support for fastening of counter.

.3 Provide concealed steel section posts to support channels at front of counter, for building into wall.

.4 Provide posts with anchor plates and 9 mm diameter bolts for attachment to structure.

.5 Unless otherwise indicated, provide intermediate posts to support long counter spans.

.6 Conceal framing from view to greatest extent possible.

.7 Prime paint finish. Finish paint by Section 09 91 00.

.11 Other Miscellaneous Metal Components:

.1 Provide steel framing and supports not specified in other Sections as needed to complete the Work.

.2 Concealed metal angles and support not included in Division 5 sections.

.3 Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

.4 Support brackets and welded plates

.5 As required and indicated on drawings.

.6 Finish:

.1 Prime paint for interior components, ready for finishing by Section 09 90 00 – Painting and hot-dip galvanized after fabrication for exterior components.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 Sections of Division 01 apply to this Section.

.2 All references standards specified herein imply the latest edition of the standard.

1.2 SUMMARY

.1 This Section includes requirements for supply, fabrication and installation of the following:

.1 Structural Steel Stairs: Steel stair stringers will be considered as structural steel components and shall be coordinated with Division 05 Structural Steel sections; requirements for certification and record keeping for steel stairs shall be the same as for structural steel framing with galvanized steel grating treads.

.2 Steel Railings, as follows:

.1 Handrails and railings attached to stairs.

.2 Handrails attached to walls adjacent to stairs.

1.3 DEFINITIONS

.1 Field Dimensions: Actual dimensions measured on site and used by fabricator to construct required assemblies.

.2 Established Dimensions: Dimensions derived from drawings or that can be reasonably determined from adjacent construction where actual dimensions required by components fabricated in this section are not available; dimensions shall have suitable tolerances so that assemblies can be adjusted on site to fit actual field dimensions.

1.4 DESIGN REQUIREMENTS

.1 Retain a Professional Engineer, registered in the province of the Work, to design details and connections of steel stairs, and ascertain that the following will comply with the requirements of the Building Code and the Contract Documents:

.1 Selection and design of connections not detailed on the Contract Documents;

.2 Fabrication of components;

.3 Erection of the work of this section.

.2 Design details and connections in accordance with requirements of CAN/CSA S16.1, and applicable codes and authorities having jurisdiction.

.3 Design gratings for 4.8 kN/m2 or a concentrated load of 4.8 kN at any point on the standard grating width.

.4 Design stair and landing sections, attachments and connections, except where members are specifically sized on the drawings, to support a minimum live load of 4.8 kN/m2 or a concentrated load of 2.0 kN at any point on indicated tread widths in accordance with Building Code.

.5 Design railing assemblies to withstand a minimum uniform load of 0.75 kN/m or a concentrated load of 1.0 kN at any point applied horizontally to top rail and a minimum of 1.5 kN/m applied vertically to top rail, with individual elements within the assembly designed for a concentrated load of 0.5 kN at any point in the element in accordance with the Building Code.

1.5 SUBMITTALS

Provide submittals bearing stamp or seal and signature of the Professional Engineer responsible for the design of the work of this Section.

.2 Shop Drawings: Provide shop drawings including, but not be limited to, the following:

.1 Sections and plans of stairs, railings and ladders indicating dimensions and assembly of components.

.2 Indicate fasteners, welds and connection details between stringers; treads; risers; headers; newels; platforms; struts, columns and hangers; railings; handrails; brackets; reinforcements; anchors; and welded and bolted connections.

.3 Methods and locations of all exposed fastenings.

.4 Methods and locations of specified finishes.

.5 Shop drawings requiring to be sealed by the professional engineer registered in province of work, responsible for the design.

1.6 QUALITY ASSURANCE

.1 Detail and fabricate metal fabrications in accordance with the NAAMM AMP 510, 521, and 555; prepare fabrication and erection documents and materials lists in accordance with CSA S16-09.

.2 Fabricator shall have a minimum five (5) years documented experience fabricating metal stairs and railings and shall perform work of this Section to the highest standard of modern shop and field practice, by personnel experienced in architectural quality metalwork.

.3 Retain a Professional Engineer, registered in the Province of the work, to design fabrication and erection of the work of this Section in accordance with applicable Building Code and Contract Documents requirements including, but not limited to, the following:

.1 Seal and signature to shop drawings and design submittals.

.2 Field review of installed components.

1.7 SITE CONDITIONS

.1 Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings where metal fabrications are indicated to fit walls and other construction.

.2 Establish dimensions and proceed with fabricating metal fabrications where field measurements cannot be made without delaying the work; allow for trimming and fitting.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Store materials in a location and manner to avoid damage; stack materials to prevent bending or applying stress to components; keep handling of materials on-site to a minimum.

.2 Store components and materials in clean, dry location, away from uncured concrete or masonry; cover with waterproof paper, tarpaulin or polyethylene sheeting in a manner that permits air circulation inside of covering.

.3 Correct damaged material and where damage is deemed irreparable by the Owner, replace the affected item at no additional expense to the Owner.

.4 Apply protective covering to face of all exposed finished metalwork before it leaves shop, covering to remain until item installed and ready for final finishing.

.5 Fabricate large assemblies so they can be safely and easily transported and handled to their place of installation.

1.9 COORDINATION

.1 Coordinate fabrication schedule with construction progress to avoid delaying the work.

.2 Coordinate with Contractor so that field dimensions correspond to established dimensions.

.3 Coordinate shop priming and finishing requirements.

.4 Coordinate installation of anchorages for metal stairs.

.5 Supply items required to be built-in by other Sections, with instructions for installation for work not installed by this Section; install finish hardware and items supplied under other Sections required for completion of components of this Section.

.6 Coordinate nosing with specified stair finishes and set top of nosing level with top of floor finish; set materials flush with concrete surfaces where no floor finish is indicated.

2 Products

2.1 MATERIALS

.1 Use only materials that are new, free from defects that would impair the strength, durability or appearance, and of the best commercial quality for the purposes specified.

.2 Structural Steel Sections, Steel Plates and Checker Plate:

.1 New stock (not weathered or rusted); to conform to CAN/CSA-G40.21, Grade 300W (44W) and Grade 350W (50W) for wide flange shapes.

.3 Hollow Structural Sections (HSS):

.1 New stock; to conform to CAN/CSA-G40.21, Grade 350W (50W), Class C, stress relieved.

.4 Sheet Steel (Structural Quality):

.1 Conforms to ASTM A1011/A1011M

.5 Sheet Steel (Commercial Quality):

.1 Conforms to ASTM A1011/A1011M, stretcher levelled or temper rolled.

.6 Steel Grating:

.1 Pressure locked type steel grating with serrated upper edges where grating is exposed to exterior conditions, thicknesses as required to support loading and conforming to Metal Bar Grating Manuals, MBG 531-93 and MBG 532-93, type as approved by Consultant, by Borden Metal Products (Canada) Limited, or by Dominion Bridge Company Limited, or by Robertson Building Systems, or by Armtec Inc., or by Fisher & Ludlow, Division of Harris Steel Ltd.

.2 Provide steel grating stair treads and landings with non-slip steel checker plate nosings.

.3 Provide manufacturer's standard and saddle clip type fasteners for grating.

.4 Hot-dip galvanize steel gratings and steel grating stair treads for exterior locations.

.7 Steel Pipe: Hot-dip galvanized, zinc coated, welded and seamless type steel pipe conforming to ASTM A53/A53M-12.

.8 Welding Materials: Conforms to CSA W59.

.9 Shop Applied Structural Steel Primer: Steel Spec Universal Primer (B50RV6227 Red), by Sherwin Williams Company of Canada Ltd., or approved equal. Apply a minimum of 2 mils dft./coat. Grey coloured primer is acceptable.

.10 Touch-up Primer (On Site): Procryl Universal Acrylic Primer by Sherwin Williams Company of Canada Ltd, or approved equal. Touch-up primer shall be no less than 3 mil dft.

.11 Zinc Rich Paint For Touch-up of Galvanized Metals: Ready mixed, zinc-rich primer conforming to CAN/CGSB-1.181, Zinc Clad No. 5 Organic Zinc Rich Primer by Sherwin Williams Company of Canada Ltd., or approved equal.

.12 Refer to Division 09 Painting sections for site finish paint requirement.

.13 Non-Shrink Grout:

.1 Premixed, high strength, maximum bearing, impact resistant, non-shrink metallic aggregate grout having minimum 76 Mpa 28 day compressive strength and conforms to ASTM C939 and ASTM C1107/C1107M, SikaGrout 212 by Sika Canada Inc., or approved equal.

.14 Bituminous Paint: Acid and alkali resistant bituminous isolation coating.

.15 Butyl Tape: Extruded, High grade macro-polyisobutylene tape of width and shore hardness to suit conditions.

.16 Building Paper: No.15 asphalt saturated, organic felt in accordance with CSA A123.3.

.17 Galvanizing:

.1 All uncoated steel specified to be galvanized shall be galvanized after fabrication by the hot-dip process according to CAN/CSA-G164-M92 (R2003), with minimum coating of 2 oz./sq.ft. Galvanize after all welding is complete. Welding of galvanized material will not be permitted. Specially treat by phosphate conversion process conforming to CGSB 31-GP-105Ma ready to receive prime paint finish.

2.2 FABRICATION AND MANUFACTURE

.1 General:

.1 Fabricate steel stairs and railings to details indicated on Drawings and to Metal Stairs Manual, AMP 510.

.2 Fabricate to reviewed shop drawings and in general to details indicated on drawings and specified herein. Where possible, fit and shop assemble and deliver to site in largest practicable sections.

.3 Fabricated work shall be complete with components required for anchoring.

.4 Fit joints and intersecting members accurately with hairline joints in least conspicuous locations and manner. Make work in true plane with adequate fastenings.

.2 Welding:

.1 Except where bolted connections are indicated, make stairs of welded construction conforming to requirements of CSA W59.

.2 Grind exposed welds smooth. Machine materials and straighten in such a way that no disfigurement will show in finished work.

.3 Fastenings and Connections:

.1 Weld connections where possible. Where not possible bolt or otherwise secure in approved manner. Where approved, install exposed fastenings of same materials, colour and finish as base metal on which they occur.

.2 Countersink screws unless noted otherwise and reinforce where necessary.

.3 Use shop and field connections detailed. Where not detailed, connections shall comply with CSA S16.

2.3 COMPONENTS

.1 Steel Grating Stairs:

.1 Treads and Landings: Provide steel grating landings and stair treads where indicated on drawings, reinforced as required. Form open riser grating stair treads and landings from

steel grating with checker plate nosings. Fasten open riser stair treads to stringers with concealed brackets

.2 Grating: Galvanized steel stair landing and treads, slip resistant surface. Minimum 32 mm (1 1/4") depth, with bearing bar spacing of 11 mm (7/16”) and cross bar spacing of 102 mm (4”); with FRP preinstalled nosing, colour safety yellow. Live load capacity 4.8 kPa (100 psi).

.1 Stair Treads by Interstate Gratings.

.2 Grating Stair Treads by grating Pacific.

.3 Stringers: Steel stringer channel unless otherwise noted, with 14 gauge formed fascia where indicated.

.4 Balusters and Handrails: Provide balustrades, railings and handrails as indicated on drawings, complete with brackets and anchoring devices.

.5 Framing: Structural steel framing, angles, channels, trimmers, posts and columns, channel bearings, support angles and clip angle connections to floor slabs and walls.

.6 Finish: Hot-dip galvanize after fabrication.

.2 Railings and Handrails:

.1 Provide floor and wall mounted railings and handrails as indicated on drawings, complete with brackets, anchoring devices and removable sections.

.2 Handrails and Wall Brackets: Tubular steel, 38mm (1-1/2”) dia. pipe rail with rod and mounting flange as inidcated.

2.4 HOT DIP GALVANIZING

.1 Hot dip galvanize, after fabrication, steel metal fabrication items. Straighten shapes and assemblies true to line and plane after galvanizing. Repair damaged galvanized surfaces with brush or spray-applied anti-corrosion coating containing 92-95% zinc, in accordance with manufacturer's printed directions.

.1 Members exposed to elements when in final location.

.2 Members embedded on exterior side of exterior walls.

.3 Members imbedded in concrete.

.4 Members specified in this Section or indicated on Drawings.

.2 Hot-dip galvanize members in accordance with CAN/CSA G164 and requirements of the following ASTM standards, with minimum coating weights or thicknesses as follows:

.1 Rolled, Pressed and Forged Steel Shapes, Plates, Bars and Strips: ASTM A123/A123M; average weight of zinc coating of actual surface

.1 4.8 mm (3/16”) and less member thickness: 600 g/sq.m.

.2 6 mm (1/4”) and heavier members: 640 g/sq.m.

.2 Iron and Steel Hardware: ASTM A153/A153M; minimum weight of zinc coating, in gram per square meter of surface, in accordance with Table 1 for the various classes of materials used in the Work.

3 Execution

3.1 EXAMINATION

.1 Examine the work of other Sections upon which the work of this Section depends and report any defects to the Consultant. Do not commence installation until such time as all wet trades have been completed. Commencement of work implies acceptance of surface and conditions.

3.2 PREPARATION

.1 Provide anchorage devices and fasteners to other Sections where necessary for securing metal stairs to in place construction; include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.

.2 Perform cutting, drilling, and fitting required for installing metal stairs.

.3 Field check and verify that structural framing, enclosures, weld plates, blocking, and that size and location of pockets are placed in accordance with reviewed shop drawings.

.4 Report discrepancies to Contractor and Consultant, and recommend corrective action by responsible parties.

.5 Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

.6 Hand items over for casting into concrete or building into masonry to appropriate trades together with setting templates and instructions for installation.

3.3 INSTALLATION

.1 Furnish, set and secure framing brackets, hangers, anchors, inserts or similar supports for proper erection of stairs before masonry and concrete is placed. Provide temporary supports and bracing required to position stairs and railings.

.2 Do all coring, drilling and fitting necessary to attach work of this Section to adjoining work.

.3 Continuous weld connections between handrails and balusters and in lengths of handrails.

.4 Secure wall brackets to wall at 1220 (4') O.C. maximum with through-bolts and plate where these can be concealed, otherwise use bolts and expansion shields to achieve maximum rigidity of rail. Wood plugs for fixing to walls will not be permitted. Use metal anchoring devices.

.5 Grout bases of posts, balusters or newels occurring in concrete using non-shrink grout in accordance with manufacturer's instructions. Finish smooth, level and flush with surrounding finished surface.

.6 Isolate contact surfaces to prevent electrolysis due to metal contact with masonry, concrete or dissimilar metal surfaces. Use bituminous paint, building paper, butyl tape or other approved means.

.7 Grind off surplus welding materials and provide sharp profiles and arrises.

.8 Build and erect work plumb, true, square, straight, level and accurate, to sizes detailed, to reviewed shop drawings, free from distortion or defects detrimental to appearance and performance.

.9 Touch up with matching primer, or zinc rich paint for galvanized components, field welds, damaged and abraded surfaces, and surfaces not previously primed. Leave ready for finish painting by Division 09 Painting section.

3.4 PROTECTION

.1 Protect completed work from damage during and after installation.

.2 Field repair or refinishing of damaged, marred or discoloured finishes will not be accepted.

3.5 CLEANING

.1 Clean installations and assemblies progressively as work proceeds, and at completion of work.

.2 Remove protective coverings and clean metal work using cleaning solutions and methods to suit the metal and its finish at completion of work.

.3 Protect adjacent materials and finishes from damage or discolouring during cleaning.

.4 At completion, remove all equipment, tools, surplus materials and debris from job site.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 Sections of Division 01 apply to this Section.

.2 All references standards specified herein imply the latest edition of the standards.

1.2 SUMMARY

.1 Supply all labour, materials, equipment, services and perform all operations required to complete all rough carpentry work to the full intent of the drawings and as herein specified.

1.3 DELIVERY, STORAGE, HANDLING AND PROTECTION

.1 Co-ordinate deliveries to comply with construction schedule and arrange ahead for off-the-ground, under cover storage location. Do not load any area beyond the design limits.

.2 Materials shall be carefully checked, unloaded, stored and handled to prevent damage. Protect materials with suitable non-staining waterproof coverings.

.3 Do not store seasoned materials under conditions that will cause their moisture content to increase.

.4 Protect edges and corners of sheet materials from damage during handling and storage.

.5 Store preservative treated materials under cover, off the ground and protected from moisture.

2 Products

2.1 MATERIALS

.1 Framing Lumber:

.1 Lumber for structural components shall be of species and grade specified, well seasoned, processed and stamped at same mill with appropriate grade markings. Conform to requirements of Standard Grading Rules for Canadian Lumber of National Lumber Grades Authority the (NLGA) with latest supplements, approved by the Canadian Lumber Standards Administrative Board.

.2 Framing, Furring, Strapping, Blocking:

.1 Spruce, 122c, "Standard" light framing, except as otherwise specified.

.3 Plywood Sheathing:

.1 Shall be 19 mm (3/4") thick and/or thickness as indicated on drawings, exterior grade at exterior locations, Douglas Fir plywood, veneer core, Select Sheathing - Tight Face, unsanded, "B" faces and conforming to CSA O121.

.4 Rough Hardware:

.1 Provide rough hardware such as nails, spikes, staples, H-clips, bolts, nuts, washers, screws, clips, strap iron and including hardware for temporary enclosures. Nails for plywood shall be annular or spiral type, all other nails shall be spiral type. All nails, spikes and staples shall conform to CSA B111. All rough hardware shall be galvanized unless otherwise noted. Galvanizing shall conform to CAN/CSA-G164.

.5 All Other Materials and Hardware:

.1 Shall be as noted on drawings.

2.2 PRESSURE PRESERVATIVE TREATED MATERIALS

.1 Pressure Preservative Treated Lumber: Lumber graded and stamped in accordance with applicable grading rules and standards of associations or agencies approved to grade lumber by Canadian Lumber Standards Accreditation Board in accordance with CAN/CSA O80.

.1 Species: Pine or Spruce Pine

.2 Grade: No.2 or better structural posts and lumber, pieces may be grade stamped or shipment certified by letter of compliance.

.3 Grading authority: NLGA, paragraph 131CC

.4 Material having twisted grain or structural defects affecting integrity of lumber will not be acceptable for this project.

.5 Use only material with radius edges, minimum 6 mm.

.6 Kiln dry lumber materials to 8% moisture content or less.

.2 Pressure Preservative Treated Plywood: Treated in accordance with CAN/CSA O80 using water borne preservative to obtain minimum net retention of 4 kg/m³ (0.25 lb/ft3)of wood. Plywood or laminated materials shall be manufactured with exterior grade adhesives. After treatment, plywood shall be kiln dried to moisture content of 8% or less.

2.3 PRESSURE FIRE RETARDANT TREATED MATERIALS

.1 Treat by pressure impregnation with fire retardant chemicals in accordance with CAN/CSA O80 to provide classification for flame spread of not more than 25, smoke developed of not more than 75 in accordance with CAN4 S102.

.2 All fire retardant wood must comply with the requirements in AWPA Standard C20 for lumber and C27 for plywood.

.1 AWPA C20: Structural Lumber, Fire Retardant Pressure Treatment, lumber materials shall only be of species listed. After treatment, lumber 50 mm (2”) or less in thickness shall be kiln dried to moisture content of 8% or less.

.2 AWPA C27: Plywood, Fire Retardant Pressure Treatment, plywood or laminated materials shall be manufactured with exterior grade adhesives. After treatment, plywood shall be kiln dried to moisture content of 8% or less.

.3 All species to comply with CAN4 S102 for surface burning characteristics and shall bear identification showing classification and type of fire retardant.

.3 Each piece or bundle of fire retardant treated material or panel to bear ULC inspection label or stamp attesting to FRS rating indicating flame spread, smoke developed, and fuel contributed classification meeting AWPA standard C20 and C27 for Type A Use.

.4 Fire retardant chemicals used to treat lumber must comply with FR 1 of AWPA Standard P17 and shall be free of halogens, sulphates and ammonium phosphate.

.5 Acceptable materials: Plywood and lumber materials treated by licensed applicators with fire retardant materials from the following:

.1 Dricon FRTW by Hickson Corporation.

.2 Pyro Guard by Hoover Treated Wood Products Inc.

.3 D Blaze by Chemical Specialties Inc.

3 Execution

3.1 INSTALLATION-GENERAL

.1 Consult with and co-operate with other Sections in advance and build-in or make provisions for installation of other work.

.2 Provide and fit in place all furring, strapping, battens, nailers, sleepers, grounds and blocking required to provide adequate properly placed fixing for all wood finishes, fitments and as required for the work of others trades.

.3 Blocking, strapping and other rough carpentry indicated shall not be regarded as complete or exact. Provide all rough carpentry work required, whether specifically shown or not. Grounds shall be of a thickness to provide for application of finishes. Room side surfaces of grounds shall be plumb and in true plane throughout.

.4 All nails shall be long enough so that at least half their length penetrate in to the second member. Splitting of wood members shall be minimized by staggering the nails in the direction of the grain and by keeping nails well in from edges.

.5 Blocking shall be through-bolted to structure.

.6 Anchor rough bucks to concrete or masonry with 9.5 mm (3/8") diameter expansion bolts and shields or Drummond and Reeves security buck anchors, minimum three per jamb.

3.2 WOOD BLOCKING, CANTS AND NAILERS

.1 Provide wood blocking, cants and nailers, where shown to be required as detailed. Bolt securely in place. Block under cants same thickness as installed roof insulation.

.2 Check mechanical, electrical, architectural drawings and provide all blocking, cants, nailers etc. required. Leave work ready for built-up bituminous roofing and prefinished sheet metal flashings.

3.3 PLYWOOD PANELS

.1 Provide plywood panels required for electrical/telephone mounting of equipment and in other locations as indicated on drawings.

3.4 PRESSURE PRESERVATIVE TREADED WOOD INSTALLATION

.1 Comply with AWPA M4.

.2 Re treat surfaces exposed by cutting, trimming or boring with liberal brush application of preservative before installation. Allow first coating to fully soak into grain before applying second coating in accordance with manufacturer’s instructions.

.3 Remove with fine sandpaper, chemical deposits on treated wood to receive applied finish.

.4 Use only hot dipped galvanized, corrosion resistant nail or screw fasteners. Staples are not acceptable for installation of preservative treated materials.

.5 Use water borne preservative treated wood for:

.1 Wood in contact with masonry or concrete,

.2 Wood within 450 mm (18”) of grade,

.3 Wood decking and fence boards,

.4 Wood in contact with flashings,

.5 Wood in contact with waterproofing membranes, confirm compatibility with membrane manufacturer prior to application.

3.5 PRESSURE FIRE RETARDANT TREATED WOOD INSTALLATION

.1 Field Cuts:

.1 Do not rip, mill or conduct extensive surfacing of fire retardant treated lumber, label will be voided.

.2 Only end cuts, drilling holes and joining cuts are permitted.

.3 All cuts on plywood will be considered end cuts.

.4 Fire retardant lumber and plywood can be given a light sanding for cosmetic cleaning after treatment.

.5 Pre cut to the greatest extent possible before treating.

.2 Fire retardant treated plywood used in structural applications shall be graded or span rated material.

.3 Use only hot dipped galvanized, corrosion resistant nail or screw fasteners. Staples are not acceptable for installation of fire resistant treated materials.

.4 Where humidity conditions are such that moisture may condense between hardware and treated wood, hardware shall be back primed with a corrosive inhibitive paint.

.5 Back prime at contact points and fasteners to prevent electrolysis when fire retardant framing members are used in metal buildings.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 Sections of Division 01 apply to this Section.

1.2 SECTION INCLUDES

.1 Polymer based solid surface (PSS)

1.3 SUBMITTALS FOR REVIEW

.1 Shop Drawings: Indicate all dimensions, component sizes, fabrication details, attachment provisions and coordination requirements with adjacent work.

.2 Samples: Submit two 50 x 50 mm samples of each colour and finish.

1.4 CLOSEOUT SUBMITTALS

.1 Operation and Maintenance Data: Submit manufacturer's instructions for care and maintenance of solid surface materials including repair instructions.

1.5 QUALITY ASSURANCE

.1 Fabricator/Installer Qualifications: Company specializing in performing the work of this Section with minimum five (5) years' experience and certified by the Manufacturer.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Do not deliver components to site until cabinetry or substrates are ready for installation. Store materials indoors prior to installation.

1.7 WARRANTY

.1 Provide ten (10) year manufacturer warranty against defects in materials and workmanship under normal usage. Warranty shall provide for all material and labour to repair or replace defective materials.

2 Products

2.1 MANUFACTURERS

.1 Subject to conformance with the requirements of this Section provide product by manufacturer named as the basis-of-design or approved equivalent product by an acceptable manufacturer.

.2 Basis of Design: Refer to Schedule of Finishes.

2.2 MATERIAL

.1 Acrylic (PSS): Homogeneous acrylic; not coated or laminated; meeting ANSI Z124.3 & Z124.6, Type 6. Superficial damage to a depth of 0.25mm shall be repairable by sanding and polishing.

.1 Colours: Colour to be selected from manufacturer's standard colour selection.

.2 Countertops: 12mm thick countertop; edge details as indicated on the Drawings. Provide counters complete with backsplash of size shown on the Drawings.

.1 Colours: Refer to Schedule of Finishes.

2.3 ACCESSORIES

.1 Joint adhesive: Manufacturer's recommended adhesive designed to create chemically bonded, inconspicuous, non-porous joints.

.2 Panel Adhesive: Manufacturer's standard neoprene-based panel adhesive meeting ANSI A136.1-1967, UL listed.

.3 Sealant: Mildew-resistant, FDA/UL recognized silicone sealant in colour matching or clear formulations as specified.

2.4 FABRICATION

.1 Fabrications to be performed by a Manufacturer Certified fabricator/installer.

.2 Fabricate components in shop to greatest extent practical to sizes and shapes indicated, in accordance with approved shop drawings and Manufacturer's requirements.

.3 Form joints between components using manufacturer's standard joint adhesive. Joints shall be inconspicuous in appearance and without voids. Attach 50mm wide reinforcing strip of solid surface material under each joint.

.4 Provide holes and cutouts for plumbing and bath accessories as indicated on the drawings.

.5 Rout and finish component edges to a smooth, uniform finish. Rout all cutouts, then sand all edges smooth. Repair or reject defective or inaccurate work.

.6 Finish: All surfaces shall have uniform finish.

.1 Satin.

.7 Thermoforming: Comply with forming data from manufacturer.

.1 Construct matching molds of plywood to form component shape.

.2 Form pieces to shape prior to seaming and joining.

.3 Cut pieces larger than finished dimensions. Sand edges. Remove all nicks and scratches.

.4 Heat entire component uniformly between 135-163°C during forming.

.5 Prevent blistering, whitening and cracking during forming.

.8 Cove backsplashes: Where indicated, fabricate 13mm radius cove at intersection of counters and backsplashes. Form backsplashes using 13mm material. Fabricate in shop or field.

3 Execution

3.1 INSTALLATION

.1 Install components plumb and level, in accordance with approved shop drawings and product installation details.

.2 Form field joints using Manufacturer's recommended adhesive, with joints inconspicuous in finished work. Keep components and hands clean when making joints.

.3 Provide backsplashes where indicated on the drawings. Adhere to countertops using Manufacturer's standard colour-matched silicone sealant.

.4 Keep components and hands clean during installation. Remove adhesives, sealants and other stains. Components shall be clean on Date of Substantial Completion.

.5 Make plumbing connections to sinks in accordance with Mechanical.

.6 Rigidly anchor to substrate to prevent misalignment.

3.2 TOLERANCES

.1 Variation in component size: ± 3mm.

.2 Location of openings: ± 3mm from indicated location.

3.3 PROTECTION

.1 Protect completed installation from damage with heavy kraft paper cardboard until date of final inspection.

3.4 ADJUSTING AND CLEANING

.1 Repair damaged and defective countertops to eliminate functional and visual defects; where not possible to repair, replace. Adjust joinery for uniform appearance.

.2 Remove all excess adhesives, sealants and other contaminates from installation and all adjacent surfaces. Clean countertops on exposed and semi-exposed surfaces.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 Sections of Division 01 apply to this Section.

.2 All references standards specified herein imply the latest edition of the standard.

1.2 SUMMARY

.1 Section Includes:

.1 Labour, Products, equipment and services necessary to complete the work of this Section.

.2 Maintain the existing building watertight at all times. Provide required temporary protection, and enclosures. Seal off or temporarily dam open roof edges to prevent any incidence of water into existing building or structure.

1.3 MATERIALS OWNERSHIP

.1 Except for items or materials indicated to be reused, reinstalled, or otherwise indicated to remain Owner's property, demolished materials shall become Contractor's property and shall be removed from Project site.

.2 Collect and place demolished materials in containers. Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on site.

.1 Storage or sale of demolished items or materials on-site will not be permitted.

1.4 SUBMITTALS

.1 Temporary Roofing: Include Product Data and description of temporary roofing system.

.2 Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including exterior and interior finish surfaces that might be misconstrued as having been damaged by reroofing operations. Submit before Work begins.

1.5 QUALITY ASSURANCE

.1 Installer Qualifications: Installer of new membrane roofing system specified in Division 7 SBS Modified Bituminous Roofing Sections.

.2 Pre-Installation Meeting: Two weeks prior to commencing work of this Section, meet with Owner; Consultant; Owner's insurer if applicable; testing and inspecting agency representative; replacement roofing system manufacturer's representative; deck Installer; and installers whose work interfaces with or affects reroofing including installers of roof accessories and roof-mounted equipment.

.1 Review temporary protection requirements for existing roofing system that is to remain, during and after installation.

.2 Review roof drainage during each stage of reroofing and review roof drain plugging and plug removal procedures.

.3 Review existing deck removal procedures and Owner notifications.

.4 Review procedures to determine condition and acceptance of existing deck for reuse.

.5 Review structural loading limitations of deck during reroofing.

.6 Review base flashings, special roofing details, drainage, penetrations, equipment curbs, and condition of other construction that will affect reroofing.

.7 Review HVAC shutdown and sealing of air intakes.

.8 Review shutdown of fire suppression, fire protection, and fire alarm and detection systems.

.9 Review governing regulations and requirements for insurance and certificates if applicable.

.10 Review existing conditions that may require notification of Consultant before proceeding.

1.6 PROJECT CONDITIONS

.1 Owner will occupy portions of building immediately below reroofing area. Conduct reroofing so Owner's operations will not be disrupted. Provide Owner with not less than 72 hours' notice of activities that may affect Owner's operations.

.1 Coordinate work activities daily with Owner so Owner can place protective dust or water leakage covers over sensitive equipment or furnishings, shut down HVAC and fire-alarm or -detection equipment if needed, and evacuate occupants from below the work area if desired.

.2 Before working over structurally impaired areas of deck, notify Owner to evacuate occupants from below the affected area. Verify that occupants below the work area have been evacuated prior to proceeding with work over the impaired deck area.

.2 Protect building to be reroofed, adjacent buildings, walkways, site improvements, exterior plantings, and landscaping from damage or soiling from reroofing operations.

.3 Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities.

.4 Owner assumes no responsibility for condition of areas to be reroofed.

.1 Conditions existing at time of inspection for bidding will be maintained by Owner as far as practical.

.5 Limit construction loads on roof to rooftop equipment wheel loads and for uniformly distributed loads so as not to endanger the structure.

.6 Weather Limitations: Proceed with reroofing preparation only when existing and forecasted weather conditions permit Work to proceed without water entering into existing roofing system or building.

1.7 WARRANTY

.1 Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during reroofing, by methods and with materials so as not to void existing roofing system warranty. Notify warrantor before proceeding.

.1 Notify warrantor of existing roofing system on completion of reroofing, and obtain documentation verifying that existing roofing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

2 Products

2.1 MATERIALS

.1 Roofing Materials: New materials, same as and matching materials used in the existing roof system.

3 Execution

3.1 PREPARATION

.1 Protect existing membrane roofing system that is indicated not to be reroofed.

3.2 ROOFING

.1 Preparation: Prepare existing roof for receipt of new work. Ensure existing system is not damaged by preparation work.

.1 Remove only areas of the existing roofing system which can be replaced, complete with membrane flashings, on the same day.

.2 Roofing and Flashing membrane: Install in accordance with manufacturers' instructions.

.3 Curbs: Install curbs required for new work.

3.3 SLEEVE FLASHING

.1 Embed deck flange in a layer of mastic sealer. Flash into the roofing membrane in general accordance with CRCA flashing detail.

.2 Apply sealant at joint between base of sleeve flashing and roof membrane flashing.

3.4 INSTALLATION - METAL FLASHINGS AND TRIMS

.1 Install sheet metal work in accordance with CRCA specifications, using concealed fastenings except where approved before installation.

.2 Fabricate metal flashings and other sheet metal work to details shown. Form pieces in 2400 mm (8') maximum lengths. Make allowance for expansion at joints.

.3 Hem exposed edges on underside 13 mm (1/2"). Miter and seal corners with sealant.

.4 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.

.5 Apply isolation coating to metal surfaces to be embedded in concrete or mortar.

.6 Counterflash membrane flashings at intersections of roof with vertical surfaces and curbs. Flash joints using S-lock forming tight fit over hook strips.

.7 Lock end joints and seal with sealant.

3.5 CLEANING

.1 Remove existing debris from all roof areas.

.2 Clear out roof drains, scuppers, eaves troughs and down spouts of debris and ensure they are free draining at project completion.

.3 Remove surplus materials and debris resulting from work daily as the work proceeds and on completion.

.4 Remove stains, sealants and adhesives from soiled surfaces.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 Sections of Division 01 apply to this Section.

.2 All references standards specified herein imply the latest edition of the standard.

1.2 SUMMARY

.1 Foamed-in-place polyurethane insulation at exterior envelope construction for thermal insulation and air seal.

.2 Gap-filling foamed-in-place insulation for filling perimeter of window and door shim spaces, crevices, voids and penetrations in exterior walls for thermal insulation and air seal.

.3 Site quality control.

1.3 SUBMITTALS

.1 Product Data for each type of insulation product specified.

.1 Provide the CCMC Evaluation Report and manufacturer's documentation confirming material has been evaluated and conforms to the requirements of the CAN/ULC S705.1 Material Standard.

.2 Product test reports performed by a qualified third-party testing agency evidencing compliance of insulation products with specified requirements including those for thermal resistance, fire-test-response characteristics, water-vapor transmission, and other properties, based on comprehensive testing of current products.

.3 Manufacturer's certificate certifying insulation provided meets or exceeds specified requirements.

.4 Installer's certificate showing manufacturers installation certification for quality assurance.

1.4 QUALITY ASSURANCE

.1 Contractor executing work of this section shall have a minimum of five (5) years continuous Canadian experience in successful installations. Provide proof of experience to Consultant upon request.

.2 Single Source Responsibility: Single source product from one manufacturer.

.3 The insulating material must be applied by personnel who are certified by manufacturer. These certified individuals must have their certification cards in their possession and available for presentation upon request.

.4 A copy of the manufacturer's installation manual or guide for the application of sprayed on polyurethane foam must be kept on site.

.5 Tests must be conducted daily on both core density and cohesion/adhesion to the substrate, following procedures established by the manufacturer. The results of these tests must be entered in the daily report forms provided by the manufacturer.

.6 Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that foamed-in-place insulation conforms to the requirements of ULC S705.1.

.7 Submit copy of all completed forms to Consultant prior to making application for payment.

.8 Toxicity/Hazardous Materials:

.1 Provide products that contain no urea-formaldehyde

.2 Provide products that contain no PBDEs

.3 Provide products that are “Low-emitting”

1.5 ENVIRONMENTAL REQUIREMENTS

.1 Apply spray polyurethane foam when chemical, atmospheric and cavity/surface temperatures are within the limitations required by the CAN/ULC S705.2 Installation Standard and as recommended by the manufacturer.

.2 Maintain acceptable ambient and substrate surface temperatures prior to, during, and after installation of insulation and accessory materials.

.3 Maintain acceptable ambient and substrate surface temperatures prior to, during, and after installation of insulation and accessory materials.

1.6 DELIVERY, STORAGE, AND PROTECTION

.1 Deliver and store materials to site in original containers with seals unbroken, labeled with manufacturer's name, product brand name and type, date of manufacture, shelf life, and directions for storing and mixing with other components.

.2 Store materials as recommended by manufacturers in clean, dry, protected location and within required temperature range.

.3 Empty containers of isocyanates to be decontaminated or removed from site on a daily basis.

.4 Remove and replace materials that cannot be applied within their stated shelf life.

.5 Protect stored materials from direct sunlight.

.6 Protect spray polyurethane foam in place from open flame or welding as required in CAN/ULC S705.2.

1.7 WARRANTIES

.1 Provide three (3) year Manufacturer’s Material and Workmanship Warranty against defects in workmanship or material, including removal and replacement of adjacent materials.

2 Products

2.1 MATERIALS - GENERAL

.1 Use insulations free of HCFCs, CFCs and CFC compounds during manufacturing and in installed products.

2.2 SPRAY FOAM INSULATION

.1 Foamed-In-Place Insulation: Medium density, two-component closed cell polyurethane; CAN/ULC-S705.1:

.1 Aged Thermal Resistance: CAN / ULC-S770; RSI of 1.8 for 50 mm thickness.

.2 Compressive Strength: ASTM D1621; 195 kPa minimum.

.3 Flame Spread and Smoke Developed Rating:

.1 CAN/ULC-S102; maximum 250/500.

.2 CAN/ULC-S127; maximum 500/500.

.4 Off Gassing – VOC Emissions during Aging: CAN/ULC-S774; below detection limit, 24 h.

.2 Approvals:

.1 Current CCMC Evaluation/Listings for Spray-Applied Rigid Polyurethane Foam Insulation,

.2 CAN/ULC-S742 Air Barrier System or Current CCMC Evaluation/Listing for Air Barrier System.

.3 Product and Manufacturers:

.1 SealTite One by Carlisle Spray Foam Insulation

.2 Walltite CM01 manufactured by BASF Canada Inc.

.3 Insulthane Extreme by Elastochem Specialty Chemicals Inc.

.4 Heatlok Soy HFO by Huntsman Building Solutions.

2.3 GAP-FILLING FOAM INSULATION

.1 Gap-Filling Foam Insulation: Single or multi-component, low VOC, low expansion spray-in-place polyurethane based liquid foam insulation providing an air-tight flexible seal as recommended by spray foam insulation Manufacturer.

2.4 ACCESSORIES

.1 Primer: As required by insulation manufacturer and as well as CAN/ULC-S705.2.

3 Execution

3.1 EXAMINATION

.1 Verify work within construction spaces or spaces to receive insulation are complete prior to insulation application.

.2 Verify that surfaces are clean, dry, and free of matter that may inhibit insulation adhesion.

3.2 PREPARATION

.1 Isolate the working area during spraying. Mask and protect adjacent surfaces from over spray or dusting.

.2 Apply primer in accordance with manufacturer's instructions.

3.3 APPLICATION

.1 Protect workers as recommended by CAN/ULC-S705.2.

.2 Apply insulation in accordance with manufacturer's instructions and CAN/ULC-S705.2.

.3 Ventilation for applications inside the Air Vapour Barrier: Provide ventilation at a rate of 0.3 air changes within the working area during the application. Isolate the working area during spraying. Maintain ventilation and isolation after the product has been sprayed for the time period determined in accordance with the CAN/ULC-S705.1.

.4 Apply insulation by spray method, to a uniform monolithic density without voids. Use only one proportioner to supply each spray gun. Do not exceed 50 mm thickness of each pass of spray gun.

.5 Apply to a minimum cured thickness as indicated.

.6 Do not apply insulation until installation of pipes, ducts, conduits, wiring, and electrical outlets are completed and windows, electrical boxes, and other items not indicated to receive insulation are masked.

.7 Patch damaged areas.

.8 Finished surface of foam insulation to be free of voids and imbedded foreign objects.

.9 Trim any excess thickness that would interfere with the application of cladding/covering system by other trades

3.4 GAP-FILLING FOAM INSULATION

.1 Install insulation in accordance with manufacturer's written installation and safety instructions.

.2 Clean openings and mask adjacent surfaces as required.

.3 Install insulation to provide insulating air seal in exterior envelope construction as follows:

.1 Shim Spaces between Frames and Adjacent Construction: Fill with insulation as indicated or as specified in individual sections.

.2 Miscellaneous Crevices, Voids: Install insulation in miscellaneous crevices and voids, under sill plates and where required to prevent gaps in insulation.

.3 Wall Penetrations: Install insulation around wall penetrations to attain a thermal or acoustic seal or for air-infiltration reduction.

.4 Ensure insulation does not impair or impeded opening operating components.

.5 Trim cured foam to permit installation of subsequent materials.

3.5 SITE QUALITY CONTROL

.1 Testing Agency Services: Engage a qualified testing agency to perform tests and related inspections in accordance with the CUFCA manual or Manufacturer’s programme and to provide the following:

.1 Testing in accordance with CAN/ULC S705.2.

.2 Daily visual inspections verifying insulation thickness, density measurements and adhesion/cohesion testing.

.3 Prepare test and inspection reports.

3.6 CLEANING

.1 Remove masking materials and overspray from adjacent surfaces immediately after foam surface has hardened.

.2 Use cleaning methods that will not damage adjacent work.

3.7 PROTECTION OF FINISHED WORK

.1 Do not permit subsequent construction work to disturb applied insulation.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 Sections of Division 01 apply to this Section.

.2 All references standards specified herein imply the latest edition of the standard.

1.2 SUMMARY

.1 This Section includes requirements for supply and installation of factory formed, site assembled, non-structural, concealed fastener, metal roofing system; including accessories required for weather tight installation; job site manufactured materials will not be acceptable for this project.

.2 Drawings indicate size, profiles, and dimensional requirements of metal roofing system and are based on the specific system indicated; do not modify intended aesthetic effects.

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Construction Meeting: Arrange a pre-construction meeting at project site with Contractor, Subcontractor and Consultant present before starting roof construction; purpose of meeting is to review methods and procedures related to roof construction and metal roofing system including; but not limited to, the following:

.1 Review and finalize construction schedule and verify availability of materials, installer's personnel, equipment, and facilities needed to make progress and avoid delays.

.2 Review methods and procedures related to metal roofing system installation, including manufacturer's written instructions.

.3 Examine substrate and sheathing conditions for compliance with requirements, including flatness and attachment to structural members.

.4 Review structural loading limitations of deck during and after roofing.

.5 Review flashings, special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect metal roofing system.

.6 Review temporary protection requirements for metal roofing system during and after installation.

.7 Review roof observation and repair procedures after metal roofing system installation.

.8 Inspection agency will document proceedings, including corrective measures and actions required, and furnish copy of record to each meeting participant.

.2 Coordination:

.1 Coordinate metal roofing system with rain drainage work, flashing, trim, and construction of decks, parapets, walls, and other adjoining work to provide a leak proof, secure, and non-corrosive installation.

1.4 PERFORMANCE REQUIREMENTS

.1 Design and construct roof so that completed installation will not leak.

.2 Structural Design Performance:

.1 Design Roof System to Resist:

.1 Maximum deflection not to exceed l/180 under system’s own weight plus wind load (positive and negative) loads acting normal to the plane in accordance with the Building Code Climatic Data, wind load 1:50 years.

.2 Design the systems so that there is no air or water infiltration under the positive and negative forces imposed by wind and gravity loads. Provide means of draining space between insulation and exterior skin, in accord with NRC Rain Screen Principles.

.2 Thermal movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, overstressing of components, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime sky heat loss.

.1 Temperature change (range): 20 deg C, ambient; 40 deg C, material surfaces.

1.5 SUBMITTALS

.1 Provide submittals bearing stamp or seal and signature of the Professional Engineer responsible for the design of the work of this Section.

.2 Action Submittals: Provide the following submittals before starting any work of this Section:

.1 Product Data: Submit product data including; but not limited to, construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal roofing system and accessory.

.2 Shop Drawings: Submit shop drawings indicating fabrication and installation layouts of metal roofing system; details of edge conditions, joints, panel profiles, corners, anchorages, trim, flashings, closures, and accessories; and special details, identify between factory and site assembled work, include details for the following:

.1 Flashing and trim

.2 Snow guards

.3 Samples: Submit one (1) sample for each type of exposed finish required for Consultant's verification of finishes, prepared in sizes as follows:

.3 Informational Submittals: Provide the following submittals when requested by the Consultant:

.1 Coordination Drawings: Coordination drawings indicating locations of penetrations and roof mounted items including; but not limited to, the following:

.1 Roof systems and attachments.

.2 Snow guards

1.6 PROJECT CLOSEOUT SUBMISSIONS

.1 Operation and Maintenance Data: Submit manufacturers written maintenance data for metal roofing system, include name of original installer and contact information for inclusion in maintenance manuals.

1.7 QUALITY ASSURANCE

.1 Qualifications: Provide proof of qualifications when requested by Consultant:

.1 Manufacturer: Obtain each type of metal roofing system through one source from a single manufacturer.

.2 Installer: Use only installers that are trained and qualified by factory formed roofing panel manufacturer, and who have experience in projects of similar complexity and scope.

1.8 DELIVERY, STORAGE, AND HANDLING

.1 Delivery and Acceptance Requirements: Deliver components, metal roofing system, and other manufactured items to prevent damage or deformation; package metal roofing system for protection during transportation and handling.

.2 Storage and Handling Requirements: Unload, store, and erect metal roofing system in a manner to prevent bending, warping, twisting, and surface damage, and as follows:

.1 Protect metal roofing system to prevent wetting of materials, and as follows:

.1 Stack metal roofing system on platforms or pallets, covered with suitable weather tight and ventilated covering.

.2 Do not store metal roofing system in contact with other materials that might cause staining, denting, or other surface damage.

.2 Protect strippable protective covering on metal roofing system from exposure to sunlight and high humidity, except to extent necessary for period of metal roofing system installation.

.3 Protect foam plastic insulation from surface degradation, and as follows:

.1 Do not expose to sunlight, except to extent necessary for period of installation and concealment.

.2 Protect against ignition at all times. Do not deliver foam-plastic insulation materials to Project site before installation time.

.3 Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

1.9 SITE CONDITIONS

.1 Site Measurements: Verify locations of roof framing and roof opening dimensions by site measurements before metal roofing system fabrication and indicate measurements on shop drawings.

.2 Established Dimensions: Establish framing and opening dimensions and proceed with fabricating metal roofing system without site measurements where site measurements cannot be made without delaying the Work, or allow for site trimming of panels; coordinate roof construction to ensure that actual building dimensions, locations of structural members, and openings correspond to established dimensions.

.3 Ambient Conditions: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal roofing system in accordance with manufacturers' written instructions and warranty requirements.

1.10 WARRANTY

.1 Provide manufacturer's standard form of warranty stating that manufacturer agrees to repair or replace components of metal roofing system that fail in materials within specified warranty period; failures will be considered to include; but are not limited to, the following:

.1 Structural failures, including rupturing, cracking, or puncturing.

.2 Deterioration of metals, metal finishes, and other materials beyond normal weathering.

.3 Deterioration of finishes, peeling or cracking of coating, failure to adhere to bare metal, colour fading and chalking.

.2 Warranty Period:

.1 Finishes: Ten (10) years from date of Substantial Performance.

.2 Weather Tightness: Five (5) years from date of Substantial Performance stating that manufacturer agrees to repair or replace metal roofing system failing to remain weather tight; including leaks, within specified warranty period.

.3 Installer's Warranty: Written Installer's warranty, signed by Installer, covering Work of this Section, for warranty period of two years after date of Substantial Performance.

.1 Warranty includes removing and reinstalling work of this Section.

2 Products

2.1 MATERIALS

.1 Insulated Panel: Side joint with vertical sidelap, mechanically seamed, concealed fasteners and attachment clips. Panel formed with 2 layers pre-finished steel sheet, sandwich with polyiso insulation core, minimum overall thickness 150 mm (6"), minimum thermal value R45.

.1 Exterior Face Sheet: 0.7 mm (22 Gauge) prefinished steel sheet, in PVDF coating consisting of dry film thickness of not less than 0.005 mm (0.2 mil) primer and 0.02 mm (0.8 mil) top coat, micro rib texture finish.

.1 Colour to be selected from manufacturer’s standard colour range.

.2 Interior Face Sheet: 0.45 mm (26 Gauge), prefinished steel sheet, in siliconized polyester coating consisting of epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.005 mm (0.2 mil) for primer and 0.02 mm (0.8 mil) for topcoat, standard texture finish.

.1 Colour to be selected from manufacturer’s standard colour range.

.3 Products:

.1 KingSeam by Kingspan Group.

.2 Standing Seam (SR2) Roof Panel by Vicwest Building Products.

.3 CFR-IMP Insulated Standing Seam Roof Panels by Nucor Building Systems.

.2 Bituminous Paint: Acid and alkali resistant bituminous isolation coating.

.3 Butyl Tape: Extruded, High grade macro-polyisobutylene tape of width and shore hardness to suit conditions.

.4 Building Paper: No.15 asphalt saturated, organic felt in accordance with CSA A123.3.

.5 Flashing: As specified in Section 07 62 00 – Prefinished Metal Flashing and Trim.

.6 Sealants: In accordance with manufacturer's recommendation and Section 07 92 00 – Sealants.

2.2 FABRICATION

.1 Fabricate and finish metal roofing system and accessories at the factory to greatest extent possible, using manufacturer's standard procedures and processes to obtain the indicated profiles and meeting dimensional and structural requirements for the Project.

2.3 FINISHES, GENERAL

.1 Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

.2 Variations in appearance of abutting or adjacent pieces are acceptable if they are within half the range of reviewed samples:

.1 Noticeable variations in the same piece are not acceptable.

.2 Variations in appearance of other components are acceptable if they are within the range of reviewed samples and are assembled or installed to minimize contrast.

3 Execution

3.1 EXAMINATION

.1 Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal roofing system supports, and other conditions affecting performance of work.

.2 Examine primary and secondary roof framing to verify that angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal roofing system manufacturer.

.3 Examine roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roofing system manufacturer.

.4 Examine roughing-in for components and systems penetrating metal roofing system to verify actual locations of penetrations relative to seam locations of metal roofing system before metal roofing system installation.

.5 Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

.1 Clean substrates of substances harmful to insulation, including removing projections capable of interfering with insulation attachment.

.2 Install auxiliary levelling substrate boards over metal deck; attach with mechanical fasteners into top flutes of steel to prevent wind uplift.

.3 Install flashings and other sheet metal in accordance with requirements specified in Division 07 Metal Flashing and Trim section.

.4 Install eave angles, furring, and other miscellaneous roof system support members and anchorage in accordance with metal roofing system manufacturer's written recommendations.

3.3 INSTALLATION

.1 Install structural girts and other members required to support work of this Section except as otherwise shown on Drawings.

.2 Install work in accordance with manufacturer's written instructions, plumb with intersecting parts joined together to provide accurately fitted joints with adjoining surfaces in true planes. Attach components in manner not restricting thermal movement.

.3 Apply heavy coat of isolation coating to concealed surfaces of dissimilar metals and metals in direct contact with concrete or masonry.

.4 Metal Roofing System:

.1 Install metal Fasten metal roof panels to supports with concealed clips at each standing-seam joint at locations, spacings, and with fasteners recommended by manufacturer.

.1 Install clips to supports with self-tapping fasteners.

.2 Install pressure plates at locations indicated in manufacturer's written installation instructions.

.3 Crimp panel standing seams with manufacturer-approved motorized seamer tool so clip and metal roof panel are completely engaged.

3.4 ACCESSORY INSTALLATION

.1 Install accessories with positive anchorage to building and weather tight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.

.2 Install components required for a complete metal roofing system assembly including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

.3 Install flashing and trim in accordance with performance requirements, manufacturer's written installation instructions, and SMACNA recommendations; provide concealed fasteners where possible, and set units true to line and level; install work with laps, joints, and seams that will be permanently watertight and weather resistant.

.4 Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.

.5 Provide for thermal expansion of exposed flashing and trim:

.1 Space movement joints at equally spaced intervals to a maximum of 3050mm (10') feet on centre with no joints allowed within 610mm (24”) of corner or intersection.

.2 Form expansion joints of intermeshing hooked flanges, not less than 25mm (1”) deep, filled with mastic sealant concealed within joints where lapped or bayonet type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof.

.6 Attach snow guards to metal roofing system with adhesive, sealant, or adhesive tape, as recommended by snow guard manufacturer; do not use fasteners that will penetrate metal roofing system.

.7 Form flashing around pipe penetration and metal roofing system; fasten and seal to metal roofing system as recommended by manufacturer.

3.5 ERECTION TOLERANCES

.1 Shim and align metal roofing system units within installed tolerance of 6mm (1/4") in 6m (20') on slope and location lines as indicated and within 3mm (1/8") offset of adjoining faces and of alignment of matching profiles.

3.6 SITE QUALITY CONTROL

.1 Engage a factory authorized service representative to inspect completed metal roofing system installation, including accessories and to report results in writing to Owner and Consultant.

.2 Remove and replace applications of metal roofing system where inspections indicate that they do not comply with specified requirements.

.3 Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.7 CLEANING AND PROTECTION

.1 Remove temporary protective coverings and strippable films, if any, as metal roofing system are installed, unless otherwise indicated in manufacturer's written installation instructions.

.2 Clean finished surfaces as recommended by metal roofing system manufacturer upon completion of metal roofing system installation; maintain in a clean condition during remainder of construction.

.1 Replace metal roofing system components that become damaged or have deteriorated beyond successful repair by finish touch-up or similar minor repair procedures.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 Sections of Division 01 apply to this Section.

.2 All references standards specified herein imply the latest edition of the standard.

1.2 SUMMARY

.1 This Section includes requirements for prefinished metal siding, complete with a system of girts, flashings and trims, using sheet metals and exposed fasteners, on the following installation applications:

.1 As an exterior wall cladding

.2 Provide specified system with labour, materials, and equipment required to fabricate and erect siding including cutting and penetrations, accessories, flashings, trims and closures necessary for a complete installation.

1.3 SUBMITTALS

.1 Provide submittals bearing stamp or seal and signature of the Professional Engineer responsible for the design of the work of this Section.

.2 Submit manufacturer's product specifications, standard details, certified product test results, and general recommendations, as applicable to materials and finishes for each component and for total panel assemblies.

.3 Shop Drawings:

.1 Submit fully dimensioned shop drawings to Consultant showing construction, assembly, elevations, sections and interfacing with work of other Sections.

.2 No work of this Section shall be fabricated until shop drawings and all other related submittals, documentation, certifications and samples as required by this Section, have been reviewed by the Consultant.

.3 Details shall indicate metal thicknesses, areas to be sealed and sealant materials, gaskets, type of joints, flashings, trim, finishes, fasteners and welds, all anchorage assemblies and components and erection details.

.4 Shop drawings shall bear the seal of an engineer registered to practice in the place of Work, employed by the preformed metal siding manufacturer, and shall include complete design calculations for the system and documentation in regard to the reactions of the metal siding due to thermal expansion and contraction, positive and negative wind pressure and assurance that the thermal movement and wind forces have sufficient attachments, supports, bracing and anchorage.

.4 Samples:

.1 Submit to the Consultant for approval, samples of materials and components to be used in the system, prior to fabrication of work together with name of manufacturer and technical literature. Submit 305 mm x 305 mm (12" x 12") samples of metal, peel and stick membrane and Z-girts. Submit two (2) full size panels of metal siding.

.5 Safety Data Sheets:

.1 Submit WHMIS safety data sheets for inclusion with project record documents. Keep one copy of WHMIS safety data sheets on Site for reference by workers.

1.4 QUALITY ASSURANCE

.1 Qualifications:

.1 Manufacturer and tradesmen executing the work of this Section shall have had a minimum five (5) years continuous Canadian experience in successful manufacture and installation of work of type and quality shown and specified. Submit proof of experience upon Consultant's request.

.2 Erection of preformed metal siding systems shall be by workers especially trained and experienced in this type of work. Have a qualified representative at the job site to direct the work of this Section at all times.

.3 Retain a professional engineer, registered in the province of the Work, to design fabrication and erection of the Work of this Section in accordance with applicable Building Code and Contract Document requirements including, but not limited to, the following:

.1 Seal and signature to shop drawings and design submittals requiring structural engineering.

.2 Field review of installed components.

.4 Conform to the requirements of the local Building Code, local by-laws and Authorities having jurisdiction.

1.5 PRE-INSTALLATION CONFERENCE

.1 Convene one (1) week before commencing Work of this Section to discuss expectations for fit and finish of wall system, quality of workmanship for installation of air/vapour retarders and insulation and relationship of wall system to adjacent components.

.2 Meeting shall be attended by the installer, manufacturer’s representative, Contractor and the Consultant.

.3 Manufacturer’s representative shall also provide frequent inspection visits during the course of work of this Section to assure quality and competence of membrane installation and panel alignment

1.6 DESIGN REQUIREMENTS

.1 Maximum deflection not to exceed L/180 under system’s own weight plus wind load (positive and negative) loads acting normal to the plane in accordance with the Building Code Climatic Data, wind load 1:50 years.

.2 Design sheet cladding to span continuously over at least four structural supports (three spans) and design fastening to structural supports to sustain factored loads in accordance with CAN/CSA S136.

.3 Calculate live load deflections in accordance with CSSBI 20M, as modified by the requirements of this Section.

.4 Provide for movement of components without causing buckling, failure of joint seals, undue stress on fasteners when subject to seasonal temperature range from -40 deg C to +50 deg C, and wind loads noted above.

.5 Design the systems so that there is no air or water infiltration under the positive and negative forces imposed by wind and gravity loads. Provide means of draining space between insulation and exterior skin, in accord with NRC Rain Screen Principles.

.6 Final review and acceptance of work completed by this Section shall be carried out by the manufacturer's representative, the Consultant, Contractor and the Subcontractor.

1.7 STORAGE, DELIVERY, HANDLING AND PROTECTION

.1 Co-ordinate deliveries to comply with construction schedule and arrange ahead for off-the-ground, under cover storage locations. Do not load any area beyond the design limits.

.2 Adequately protect and crate all components against damage, dirt, disfigurement and weather.

.3 Assembled units and/or their component parts shall be transported, handled and stored in a manner to preclude damage. Accessory materials required for erection at the Site shall be delivered to the Site in manufacturer's labelled containers. Remove all units or components which are cracked, bent, chipped, scratched or otherwise unsuitable for installation and replace with new.

.4 Provide safe and adequate equipment on the Site to execute the work of this Section, hoisting, scaffolding, staging, safety protection equipment, tools, plant and other equipment required for the completion of the work of this Section.

.5 Delivered damaged materials or materials which do not comply with this Section shall be rejected by Consultant, removed from the Site and replaced with acceptable materials at Contractor's expense.

.6 Adequately protect the structure and work of all other trades during delivery, storage, handling and erection of the work of this Section.

.7 Preformed metal siding components being hoisted to the working level shall be adequately banded and carefully slung employing steel wire rope.

.8 Bundles shall be tag lined during the ascent of the hoisting operation. Precaution shall be taken to avoid damage to metal siding components and to prevent marring of exposed surfaces.

.9 Preformed metal siding components, after being positioned, shall be adequately secured in place as quickly as possible and prior to leaving the job site at the end of the working day.

.10 Loose bundles of preformed metal siding components shall be adequately secured at the completion of each working day.

.11 Scaffolds, platforms, ladders, and the like, required by the erector for installation of metal siding components shall be properly secured to prevent accidental movement or collapse.

1.8 PROJECT CONDITIONS

.1 Make thorough examination of drawings and details. Determine the intent, extent, materials, and conditions of interfacing with work of other Sections and be fully cognizant of requirements.

.2 Inspect substrate surfaces on which the work of this Section is erected for any irregularities detrimental to the application and performance of the work of this Section. Confirm conditions satisfactory before proceeding.

.3 Co-ordinate and verify, by measurement at the job site, all dimensions affecting work of this Section. Notify Consultant, in writing, of all dimensions and/or conditions at variance with those on the reviewed shop drawings, Contract Documents and/or detrimental to the proper and timely installation of materials. Direction regarding correction measures shall be obtained from Consultant prior to fabrication of the item affected. Insure the compatibility of adjacent items in relationship to the work of this Section.

.4 Do not perform work of this Section during period of rain, fog, sleet or snow, or upon surfaces covered with dust, water, dew, ice, frost or snow.

.5 Report to Consultant in writing, defects of work prepared by other trades and unsatisfactory Site conditions. Commencement of application implies acceptance of surfaces and conditions.

1.9 COORDINATION

.1 Coordinate work of this section with the requirements of Section 07 62 00 – Prefinished Metal Flashing and Trim, for specific requirements for supply of prefinished sheet metal flashing materials to other sections of the work as follows:

.1 Supply prefinished sheet metal flashings required for the project, regardless of sheet metal thickness and colour.

.2 Provide prefinished sheet metal flashings to installing trades, tension levelled and guillotine sheared to length ready for brake forming, fabrication and installation by installing trades.

.3 Coordinate with installing trades during bid period and provide unit prices for materials based on specified thickness and colour of flashing materials required under their respective scopes of work; installing trades will be responsible for carrying cost for flashing materials in their scope of work in their Bid Price.

.4 Requirements of this portion of the scope of work do not apply to extruded aluminum or other pre-manufactured flashing materials normally supplied by installing trades (i.e.: extruded aluminum curtain wall flashing and sills, preformed roof penetrations, non-prefinished sheet metal products).

.5 Subcontractor responsible for supply of metal wall and soffit cladding will only be responsible for fabrication and installation of flashings relating to their scope of work.

1.10 WARRANTY

.1 Warrant the work of this Section against defects in materials and workmanship in accordance with General Conditions, but for a period of five (5) years. Agree to promptly make good defects which become evident during warranty period without cost to the Owner.

.2 Without restricting the generality of the Warranty, defects shall include deformation, buckling, leakage, weather tightness, failure of anchors and fastenings, failure of paint coating and sealants.

.3 Promptly make good defects and/or failures in the Work upon written notification by the Owner. Remedy shall include labour, materials, equipment and services required to make good defective work, and to replace components and finishes and the Owner's property damaged or disturbed in the course of remedying defects.

2 Products

2.1 MANUFACTURERS

.1 Basis of Design Products: Products named in this Section were used as the basis of design for the project; additional manufacturers offering similar products may be incorporated into the work of this Section.

.2 Acceptable Preformed Metal Siding Profile: Subject to compliance with requirements specified in this Section, profiles that may be incorporated into the Work include; but are not limited to, the following:

.1 Liner Panel: L-800R Liner by Vicwest Building Products.

.2 Exterior Wall Cladding: Profile, size, and colour to match adjacent existing.

2.2 MATERIALS

.1 Sheet steel conforming to ASTM A653/A653M, structural quality, Grade 'A' with a minimized spangle zinc coating of Z275 conforming to ASTM A653/A653M shall be used for girts, sub-grits, Z-bars, brackets, battens, retention clips, cleats, fascias, preformed metal siding panels, closures and flashings.

.1 Girts, Sub-girts, Z bars, Clips and Brackets: Base steel nominal thickness to meet design requirements. Thermal clips shall be slotted to minimize thru-metal conductivity.

.2 Preformed Cladding and Liner Panel: Base steel nominal thickness to meet design requirements.

.3 Flashings, Trims and Closures: Factory finish steel of suitable core thickness and finish to match cladding. Inside corners, outside corners, cap strip, drip cap, undersill trim, starter strip, transition/ termination trim and window/ door trim of same material and colour as cladding, with fastener holes pre-punched.

.2 Finish:

.1 Preformed wall cladding, liner panel and related metal flashings shall be prefinished coil coated material in accordance with Technical Bulletin No. 178 mm (7 ") Prefinished and Post Painted Galvanized Sheet Steel for Exterior Building Products" of the Canadian Sheet Steel Building Institute (CSSBI), prefinished to CSSBI 10,000 Series requirements. Colours shall be as indicated on drawings and where not indicated, as selected later by Consultant from manufacturer's full available colours range, including manufacturer's extended colours range. Allow for two (2) different colours to be selected.

.3 Mineral Fibre Semi-Rigid Insulation: Installation within Roof Equipment Screens for acoustical value:

.1 Unfaced, preformed mineral slag batt insulation in accordance with CAN/ULC S702, Type 1; having a nominal R value of 115 mm (4.2/1”); rated non-combustible in accordance with CAN/ULC S114 and having a flame spread rating of 5 or less in accordance with CAN/ULC S102; density 32 kg/m^3; square edges, thickness as required to meet design insulation values indicated on drawings.

.1 Basis of Design Materials: CavityRock MD by Rockwool.

.4 Sealing Tape: Macro-polyisobutylene preformed sealant tape designed for use in metal cladding assemblies.

.5 Sealants And Gaskets:

.1 Sealants and gaskets shall be of types to allow for maximum movements anticipated, maintaining life cycle expectancy, adhesion and flexibility under temperature ranges of -25 degree C up to +80 degree C, without undue softening or deleterious effects.

.2 At sidelaps and end laps of panels, as required, factory applied butyl tape, or polyvinyl chloride "wedge fit" type extrusions.

.3 Perimeter Sealant: Multi-component, chemical curing epoxidized polyurethane type sealant conforming to ASTM C920, DYMERIC 240FC by Tremco Inc. (Canada) Ltd., or Sonolastic NP2 by BASF Construction Chemicals, or approved equal. Colour as selected later by Consultant. Provide primers, bond breakers and cleaning agents as recommended by the sealant manufacturer.

.6 Screws, Bolts, Nuts, Washers, Rivets And Other Fastening Devices:

.1 Exposed fasteners used on exterior facing panels, flashing and all trim members shall be Series 400 stainless steel and nylon coloured coated head to match substrate colour, Atlas Colormate or VistaCoat by SFS intec AG.

.2 Mechanical fasteners used on underlayment; self tapping metal screws, type and length to suit application and securement plates to the approval of the Consultant.

.3 Concealed fasteners located within wall: No.12 teks, self-drilling, self-tapping galvanized screws.

.7 Bituminous Paint: Acid and alkali resistant bituminous isolation coating.

.8 Zinc Rich Paint For Touch-up of Galvanized Metals: Ready mixed, zinc-rich primer conforming to CAN/CGSB-1.181, Zinc Clad No. 5 Organic Zinc Rich Primer by Sherwin Williams Company of Canada Ltd., or approved equal.

.9 Protective Membrane:

.1 Minimum 40 mils thick, self-adhesive, glass fibre reinforced 914 mm (36") wide roll form type laminated styrene butadiene styrene (SBS) modified asphalt protective membrane.

.10 Preformed Penetration Flashings

.1 Flexible vent pipe flashing: EPDM, colour gray cone and base with aluminium strip edges for fasteners. Size to match pipe and conduits dimensions. Dektite Premium by DEKS North America Inc. or similar approved equivalent.

2.3 FABRICATION

.1 Co-ordinate and verify, by measurement at the job site, all dimensions affecting the Work. Submit written notifications documenting any and all field dimensions and/or conditions which are at variance with those on the reviewed shop drawings. The Contract documents and/or detrimental to the proper and timely installation of job site materials. The decision regarding corrective measures shall be obtained from the Consultant prior to the fabrication of the item affected. Ensure the suitability of adjacent items in relationship to the work of this Section.

.2 Report to Consultant in writing, defects in Work prepared by other trades and unsatisfactory Site conditions. Commencement of work shall imply acceptance of conditions.

.3 Workmanship shall be best trade shop and field practice known to recognized manufacturers specializing in work of this Section. Joints and intersecting members shall be accurately fitted to true planes, adequately and securely fastened and made completely weathertight. Component fastenings shall be concealed of adequate strength.

.4 Fabricate units to profile and sizes indicated complete with rabbets, interlocks, flashings, trim and filler sections, as required to interface with work of other trades.

.5 Fabricate all devices required for erection and adequate anchorage and attachment required to be built into or attached to the steel structural or steel deck and main building structure for the support of the Work.

.6 Anchorage brackets and devices shall be designed and fabricated to compensate for unevenness and dimensional difference in the structure and permit unrestricted expansion and contraction of framing members.

.7 Steel Welding: Conform with CSA W59 and executed in accordance with CSA W47.1 or CSA W55.3.

.8 Fabricate preformed metal siding systems where indicated. The systems shall be formed to meet design requirements, and of prefinished steel sheet. The system shall be accurately cut and fitted, all fastenings shall be concealed. Method of attachment shall be to the Consultant's approval and clearly detailed on shop drawings. Panel faces shall be flat and true without waves, buckles or oil canning.

.9 Supply sufficient prefinished metal of same thickness and colours as the preformed metal siding to Section 07 62 00 – Prefinished Metal Flashing and Trim for his use in installing roof flashings.

.10 Form starter strips of same material as flashings 38 mm (1-1/2") wide and continuous.

.11 Exposed steel surfaces shall be smooth and free from imperfections such as warping, buckling, scratches, dents and abrasion.

.12 Thickness of metal shall be adequate for various conditions.

.13 Isolate where necessary to prevent electrolysis due to dissimilar metal to metal contact or metal to masonry or concrete. Use bituminous paint or other approved divorcing membrane.

3 Execution

3.1 INSTALLATION

.1 Erect preformed metal siding and accessories in strict accordance with reviewed shop and erection drawings and manufacturer's instructions to give a complete and weatherproof system.

.2 Install underlayment and protective membrane under preformed metal siding and elsewhere as required in strict accordance with manufacturer's written instructions forming a complete waterproof barrier, free of leaks.

.3 Install girts, 'Z' girts, liner panels, sub-girts, cleats and retention clips and other attachment members necessary to complete the work of this Section.

.4 Co-operate with other trades to ensure proper installation and anchorage of work of this Section. Install steel bracing and framing and continuous clip angles and secure plumb and in line.

.5 Damaged, bent or dished sheets will be rejected.

.6 Place preformed metal siding against supporting substrate and adjust to final position before permanently securing. Bring each unit to bear evenly on framing.

.7 Align units to provide accurate fit with corresponding sections parallel and straight. Ensure complete nesting of interlocking and sealed side lap joint and fasten sheets to structural supports.

.8 Fasten exterior sheets of panels to horizontal sub-girts, using colour matching fasteners, where indicated.

.9 Install necessary closure and trim or neoprene closures at openings and penetrations, fastening at 305 mm (12") O.C. Make cut-outs neatly by saw cutting.

.10 Where welding has been performed on work of this Section, or field cutting or scratches have been made, field coat such areas with touch-up paint after thoroughly cleaning affected surfaces.

.11 Seals:

.1 Fit flexible seals, tapes, formed gaskets and the like at locations required to provide air/vapour barriers and weathertight junctions. Ensure that end joints, between lengths of material have been properly sealed.

.2 Caulk junctions of preformed metal siding system components to themselves and work of other Sections with sealant in accordance with the requirements of Section 07 92 00 – Sealants, to maintain continuity of air/vapour and weather barriers.

.12 Rigidly connect all prefinished flashing pieces with specified colour matching fasteners at 305 mm (12") O.C. along length. Use preformed corner pieces and erect with ample allowance for thermal movement.

.13 Furnish adequate quantity of prefinished flat stock flashing sheet to Section 07 62 00 – Prefinished Metal Flashing and Trim for forming and installation. Trim members in this category are cap flashing, base flashing and those specifically shown on drawings as being prefinished and in close proximity to roofing. Flashing pieces entirely remote from roofing flashing and the like are furnished in place under work of this Section.

.14 Install work of this Section only during period of no rain, fog, sleet or snow, or upon surfaces covered with dust, water, dew, ice, frost or snow.

.15 Preformed Flexible Flashing:

.1 Cut the top of the flashing cone at opening 20% smaller that pipe or conduit diameter.

.2 Slide flashing over the pipe or conduit.

.3 Seal the base of the flashing to the metal cladding with sealant as recommended by flashing manufacturer.

.4 Form and press flashing base and aluminium edge firmly to fit onto the irregular metal cladding surface.

.5 Fasten the aluminium base edge to metal cladding using weather resistant fasteners as recommended by flashing manufacturer.

3.2 CLEANING AND CLEAN-UP

.1 Remove debris and surplus materials from the Site upon completion of work of this Section.

.2 Clean dirt, soil and misplaced sealants from preformed metal siding systems with recommended cleaners and solvents.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 Sections of Division 01 apply to this Section.

.2 All references standards specified herein imply the latest edition of the standard.

1.2 SUMMARY

.1 Work of this section include the supply and installation of a conventional SBS Modified Bituminous Membrane Roofing system, accessories, and site quality control as indicated in this section.

1.3 SUBMITTALS

.1 Action Submittals: Provide the following submittals before starting any work of this Section:

.1 Product Data: Submit copies of membrane manufacturers current technical data sheets describing the physical properties and recommended installation procedures.

.2 Shop Drawings:

.1 Submit sloped insulation manufacturer's proposed roofing diagrams and layouts for review by the Consultant.

.2 Submit membrane manufacturer's standard details that will be used for this project, indicate changes that must be made to make the details project specific for review by the Consultant.

1.4 SYSTEM PERFORMANCE

.1 General Performance: Installed membrane roofing shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Membrane roofing and base flashings shall remain watertight.

.2 Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.

.3 Minimum Adhesion of Each Material: 1 MPa.

.4 Fire Hazard and Windstorm Requirements:

.1 Provide membrane roofing, base flashings, and component materials equivalent to requirements in as part of a membrane roofing system and as follows:

.1 Fire Hazard Classification: CAN/ULC-S107, Class C.

.2 Roof Assembly wind uplift requirements: tested in accordance with CSA A123.21-14, Standard test method for the dynamic wind uplift resistance of membrane-roofing systems.

.5 Expected Service Life: CSA S 478; Provide a fully adhered roofing system whose cap sheet and cap sheet flashings have a predicted service life of a minimum of 20 years in accordance with requirements of Part 7 of CSA S 478.

.6 Thermal Resistance of Insulation: Minimum effective thermal resistance as indicated in accordance with CAN/ULC-S770-3 - LTTR testing and the following:

.1 Do not include other system componentry such as air surface films, structural materials, membranes, tapered insulation, roof sheathing component contributions in the calculation.

.7 Roof slope: Minimum 2% slope to drain.

1.5 QUALITY ASSURANCE

.1 Obtain roofing membrane materials through one source from a single manufacturer and install using workers who are trained and approved by the roofing membrane manufacturer; maintain a full time experienced journeyman roofer, and at least one apprentice per crew on the Work at all times.

.2 Roofing and sheet metal work will be performed in conformance with the roofing manufacturer's written recommendations using materials that meet the requirements of CAN/ULC S107 to obtain a Class A fire resistance rating; submit proof that roofing materials meet required performance when requested by the Consultant.

.3 Conform to Roofing Specifications as published by Canadian Roofing Contractors Association (CRCA) and local Provincial Roofing Contractors Association Roofing Specification Manual.

.4 Perform the work of this Section by a company which has a minimum of five (5) years of proven satisfactory experience in the Work of this Section.

.5 Execute work of this section using an applicator approved by the roofing membrane manufacturer.

1.6 FIRE PROTECTION

.1 Protect roof junctions at parapets, roof curbs and upstands with a fire-resistant tape or barrier to prevent combustible materials within assemblies from ignition arising from the use of torches. Install prior to installation of base sheets.

.2 Use a heat detector gun to spot any smouldering or concealed fire at the end of each work day. Establish a minimum one (1) hour fire watch after torch application.

.3 Do not apply torch directly to dry or unprotected wood surfaces.

.4 Maintain a clean site and have one approved ABC fire extinguisher within 6 meters of each roofing torch. Respect all safety measures described in manufacturer’s technical data sheets. Do not place torches near combustible or flammable products.

1.7 STORAGE, DELIVERY, HANDLING AND PROTECTION

.1 Deliver materials to the job site; handle and store in original packages and containers with manufacturer's seals and labels intact. The manufacturer's name, brand, mass, specification number and lot number must be shown on the labels.

.2 Store materials in weatherproof shelters having floors that will protect the materials from moisture. Store materials on end. Avoid prolonged exposure of light or heat sensitive materials to sunlight.

.3 Do not store materials on roof in concentrations that exceed design live load.

.4 Place plywood runways over the Work to enable the movement of materials and other traffic during construction of roofing.

.5 Protect surrounding surfaces against damage from roofing work. Where hoisting is necessary, hang tarpaulins to protect walls during delivery of materials from ground to roof.

.6 In the event of materials damage by the elements, improper handling or other causes, such materials will be rejected and will be replaced at no extra cost to the Owner. Remove rejected materials promptly from the site.

.7 During roofing work, exposed surfaces of finished walls must be protected with tarp to prevent damage. Contractor shall assume full responsibility for damage.

1.8 PREINSTALLATION MEETING

.1 Include the roofing manufacturer's representative, roofing contractor's representative, the roofing inspector, the Contractor, the Consultant and Owner.

.2 The purpose of this meeting is to review installation conditions particular to this project and review materials specified in this section.

.3 The roofing inspector will complete the minutes and prepare a report for this meeting.

1.9 SITE CONDITIONS

.1 Minimum ambient application temperature shall not be less than -20 deg C. Notify Consultant and roofing inspector where installation is required below stated minimum temperature and submit manufacturer's standard cold weather installation practices prior to proceeding with work of this section.

1.10 WARRANTY

.1 Manufacturer's Warranty: Transferable, Total System/Labour, Material & Workmanship Warranty, No Dollar Limit, Non-Pro-Rated for a period of twenty (20) years from date of Substantial Performance for the project including; but not limited to, the following components:

.1 Roofing membrane

.2 Base flashings

.3 Roofing membrane accessories

.4 Roof insulation

.5 Other components of membrane roofing system

.2 Submit for Owner's acceptance, manufacturer's warranty document indicated above, executed by an authorized company official.

2 Products

2.1 MATERIALS - GENERAL

.1 Source Limitations:

.1 Products of specified roofing system shall be products of one manufacturer, or approved by roofing system manufacturer as part of a system as compatible with their system and listed in and covered by the Manufacturer's Warranty.

.2 Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.

2.2 MANUFACTURERS - MEMBRANE MATERIALS

.1 Basis of Design: Soprema Inc.,

.2 Acceptable Manufacturer's: Equivalent systems from the following manufacturers will be considered provided they comply with performance requirements of this Section and the products specified:

.1 Holcim Elevate.

.2 IKO Industries Ltd.

.3 Tremco Commercial Sealants & Waterproofing.

.4 Siplast.

.3 Substitutions: Not permitted.

2.3 MEMBRANE MATERIALS

.1 Base Sheet : CGSB 37-GP-56M Type 2, Class C, Grade 2 asphalt and polymer modifiers of styrene-butadiene-styrene (SBS) type, reinforced with woven fibre glass 180 g/m2; with the following characteristics:

.1 Thickness: 2.5 mm.

.2 Application: Fully adhered.

.3 Top surface: Thermofusible plastic film.

.4 Bottom surface: Self-adhesive with silicone release sheet.

.5 Product: Sopraflash Flam Stick by Soprema.

.2 Cap Sheet: CGSB 37-GP-56M Type 1, Class A, Grade 2, asphalt and polymer modifiers of styrene-butadiene-styrene (SBS) type, heavy duty composite glass and polyester reinforcement; with the following characteristics:

.1 Thickness: 4.0 mm.

.2 Application: Fully adhered.

.3 Top surface: Factory applied granules, colour to match existing.

.4 Bottom surface: Thermofusible plastic film.

.5 Product: Sopralene Flam 250 GR by Soprema.

2.4 BITUMEN MATERIALS

.1 Asphalt Primer: As approved by manufacturer.

.2 Asphalt Bitumen: CSA A123.4M Roof Asphalt Type 3.

.3 Plastic Cement: ASTM D2822 Type I or II, cutback asphalt type as recommended by roofing system manufacturer for application.

2.5 VAPOUR RETARDER

.1 Prefabricated Vapour Retarder Membrane (noted as membrane in roof system): Self-adhesive air/vapour barrier membranes composed of bitumen modified with thermoplastic polymers and high-density polyethylene film, as per roof membrane manufacturer's standard and compliance with extended warranty requirements.

.2 Prefabricated Vapour Retarder Transition Strip and Flashing Self Adhesive: Asphalt and polymer modifiers of styrene-butadiene-styrene (SBS) type, polyester and glass reinforcement; smooth surfaced, as approved by system's manufacturer.

2.6 INSULATION

.1 Bottom Insulation; Faced Polyisocyanurate insulation boards, CAN/ULC-S704, Type 3, Class 3, HCFC and CFC-free, rigid board, inorganic coated-glass facers, and square edges.

.1 Board Density: 32 kg/cu m.

.2 Thermal Resistance: Min LTTR value of RSI value of 1.8 per 50 mm.

.3 Board Size: 1220 x 1220 mm and 1220 x 2440 mm

.4 Thickness: to match existing.

.5 Acceptable Manufacturers- Polyisocyanurate Insulation:

.1 AC Foam III by Atlas Roofing Corporation.

.2 RESISTA ISO by Holcim Elevate.

.3 IKO Therm III by IKO Industries Ltd.

.4 Sopra ISO Plus by Soprema Inc.

.6 Tapered Insulation:

.1 Board Thickness: As required for fabrication of slopes with a minimum thickness of 13 mm.

.2 Fabricate to minimum slope to drain meeting performance criteria specified. Provide custom saddles, sumps, crickets, tapered edge strips and other insulation shapes with increased local slopes to prevent trapping of water behind parapets returns or curbs.

.3 Design a custom configured sloping insulation to provide minimum slope to drains with custom sloped accessories.

.2 Single layer insulating system combining base insulation and tapered insulation will not be accepted as substitute to multi layer insulating system.

2.7 GYPSUM ROOF SHEATHING AND OVERLAY BOARD

.1 Gypsum roof sheathing and overlay board; ASTM C1396; 13 mm thick unless otherwise indicated; primed finish with non-woven glass mats embedded in a water resistant treated gypsum core; minimum compression strength 500 psi.

.1 Product:

.1 DensDeck Prime Roof Board by Georgia-Pacific Gypsum LLC,

.2 Securock Gypsum Fiber Roof Board by CGC Inc.

.3 CertainTeed Glasroc Roof Board by CertainTeed

2.8 ADHESIVES

.1 Insulation Adhesive: One or two component, low-rise, chemically cured urethane foam adhesive for the attachment of selected rigid roof insulation to one another and to adhere to vapour barrier membranes; contains no solvents and is compatible with the roofing Manufacturers system.

2.9 CARPENTRY

.1 Wood roof materials shall be as specified in Section 06 10 00 – Rough Carpentry. Do not use pressure treated materials where SBS membrane materials are to be adhered to wood fabrications.

2.10 ACCESSORIES

.1 Sheathing Joint Tape: Paper, heat-resistant type.

.2 Insulation Joint Tape: Asphalt treated glass fibre reinforced; 150 mm wide; self adhering.

.3 Flame-Stop Tape: Self-adhesive membrane composed of SBS modified bitumen and a glass mat reinforcement, designed to prevent flames from penetrating into voids, cavities and openings before installing heat-welded membranes; type recommended by membrane Manufacturer.

.4 Roofing Nails: Galvanized, hot dipped type, size as required to suit application.

.5 Jointing Material for Overlay Board: Tape or sealant as recommended by membrane manufacturer.

.6 Sealants: As recommended by membrane manufacturer.

.7 Cant Strips: Fabricated from High density mineral wool, asphalt impregnated facer for torch application; 100 mm x 100 mm fabricated to 45 degree angle (with min.140 mm sloped face) dimension.

.8 Termination Bars: Aluminum, surface mounted, prepunched, maximum possible length per location, with attachment flanges.

.9 Miscellaneous Accessories: Provide all miscellaneous accessories recommended by roofing system manufacturer.

.10 Roof drain: Refer to Mechanical Drawings.

3 Execution

3.1 GENERAL

.1 Perform roofing installation in accordance with membrane manufacturer’s written instructions and to CRCA and local Provincial Roofing Contractors Association Roofing Specification Manualrequirements.

.2 Coordinate installation of roofing system so insulation and other components of the roofing membrane system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.

.1 At end of each day's work, provide water cut-offs to cover exposed roofing membrane sheets and insulation with a course of coated felt set in roofing cement or hot roofing asphalt, with joints and edges sealed. Minimize or eliminate staggered joints to accommodate water cut-offs.

.2 Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system. Use membrane flashings consistent with permanent detailing sealed to base layer and vapour retarder with minimum 100 mm laps.

.3 Remove and discard temporary seals before beginning work on adjoining roofing.

.3 Provide water cut-offs to prevent dispersion of moisture at insulation level throughout roof assembly, in the event of future roof leak. Locate cut-offs at 9 m intervals each way.

.4 Install cap sheets within 48 hrs of installation of base sheets.

.5 No visible fasteners permitted on underside of exposed decks.

3.2 EXAMINATION

.1 Verify that surfaces and site conditions are ready to receive work.

.2 Verify deck is supported and secured.

.3 Verify deck is clean and smooth, free of depressions, waves, or projections, properly sloped to drains.

.4 Verify deck surfaces are dry and free of snow or ice.

.5 Confirm dry deck by moisture meter with 12 percent moisture maximum.

.6 Verify roof openings, curbs, pipes, conduit, sleeves, ducts, and vents through roof are solidly set, and correctly located.

3.3 PREPARATION – GENERAL

.1 Prepare surfaces in accordance with Standards and manufacturer's written installation instructions of CRCA and and local Provincial Roofing Contractors Association Roofing Specification Manual..

3.4 GYPSUM ROOF SHEATHING

.1 Apply with adhesive in conformance with manufacturer's written recommendations to obtain wind uplift rating specified.

3.5 VAPOUR RETARDER APPLICATION

.1 Primer: Apply primer in accordance with manufacturer's written instructions for system specified. Allow to dry.

.2 Apply vapour retarder to substrate surface with adhesive overlapping side and end laps in conformance with manufacturer's written recommendations.

.3 Stagger laps a minimum of 300 mm.

.4 Begin work at bottom of slopes; unroll and align on substrate, ensuring full contact and support at edges.

.5 Meet and overlap air/vapour barrier on adjoining walls.

.6 Seal membrane at insulation perimeters and around penetrations to ensure sealed connections with base sheet at upstands.

3.6 INSULATION APPLICATION

.1 Install insulation to manufacturer written instructions.

.2 Ensure vapour retarder is clean and dry.

.3 Bottom Insulation: Install bottom layer of insulation in minimum 2 layers. Apply adhesive to substrate in accordance with adhesive and insulation manufacturer's written instructions. Embed first layer of insulation into adhesive over vapour retarder in accordance with manufacturer's recommendations.

.1 For second layer of bottom insulation, apply adhesive to the top surface of first layer of insulation. Embed the second layer of insulation into adhesive, with joints staggered minimum 300 mm from joints of first layer.

.4 Tapered Insulation: Place constant thickness first layer and tapered thickness insulation second layer to indicated slope pattern in accordance with manufacturer's written instructions.

.1 Embed insulation into adhesive as per manufacturer's instructions.

.5 Minimum Total Insulation Thickness: As required to achieve insulation R or RSI value as indicated. Do not use tapered insulation in the calculation of thickness required.

.6 Lay boards with edges in moderate contact without forcing. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.

.7 Lay tapered boards for a distance of 450 mm back from roof drains for positive drainage.

.8 Apply no more insulation than can be covered with membrane in same day.

3.7 OVERLAY BOARDS

.1 Install overlay boards with adhesive in accordance with manufacture recommendations over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints a minimum of 150 mm in each direction from joints of insulation below. Loosely butt cover boards together. Tape or seal joints if required by roofing system manufacturer.

.2 Immediately cover overlay boards with subsequent materials; do not leave exposed.

3.8 MEMBRANE APPLICATION

.1 Apply membrane and primer to manufacturer written instructions.

.2 Hot mop –fully adhere base sheet with SBS modified asphalt at a rate of 1.25 kg/m2.

.3 Apply membrane; lap and seal edges and ends permanently waterproof.

.4 Apply membrane smooth, free from air pockets, wrinkles, or tears. Ensure full bond of membrane to substrate. Use rollers

.5 Extend membrane minimum of 200 mm onto vertical surfaces. Secure base sheets to vertical surfaces of parapets with binder bars.

.6 Extend membrane over vapour and air barrier of wall construction and seal.

.7 Mop and seal membrane around roof protrusions and penetrations.

.8 Torch cap sheet to manufacturer written instructions. On exposed membranes lap cap sheets at seams to limit bitumen bleed-out. Alternatively, apply loose granules of same colour as cap sheet to bitumen bleed-out while material is hot; ensure full coverage and embedment. Visible bleed-out not permitted.

3.9 FLASHINGS AND ACCESSORIES

.1 Apply flexible sheet base flashings to seal membrane to vertical elements.

.2 Secure to nailing strips at 100 mm on centre.

.3 Fabricate roofing control and expansion joints to isolate roof into areas as indicated.

.4 Install prefabricated roof penetration flashings and expansion joint flashings in accordance with manufacturer's instructions.

.5 Coordinate installation of roof drains, curbs, and related flashings.

.6 Seal flashings and flanges of items penetrating or protruding through the membrane.

.7 At locations where standard flashing materials cannot be used apply liquid membrane flashing in accordance with manufacturer’s details.

3.10 SITE QUALITY CONTROL

.1 Owner will hire an independent inspection agency for this project to provide inspection services and verify conformance of roofing to specified requirements. Owner to appoint and pay for roof inspections.

.2 Notify Inspection Company, roofing membrane manufacturer and Consultant 72 hours in advance of commencing roofing. Inspection Company will:

.1 Carry out full and complete inspections while the work is in progress, at completion of roofing installation and just prior to the date of Substantial Performance

.2 Inspect and review materials and workmanship including storage, handling and protection. Advise the Consultant and the Owner of inspections.

.3 Include procedures followed; ambient temperatures, humidity, wind velocity during application.

.4 Submit a daily report while work is in progress to the Owner, Consultant, Roofing subcontractor and Contractor. This report is to be countersigned by the Roofing Subcontractor's Superintendent acknowledging content.

.3 Inspection of all roofing to be provided by Owner appointed inspection agency.

3.11 MANUFACTURERS SITE SERVICES

.1 Attend Pre-installation Meetings:

.1 Review preparation and installation procedures and coordinating and scheduling required with related work.

.2 Require site attendance of roofing system manufacturer's technical personnel during installation of the Work to provide field surveillance of the installation of their Products:

.1 Schedule of Site Visits: Provide a minimum of three visits beginning with initial start-up of installation, at 25% completion and at 50% completion for each roof assembly.

.2 Inspect and review materials and workmanship including storage, handling and protection. Advise Consultant and Owner 48 hours in advance of inspections.

.3 Monitor and report installation procedures and unacceptable conditions.

.4 Manufacturer's representative to provide a written Site Report for each Site visit.

.3 Correct identified defects or irregularities.

.4 Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion of roofing membrane and flashing.

.1 Notify Consultant and Owner 48 hours in advance of date and time of final inspection.

.2 Manufacturer's representative to provide a written Site Report for Final Inspection.

3.12 CLEANING

.1 In areas where finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and comply with their documented instructions.

.2 Repair or replace defaced or disfigured finishes caused by work of this section.

3.13 PROTECTION OF FINISHED WORK

.1 Protect building surfaces against damage from roofing work.

.2 Where traffic must continue over finished roof membrane, protect surfaces using 19 mm thick plywood sheets of plywood arranged and installed to prevent tripping and wind uplift.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 Sections of Division 01 apply to this Section.

.2 All references standards specified herein imply the latest edition of the standard.

1.2 SUMMARY

.1 Furnish labour, materials and other services to complete the fabrication and installation of;

.1 Cap and base flashing; curb flashings,

.2 Roof edge flashing,

.3 Flashing at intersection of roof with vertical surfaces,

.4 Break metal flashings where shown,

.5 Prefinished flashings where indicated,

.6 Any other flashing as indicated on the drawings or as required, including all materials and fitments required for the operation of any unit furnished, in the manner, direction and performance shown on the shop drawings and specified herein.

.2 Furnish, complete, all materials which shall be installed by other trades as specified and/or shown on the drawings including:

.1 Furnish to Section 04 20 00 all metal flashings and counter flashings which are to be built into masonry work.

1.3 SUBMITTALS

.1 Provide submittals specified and as required to assess conformance with the Contract Documents, in accordance with the Contract Requirements.

.2 Submit shop drawings indicating material, thickness and finish.

.3 Submit duplicate 100mm x 100mm (4” x 4”) samples of each type of sheet metal material, colour and finish for review by Consultant prior to fabrication.

1.4 QUALITY ASSURANCE

.1 Fabricator and tradesmen executing the work of this Section shall have had a minimum five (5) years continuous Canadian experience in successful manufacture and installation of Work of type and quality shown and specified. Submit proof of experience upon Consultant's request.

.2 Erection of metal flashing systems shall be by workmen especially trained and experienced in this type of work. Have a senior, qualified representative at the job site to direct the work of this Section at all times.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Store materials flat at site under protection to prevent staining from the work of other trades or from collection of water on material and secured against wind damage.

.2 Carefully store preformed sheet metal work in such a manner as to prevent twisting, bending and rubbing.

.3 Protect sheet metal work from corrosive materials and dissimilar metals.

1.6 WARRANTY

.1 Warrant the work of this Section against defects in materials and workmanship in accordance with General Conditions, but for a period of two (2) years. Agree to promptly make good defects which become evident during warranty period without cost to the Owner.

.2 Without restricting the generality of the Warranty, defects shall include deformation, buckling, leakage, weather tightness, failure of anchors and fastenings, failure of paint coating and sealants.

.3 Promptly make good defects and/or failures in the work of this Section upon written notification by the Owner that such exist. Remedy shall include labour, materials, equipment and services required to make good defective work, and to replace components and finishes and Owner's property damaged or disturbed in the course of remedying defects.

2 Products

2.1 MATERIALS

.1 Zinc Coated Steel Sheet: ASTM A653/A653M, commercial quality, with Z275 designation zinc coating, factory finished, minimum 0.89 mm (0.0336") base metal thickness.

.2 Nails, bolts screws and rivets: Material - galvanized steel, stainless steel or same metal as material to be fastened. Type - to approved samples.

.3 Isolation coating: Alkali and acid resistant bituminous paint.

.4 Zinc Rich Paint For Touch-up of Galvanized Metals: Ready mixed, zinc-rich primer conforming to CAN/CGSB-1.181, Zinc Clad No. 5 Organic Zinc Rich Primer by Sherwin Williams Company of Canada Ltd., or approved equal.

.5 Underlay for metal flashing: Asphalt laminated 3.6 to 4.5 kg kraft paper.

.6 Sealant: Multi-component, chemical curing epoxidized polyurethane type sealant conforming to ASTM C920 Dymeric 240FC by Tremco (Canada) Ltd., or approved equal. Colour as selected later by Consultant. Provide primers, bond breakers and cleaning agents as recommended by the sealant manufacturer.

.7 All other materials not specifically described but required for a complete and proper installation of the work of this Section shall be new first quality of their respective kinds and subject to the approval of the Consultant.

2.2 FABRICATION

.1 Fabricate metal flashings and other sheet metal work to applicable CRCA 'FL' series specifications and as detailed.

.2 Form flashings, counter flashings, scuppers and copings as required to suit each condition. Use prefinished sheet steel in all locations. Form pieces in 2438 mm (8'-0") maximum lengths. Make allowance for expansion at joints.

.3 Fabricate sheet metal components with lines, arises and angles sharp and true and plane surfaces free from objectionable wave, warp or buckle.

.4 Mitre and seal corners with sealant. Form drip edging at 45 deg angle, secure with a continuous 20 ga. hold-down clip.

.5 Exposed edges of sheet metal shall be folded back to form a 13 mm (1/2") wide hem on the side concealed from view. Prefabricate corner pieces for flashings and copings. The workmanship and methods employed for forming, anchoring, cleating and the provision for expansion and contraction of sheet metal work shall be to the approval of the Consultant.

.6 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.

.7 Fabricate scuppers and overflow scuppers to applicable CRCA 'FL' Series details and as detailed.

.8 Apply two coats of bituminous paint to metal surfaces to be in contact with masonry, concrete, mortar or dissimilar metals.

2.3 FINISHING

.1 Factory Finished Metal Sheets.

.1 Silicone Modified Polyester: Coating thickness: not less than 25micrometres, custom colour.

3 Execution

3.1 EXAMINATION

.1 Inspect substrate surfaces on which the work of this Section is erected for any irregularities detrimental to the application and performance of the Work. Confirm conditions satisfactory before proceeding. Report to Consultant in writing, defects of work prepared by other trades and unsatisfactory site conditions. Commencement of work implies acceptance of surfaces and conditions.

3.2 INSTALLATION

.1 Metal flashing shall be in compliance with best sheet metal trade practice and shall in no way be contrary to sheet metal practice that will qualify for the Guarantee Certificate specified. Install with "S" lock expansion joints or standing seams incorporated on end of flashing length and all joints sealed with mastic.

.2 Provide continuous starter strips to present true, non-waving leading edge. Provide clips and anchor to backup in an approved manner to provide rigid, secure installation. Conceal fastenings in completed flashing. Lap, lock and seal all seams.

.3 Provide underlay under sheet metal. Secure in place and lap joints 100mm (4").

.4 Install sheet metal flashings, cap flashings and copings as indicated on drawings using flat lock seams. Make joints to permit thermal movement. Make surfaces free from buckling, warp, wave, dents, oil canning or other defects. Make corners square and surfaces straight and in true planes. Equally space joints in cap flashings to suit wall panel module. Space seams not farther apart than 2439mm (8').

.5 All sheet and strip flashing to be held in place by 14 gauge galvanized iron clips of a size and type to be determined by the construction requirements, except where specifically detailed on the drawings.

.6 Caulk flashing at cap flashing with sealant.

.7 Lock end joints and caulk with sealant.

.8 Use rubber-asphalt sealing compound for joints between sheet metal and bitumen.

.9 Supply rigid flashing, copings and sheet metal back-up to other trades where required to be built into other work at doors, windows, block openings, curbs and where shown on drawings.

.10 Take careful note of fans, vents, etc., on mechanical drawings to determine whether flashing and counter flashing is required or whether units are self-counter flashing.

.11 Caulking shall be installed as per written manufacturer's recommendations.

.12 Exposed fastenings will be permitted where indicated or where concealed fastening is not possible. Obtain Consultant's approval of exposed fastenings and methods of making same.

.13 If exposed screws or bolts are used, use cupped neoprene washers.

.14 Install scupper drains and overflow scupper drains as indicated on drawings, in strict accordance with CRCA manual.

3.3 CLEANING

.1 Remove, as the work progresses, all excess or foreign material which would set up or become difficult to remove from finished surfaces.

.2 Do all final cleaning upon completion of the Work of this Section. Leave building and Work in condition to meet the approval of the Consultant.

.3 Remove excess sealant by the moderate use of mineral spirits or other solvent acceptable by the sealant manufacturer.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 Sections of Division 01 apply to this Section.

.2 All references standards specified herein imply the latest edition of the standard.

1.2 SUMMARY

.1 Furnish labour, materials and other services to complete the fabrication and installation of:

.1 Preformed Penetration Flashings.

.2 Accessories and flashing material as required and as indicated on the drawings, including all materials and fitments required for the operation of any unit furnished, in the manner, direction and performance shown on the shop drawings and specified herein.

1.3 SUBMITTALS

.1 Shop Drawings:

.1 Bearing professional seal and signature of a professional engineer responsible for the engineering design of work of this Section. Show accessory profile, layout, materials, construction, and securement method to building structure.

.2 Furnish complete shop and erection drawings required for the work of this section to the Consultant for review prior to fabrication. Shop drawings shall bear the seal and signature of a Professional Engineer registered to practice at the Place of Work.

.3 Co-ordinate shop drawings for work of this section with those for other trades to ensure correct interface details required to provide watertight installation.

.4 Shop drawings shall incorporate plans, elevations, sections and details for all work in this Section. The details shall show and specify all metal thicknesses, types and finishes; areas to be sealed and sealant materials; type of construction including joinery, fasteners and welds; all anchorage assemblies and components; connections, fastenings, shapes and finishes; the fabrication and erection tolerances for the work in this section and the adjoining related work of other sections.

.2 Product Data: Submit product data including construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of product indicated.

.3 Maintenance Manuals: Include complete written and illustrated instruction manuals relative to the care, adjustment and operation of all parts of the equipment, a complete description and listing of components, with recommended frequency of service and maintenance to ensure maximum efficiency, reliability and long life of the equipment.

1.4 QUALITY ASSURANCE

.1 Fabricator and tradesmen executing the work of this Section shall have had a minimum five (5) years continuous Canadian experience in successful manufacture and installation of Work of type and quality shown and specified. Submit proof of experience upon Consultant's request.

.2 Erection of roofing specialties shall be by workmen especially trained and experienced in this type of work. Have a senior, qualified representative at the job site to direct the work of this Section at all times.

.3 Maintenance Seminars: Engage a factory authorized service representative to train Owner's maintenance personnel on proper maintenance procedures.

.4 Pre-Installation Meeting: Two weeks prior to commencing work of this Section, arrange for manufacturer's technical representative to visit the site and review preparatory and installation

procedures to be followed, conditions under which the work will be done, and inspect the surfaces to receive the work of this Section. Advise the Consultant of the date and time of the meeting.

.5 Manufacturer's Site Inspection: Have the manufacturer's technical representative inspect the Work at suitable intervals during application and at conclusion of the work of this Section, to ensure the Work is correctly installed. Submit manufacturer's inspection reports and verification that the work of this Section is correctly installed.

.6 Source Limitations: Obtain each type of product from a single manufacturer.

1.5 DELIVERY/STORAGE/HANDLING

.1 Inspect material upon delivery and order replacements for any missing or defective items. Keep material dry, covered and off the ground until installed.

1.6 WARRANTY

.1 Warrant the work of this Section against defects in materials and workmanship in accordance with General Conditions, but for a period of two (2) years. Agree to promptly make good defects which become evident during warranty period without cost to the Owner.

.2 Without restricting the generality of the Warranty, defects shall include deformation, buckling, leakage, weather tightness, failure of anchors and fastenings, failure of paint coating and sealants.

.3 Promptly make good defects and/or failures in the work of this Section upon written notification by the Owner that such exist. Remedy shall include labour, materials, equipment and services required to make good defective work, and to replace components and finishes and Owner's property damaged or disturbed in the course of remedying defects.

2 Products

2.1 MANUFACTURERS

.1 Specified Products: Work of this Section are based on specified products. Products by other manufacturers similar in function, design, performance, and construction complying with requirements of this Section may be incorporated into the Work subject to Consultant's acceptance.

2.2 PREFORMED PENETRATION FLASHINGS

.1 Split Flashing: 0.46 mm (0.018") thick type 304 stainless steel with matching cap, properly sized, EPDM grommet capped seals, continuous EPDM split junction and deck flange seals, coated deck flange compatible with roofing system.

.1 Round Flashing, Vented Cap: SPJ-2 by Thaler.

.2 Roof Stack Vent Flashing: Properly sized, 483 mm high, 0.8 mm (0.031", 22 ga.) type 304 stainless steel round flashing, EPDM Triple Pressure Grommet Seal and EPDM Base Seal, pre moulded urethane insulation liner, coated deck flange compatible with roofing system, SJ series by Thaler Metal Industries Ltd.

.3 Double Flexible Conduit Flashing: 1.6 mm (0.064") thick mill finished 1100 aluminium, insulated, moulded-in-place EPDM grommet seals, properly sized holes to suit conduits, galvanized conduit fittings, aluminium base enclosure, coated deck flange compatible with roofing system, MEF-AE2 by Thaler.

.4 Multiple Flexible Conduit Flashing: Flexible flashing, 1.6 mm (0.064") thick mill finished 1100 aluminium, insulated, moulded-in-place EPDM grommet seals, properly sized holes to suit conduits, galvanized conduit fittings, aluminium base enclosure, coated deck flange compatible with roofing system, MEF-AE4 by Thaler.

2.3 FABRICATION

.1 Fabricate, assemble and erect manufactured materials in accordance with manufacturer's published specifications for specific types of functions required; manufacturer's specifications are considered to form part of this Section.

.2 Fabricate assemblies complete in every respect, square, true to size and details, and free from distortion, twist or other defects that could affect strength, operation or appearance.

3 Execution

3.1 EXAMINATION

.1 Report in writing defects in adjacent work and other unsatisfactory site conditions that could affect work of this Section.

.2 Verify site dimensions. Commencement of work will imply acceptance of prepared work.

.3 Inspect roof system is properly attached and installed to withstand additional retained loading.

3.2 INSTALLATION

.1 Install in accordance with the manufacturer's written instructions and the contract documents, plumb, true, level and rigid.

.2 Ensure water-tightness continuity of roofing systems.

.3 Adjust and seal assembly with provision for expansion and contraction of components.

.4 Coat metals contact with dissimilar materials, with isolation coating.

.5 Apply full coverage sealant to fastener penetrations at roof surface and underside of through fasten brackets.

3.3 ADJUSTING

.1 Verify that manufactured units are installed in accordance with specifications and details, and will function as intended.

.1 Adjust any items where necessary to ensure proper operation.

3.4 CLEANING

.1 Clean manufactured units using materials and methods approved by manufacturer.

.2 Do not use cleaners or techniques that could impair performance of the roofing system.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 Sections of Division 01 apply to this Section.

.2 All references standards specified herein imply the latest edition of the standard.

1.2 SUMMARY

.1 This Section includes requirements of design, supply and installation of thin film intumescent fire resistant protective coating systems consisting of surface preparation, basecoat and protective decorative finish coat, having a fire resistance rating of 1 hour.

1.3 SUBMITTALS

.1 Provide required information in accordance with Section 01 33 00 – Submittal Procedures.

.2 Action Submittals: Provide the following submittals before starting any work of this Section:

.1 Product Data: Submit product data including certified copies of test reports verifying fire resistant material applied to substrate as constructed on project will meet or exceed requirements of specification.

.2 Installation Schedule: Submit schedule listing surfaces to which fire resistant material is to be applied indicating minimum thickness required a minimum of one month prior to scheduled application of cementitious fireproofing material.

.3 Manufacturer's Data: Submit manufacturer's specifications and installation instructions.

.4 Samples: Submit 305 mm x 305 mm (12” x 12”) samples of intumescent fireproofing system including final finish, for each colour indicated on the Drawings. Indicate location where material/system shall be utilized.

.5 Submit manufacturer's list of approved primers tested for adhesion and compatibility with intumescent fireproofing.

.3 Informational Submittals: Provide the following submittals when requested by the Consultant:

.1 Certificates: Submit test results in accordance with CAN/ULC S101 for fire endurance and CAN/ULC S102 for surface burning characteristics.

.4 Delegated Design Submittals: Provide engineered judgements and certification for work performed by this Section in accordance with requirements of Authority Having Jurisdiction.

1.4 QUALITY ASSURANCE

.1 Regulatory Requirements: Use materials and methods required to achieve fire resistance ratings required for the Project to the satisfaction of the Authority Having Jurisdiction, latest edition of the Ontario Building Code (OBC) and in accordance with referenced standards.

.2 Qualifications: Provide proof of qualifications when requested by Consultant:

.1 Applicator: Use applicators that are licensed or approved by manufacturer of fire resistant material.

.1 Certified to National Fireproofing Contractors Association (NFCA) in the Province of Ontario.

.1 Accredited to Intumescent Fire-Resistive Materials (IFRM) applications.

.2 Materials: Use materials produced under label service of an agency that has tested material, or assemblies containing material, in accordance with specified test standards.

.3 Air Quality: Provide ventilation in areas receiving fire resistant material during and 24 hours after application to dry material; maintain non-toxic, unpolluted working area; provide temporary enclosure to prevent spray from contaminating air.

.3 Certifications: Provide the following during the course of the Work:

.1 Compliance Certification: Provide certificates from manufacturer indicating tested performance requirements required by Authorities Having Jurisdiction.

.4 Field Inspection: An independent testing agency, hired by the Owner, to test random samples, as applied, to verify thickness of intumescent fireproofing.

.1 Inspection shall be carried out prior to application of the protective top coat.

1.5 SITE CONDITIONS

.1 Ambient Conditions: Apply fireproofing materials when temperature of substrate and surrounding air is above manufacturer's minimum temperature, provide sufficient ventilation to aid curing of materials and to maintain air quality requirements.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Delivery and Acceptance Requirements: Deliver in original undamaged sealed containers with manufacturer's labels, application instructions, and labelling agencies labels intact.

.2 Storage and Handling Requirements: Store materials in dry protected area, raised off ground and away from damp surfaces and conditions that have deleterious effect on materials; keep materials dry until ready for use; discard material that has been exposed to water before actual use; use stock before its expiration date.

1.7 SEQUENCING AND SCHEDULING

.1 Sequence work in conjunction with structural steel.

.2 Steel surfaces with less than 1 m (3') clear working access may necessitate applying material to inaccessible surfaces prior to erection of the finished steel members, either at the point of fabrication or on-site.

2 Products

2.1 MANUFACTURERS

.1 Basis-of-Design Products: Products named in this Section were used as the basis-of-design for the project; additional manufacturers offering similar products may be incorporated into the work of this Section provided they meet the performance requirements established by the named products and provided they submit requests a minimum of five (5) days in advance of Bid Closing.

.2 Additional Manufacturers: Subject to compliance with requirements specified in this Section and as established by the Basis-of-Design Materials, manufacturers offering products that may be incorporated into the Work include; but are not limited to, the following:

.1 A/D FIREFILM III by A/D Fire Protection Systems Ltd.

.2 CAFCO SprayFilm WB 5 Intumescent Fire Resistive Material (IFRM) by Cafco/Isolatek International Inc.

2.2 MATERIALS

.1 Interior Intumescent Coating: Intumescent coating system consisting of primer, base coat and top coat, approved and listed by ULC or cUL for fire ratings required, flame spread of 25 or less and smoke developed of 50 or less, tested in accordance with ULC S102. Fire finish 120+ CFP-

SP WB by Hilti, AD Firefilm III by Carboline, or Cafco SprayFilm WB 5 by Isolatek International Corp.

.2 Exterior Intumescent Coating: Intumescent coating system, water resistant, consisting of primer, base coat and top coat, approved and listed by ULC or cUL for fire ratings required, flame spread of 25 or less and smoke developed of 50 or less, tested in accordance with ULC S102. Cafco SprayFilm WB 4 by Isolatek International Corp., complete with epoxy intermediate coat Cafco WM 4 by Isolatek International Corp.

.3 Primer: Compatible with intumescent coating and substrates.

.4 Top Coat: Decorative finish coat, compatible with base coat, manufacturer's standard colour offering.

3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: Verify that materials having a high moisture load that could cause excessive humidity and affect application and drying of intumescent coatings are installed and cured before applying materials of this Section.

.2 Pre-Installation Testing: Test surfaces to receive work of this Section and report any defects that may affect the Work of this Section and to confirm compatibility of surfaces to receive fire resistant materials.

.3 Beginning of installation means acceptance of existing surfaces.

3.2 INSTALLATION

.1 Surfaces to receive fireproofing shall be free of dirt, dust, grease, oil, rust, loose materials, form release agents, frost, moisture or any other matter which would impair the bond of fireproofing material to the substrate. Commercial Blast Cleaning (SSPC-SP6/NACE No. 3) is the recommended minimum requirement for steel surface.

.2 Prime substrates in accordance with manufacturer's written instructions or recommendations. Confine primers to areas of bond; do not allow spillage or migration onto exposed surfaces.

.3 Apply intumescent fire resistant in accordance with manufacturer's instructions in sufficient thickness to achieve fire rating indicated; beginning of application means acceptance of substrate.

.4 Apply intumescent fire resistant and decorative finish using airless spray equipment, brush or roller to achieve smooth, high gloss finish. Orange peel texture and other surface runs or marks arising from painting operations will require remedial action or replacement.

.5 Apply decorative finish and protective seal coat in accordance with manufacturer's recommendations for finish matching approved samples.

.6 Mask where necessary to prevent fireproofing material from contracting adjoining surfaces that will remain exposed upon completion of Work. Remove tape as soon as it is possible to do so, without disturbing the fireproofing material located at the joint between the fireproofing and adjacent substrates.

3.3 FIELD QUALITY CONTROL

.1 Notify Consultant when completed applications are ready for inspection.

.2 Arrange for inspections by the Owner's independent inspection and testing company, appointed by Owner. Co-ordinate with requirements of Division 01.

.3 Following field inspection, provide all repairs as required to ensure compliance with the Contract Documents.

3.4 CLEANING AND PROTECTION

.1 Upon completion of this work, remove all materials, equipment and debris from the site.

.2 Leave work area and adjacent surfaces in a condition acceptable to the Consultant.

.3 Leave installed work with sufficient protection to enable it to remain untouched until project turnover.

.4 Remove excess material, overspray, droppings and debris.

3.5 PATCHING

.1 Patch and repair any fire resistant material that has been damaged by this or any other section; coordinate cost of repairs with Contractor; costs for repairs will be assessed to Sections of work responsible for damage.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 Sections of Division 01 apply to this Section.

.2 All references standards specified herein imply the latest edition of the standard.

1.2 SUMMARY

.1 This Section includes requirements for design, supply and installation of cementitious fireproofing, having a fire resistance rating as indicated in the drawings..

.2 Work of this Section includes, but is not limited to work required to patch, repair and make good after installation of adjacent materials that may cause damage to completed work of this Section.

1.3 COORDINATION

.1 Coordinate installation of hangers, inserts, clips and similar items to surfaces needing protection before applying fireproofing.

.2 Coordinate installation of ducts, pipes, conduits and similar items that could obstruct spraying operations before applying fireproofing.

.3 Coordinate patching of fireproofing after installation of materials installed subsequent to installation of fireproofing.

1.4 SUBMITTALS

.1 Action Submittals: Provide the following submittals before starting any work of this Section:

.1 Product Data: Submit product data including certified copies of test reports verifying fire resistant material applied to substrate as constructed on project will meet or exceed requirements of specification.

.2 Installation Schedule: Submit schedule listing surfaces to which fire resistant material is to be applied indicating minimum thickness required a minimum of one month prior to scheduled application of cementitious fireproofing material.

.2 Informational Submittals: Provide the following submittals when requested by the Consultant:

.1 Certificates: Submit test results in accordance with CAN/ULC S101 for fire endurance and CAN/ULC S102 for surface burning characteristics.

1.5 QUALITY ASSURANCE

.1 Regulatory Requirements: Use materials and methods required to achieve fire resistance ratings required for the Project to the satisfaction of the Authority Having Jurisdiction, latest edition of the Ontario Building Code (OBC) and in accordance with referenced standards.

.2 Qualifications: Provide proof of qualifications when requested by Consultant:

.1 Applicator: Use applicators that are licensed or approved by manufacturer of fire resistant material.

.1 Certified to National Fireproofing Contractors Association (NFCA) in the Province of Ontario.

.1 Accredited to Sprayed Fire-Resistive Materials (SFRM) applications.

.2 Materials: Use materials produced under label service of an agency that has tested material, or assemblies containing material, in accordance with specified test standards.

.3 Air Quality: Provide ventilation in areas receiving fire resistant material during and 24 hours after application to dry material; maintain non-toxic, unpolluted working area; provide temporary enclosure to prevent spray from contaminating air.

.3 Certifications: Provide the following during the course of the Work:

.1 Compliance Certification: Provide certificates from manufacturer indicating tested performance requirements required by Authorities Having Jurisdiction.

.4 Delegated Design: Provide engineered judgements and certification for work performed by this Section in accordance with requirements of Authority Having Jurisdiction.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Delivery and Acceptance Requirements: Deliver in original undamaged sealed containers with manufacturer's labels, application instructions, and labelling agency's labels intact.

.2 Storage and Handling Requirements: Store materials in dry protected area, raised off ground and away from damp surfaces and conditions that have deleterious effect on materials; keep materials dry until ready for use; discard material that has been exposed to water before actual use; use stock before its expiration date.

1.7 SITE CONDITIONS

.1 Ambient Conditions: Apply fireproofing materials when temperature of substrate and surrounding air is above manufacturer=s minimum temperature, provide sufficient ventilation to aid curing of materials and to maintain air quality requirements.

2 Products

2.1 MANUFACTURERS

.1 Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include; but are not limited to, the following:

.1 Isolatek International Inc., Cafco Industries Limited

.2 Carboline Company, A/D Fire Protection Systems Inc.

.3 GCP Applied Technologies

2.2 APPLIED FIREPROOFING

.1 Design Criteria:

.1 Adhesion: Provide materials that meet or exceed adhesion requirements in accordance with ASTM E736.

.2 Thickness and Weight: Determine application thickness and weight of fireproofing based on tests of assemblies in accordance with CAN/ULC S101, ASTM E119 or NFPA 251; apply same thickness of fireproofing material to all structural components forming a part of the assembly including; but not limited to, cross bracing, support angles and hangers.

.3 **Engineered Judgements**: Provide engineered judgment acceptable to Authority Having Jurisdiction where assembly being protected differs from the tested assembly used to determine thickness.

.2 Water: Clean, fresh, suitable for domestic consumption, and free from such amounts of mineral or organic substance as would affect set of fire resistant material.

.3 Primer/Adhesive: Manufacturers recommended primer and adhesive enhancing bonding material forming a part of fire resistant system for coated or hard to bond to substrates.

.4 Medium Density Fireproofing Material: Spray applied, single component, factory blended cementitious fireproofing, consisting of high quality Portland cement and asbestos-free vermiculite.

.1 Acceptable Materials:

.1 A/D Type 7 GP by A/D Fire Protection Systems Inc.

.2 Cafco 400 by Isolatek.

.3 Monokote Z106 by GCP Applied Technologies.

.5 Sealer: Water based sealer, as recommended by applied fireproofing manufacturer, allowing installation of approved coloured surface coatings or spray foam insulation to applied fireproofing.

3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: Verify that environmental conditions surfaces receiving fireproofing meet manufacturer's requirements before beginning installation products specified in this Section; installation of products will denote acceptance of site conditions.

3.2 PREPARATION

.1 Protection of Existing Conditions:

.1 Provide and maintain temporary enclosures to prevent spray from marring adjacent construction, close off and seal installed duct work to prevent contamination of air supply system.

.2 Provide and maintain masking, drop cloths and polyethylene coverings to protect surfaces exposed in final construction from over spray.

.2 Surface Preparation:

.1 Clean surfaces receiving sprayed fireproofing of oil, grease, dirt, loose paint, mill scale or any other material that could impair bond.

.2 Prime surfaces as required by manufacturer to achieve bond of fireproofing materials to substrates.

3.3 APPLICATION

.1 Apply fireproofing in accordance with manufacturers written installation requirements and as required to obtain fire resistance ratings indicated for the Project.

.2 Apply fireproofing in coats not exceeding recommended by manufacturer for fire resistance ratings indicated for the Project.

.3 Mix each batch of material separately in accordance with manufacturer's instructions to achieve required density and thickness; do not re-temper material or use frozen, caked, or lumpy material.

.4 Cut, patch, and repair material that does not meet requirements of this Section or which that fails to attain properties stipulated in reports of tests used to determine fire resistance rating of assembly.

.5 Repair damage to fire resistant material caused by installation of subsequent Work.

3.4 SITE QUALITY CONTROL

.1 Site Testing and Inspections: Site testing and inspections will be performed in accordance with requirements specified in Section 01 40 00 – Quality Requirements and as follows:

.1 Owner may appoint third party inspection and testing agency to confirm that installation of fireproofing materials meets requirements of ASTM E605 and ASTM E736-00.

.2 One series of tests will be performed using both laboratory and site testing for each 1000 m^2 of floor area sprayed; patch and repair inspection locations after completion of cut tests.

.3 Test results will be distributed to Contractor and installing Subcontractor at completion of each floor by Consultant.

.2 Non-Conforming Work: Repair deficiencies identified in test results; patch damage to fireproofing caused by other work of the Project before fireproofing is concealed; or if exposed, before substantial performance.

3.5 CLOSEOUT ACTIVITIES

.1 Cleaning: Remove equipment and clean exposed wall and floor areas to remove deposits of sprayed fireproofing materials after completion of fireproofing work.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 Sections of Division 01 apply to this Section.

.2 All references standards specified herein imply the latest edition of the standard.

1.2 SUMMARY

.1 Systems comprising fireproof firestopping and smoke seal materials and accessories, at joints and penetrations in fire resistance rated wall, floor and roof assemblies, materials and components.

1.3 RELATED REQUIREMENTS

.1 Coordinate with Work of other Sections having a direct bearing on Work of this Section.

1.4 PERFORMANCE REQUIREMENTS

.1 Materials, accessories and application procedures listed by ULC, cUL, WHI (Intertek/Warnock Hershey) or OPL (Omega Point Laboratories), or tested in accordance with CAN/ULC-S115 to comply with building code requirements.

.2 Fire-Resistive Joint Systems:

.1 Generally, use listed assemblies types F, FT, FH or FTH, as applicable.

.2 Joints at Exterior Curtain-Wall/Floor Intersections: Use joint systems tested at a positive pressure differential of 2.49 per ASTM E2307.

.3 Firestopping Materials: CAN/ULC-S115 and ASTM E2307, and to achieve fire ratings indicated.

.4 Surface Burning of Exposed Materials: CAN/ULC-S102 with a minimum flame spread/smoke developed rating of 25/50.

.5 Engineering Judgment: Where there is no specific third party tested and classified firestop system available for a particular firestop configuration, provide an Engineering Judgment acceptable to the authority having jurisdiction.

1.5 SUBMITTALS FOR REVIEW

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

.2 Product Data: Provide data on product characteristics, performance and limitation criteria, and indicating construction details accurately illustrating Project conditions. Include descriptions sufficient for identification at Project site.

.3 System Design Listings: Submit system design listings including design designations, locations and illustrations, from a qualified testing and inspection agency applicable, to each firestop configuration.

.1 Where Project conditions require modification to a qualified testing agency's illustration for a particular firestopping system condition, submit illustration, with modifications marked, approved by firestopping manufacturer's fire-protection engineer as an engineering judgment or equivalent fire resistance rated assembly.

.4 Firestop System Engineering Judgments: When required for acceptance by the authority having jurisdiction, Firestop System Engineering Judgment submissions shall:

.1 Clearly indicate that the recommended firestop system is an engineering judgment;

.2 Identify the job name, project location and firm which the engineering judgment is issued to.

.3 Be prepared, stamped and signed by a professional engineer, specializing in fire protection and licensed to practice in the place of the work.

.4 Be presented in appropriately descriptive written form with or without detail drawings where appropriate;

.5 Reference tested system(s) which the engineering judgment is based on;

.6 Include clear directions for the installation of the recommended firestop system;

.7 Include dates of issue and authorization signature as well as the issuer's name, address and telephone number;

.5 Samples:

.1 Submit samples of each type of firestop and smokeseal material and accessory.

1.6 SUBMITTALS FOR INFORMATION

.1 Qualifications Data: For manufacturer and installer.

.2 Installation Data: Manufacturer's special preparation and installation requirements.

.3 Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

.4 Delegated Design Submittals: Design firestopping assemblies required by the Contract Documents to withstand fire ratings indicated and in accordance with the Ontario Building Code.

.1 Provide manufacturer's standard listings where site conditions match standard assembly listing.

.2 Provide manufacturers engineered judgement with acceptance by authorities having jurisdiction, signed and sealed by the manufactures; fire protection engineer where assembly does not match standard assembly listing.

.5 Manufacturer's Field Reports: Indicate environmental conditions under which fireproofing materials were installed. Compatibility and Adhesion Test Reports: From manufacturer indicating the following:

.1 Materials have been tested for bond with substrates.

.2 Materials have been verified by manufacturer to be compatible with substrate.

.3 Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

1.7 QUALITY ASSURANCE

.1 Materials and Systems: Asbestos free closures to fire, gas and smoke at openings around penetrations, and at openings and joints within fire separations and assemblies having a fire-resistance rating, including openings and spaces at perimeter edge conditions.

.1 Draft tight barriers to retard passage of flame and smoke, and firefighter's hose stream and passage of liquids around outside of mechanical and electrical assemblies where they penetrate fire separations.

.2 Maintain fire resistance rating of adjacent floor, wall or other fire separation assembly acceptable to authorities having jurisdiction.

.3 Conform to both the temperature and flame ratings of CAN/ULC-S115 and, where applicable, to ASTM E814, and other requirements of authorities having jurisdiction.

.4 Comply with ULC XHEZC GuideInfo – Firestop Systems.

.2 Applicator shall be licensed by the manufacturer of fireproofing materials.

.1 Accredited Canadian members of the Firestop Contractors International Association (FCIA).

.1 Certified installer listed under the ULC's Qualified Firestop Contractor Program.

.3 Submit manufacturer's certification that materials meet or exceed specified requirements.

.4 Maintain flame and temperature ratings equal to surrounding materials.

.5 Single Responsibility: Perform work using single applicator having undivided responsibility for entire Project, including coordination with plumbing, mechanical and electrical installations.

.6 Single Source Responsibility: Obtain firestop systems for each type of penetration and construction situation from a single primary firestop systems manufacturer.

.7 Regulatory Requirements**:** Be responsible for securing approval from authority having jurisdiction where project conditions require modification to tested and listed systems.

.1 Submit authority having jurisdiction approval for modified systems.

1.8 DELIVERY, STORAGE, HANDLING AND PROTECTION

.1 Deliver materials in original, unopened packages bearing name of manufacturer and product identification.

.2 Store materials off ground, under cover, and away from damp surfaces.

1.9 SITE CONDITIONS

.1 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.

.2 Provide ventilation to manufacturer's instructions in areas to receive solvent cured materials.

2 Products

2.1 FIRESTOP MANUFACTURERS

.1 Subject to compliance with requirements provide products of one of the following manufacturers:

.1 3M Fire Protection Products.

.2 Hilti Canada Ltd.

.3 Specified Technologies Inc.

.4 Tremco Inc.

.5 Emseal Joint Systems Ltd.

2.2 FIRESTOP SYSTEMS

.1 Provide firestop systems to follow ULC XHEZC GuideInfo – Firestop Systems:

.1 Head of Wall Joint Firestop Systems: XHEZC.HW

.2 Joint Firestop Systems: XHEZC.JF

.3 Perimeter Joint Firestop Systems: XHEZC.PJ

.4 Service Penetration Firestop Systems: XHEZC.SP

.5 Service Penetration for Combustible Systems: XHEZC.SPC

2.3 FIRESTOP MATERIALS

.1 Cementitious Matrixes: Minimum 2758 kPa (400 psi) compressive strength when cured, to retard cable tray warping within the firestop seal.

.2 Elastomeric Assemblies: Flexible, elastomeric seal suitable to withstand the required movement and capable of returning to original configuration without damage to seal and without adhesive or cohesive failure.

.3 Primers: Manufacturer's standard for specific material, substrate, and end use.

.4 Water (if applicable): Potable, clean and free from injurious amounts of deleterious substances.

.5 Damming and Backup Materials, Supports and Anchoring Devices: To manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.

.6 Pipe and Duct Insulation and Wrappings: Compatible with firestopping systems.

.7 Intumescent Pads: Permanently pliable type.

.8 Intumescent Composite Sheet: Composite sheet, strip or precut shapes.

.9 Sealants and Putty For Vertical and Overhead Joints: Non sagging.

.10 Sealants and Fluid Seals at Floors: Self levelling.

.11 Identification Labels: Minimum 75 mm x 100 mm (3" x 4") permanent self-adhering or mechanically retained corrosion resistant metal labels, with black text on yellow background.

.12 Indicate ULC or cUL firestopping system number, rating, products used, and contact information of installers.

2.4 ACCESSORIES

.1 Provide components for each firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components recommended by firestopping manufacturer in accordance with tested assembly being installed, and acceptable to authorities having jurisdiction.

.2 Primer: Type recommended by firestopping manufacturer for specific substrate surfaces.

.3 Dam Material: Permanent:

.1 Mineral wool board: Minimum 64 kg/m³ density, non-combustible, flame spread of 0, smoke development of 0 to ULC S102.

.2 Mineral wool batt: Minimum 32 kg/m³ density, non-combustible, flame spread of 0, smoke development of 0 to ULC S102.

.3 Alumina silicate fire board.

.4 Sealants used in combination with other forming, damming and backing materials to prevent leakage of fill materials in liquid state.

.5 Fillers for sealants.

.4 Installation Accessories: Clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

.5 Water: Potable, clean and free from injurious amounts of deleterious substances.

2.5 FINISHES

.1 Colour: Red unless otherwise noted.

3 Execution

3.1 EXAMINATION

.1 Verify existing conditions before starting work.

.2 Verify opening configurations, penetrating items, substrates, and other conditions affecting performance of firestopping are ready to receive the work of this Section.

.3 Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

.1 Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter which may affect bond of firestopping material.

.2 Remove incompatible materials which may affect bond.

.3 Install backing and damming materials to arrest liquid material leakage.

.4 Mask adjacent surfaces to protect from spillage and over coating; immediately remove material from adjacent surfaces.

3.3 APPLICATION

.1 Apply primer and materials to manufacturer's written instructions, approved tested assemblies and details.

.1 Provide materials to maintain the fire separations in the project as indicated on the drawings.

.2 Install material at walls or partition openings which contain penetrating sleeves, piping, ductwork, conduit and other items, requiring firestopping.

.3 Apply firestopping material in sufficient thickness to achieve rating and to uniform density and texture.

.4 Tool or trowel exposed surfaces to a uniform finish.

.5 Compress fibred material to achieve a density of 25-40 percent of its uncompressed density required for listed system.

.6 Place material in layers to ensure homogenous density, filling cavities and spaces. Place sealant to completely seal junctions with adjacent dissimilar materials.

.7 Place intumescent coating in sufficient coats to achieve rating required.

.8 Remove dam material after firestopping material has cured. Dam material to remain.

.9 Provide identification labels as specified.

.10 In non-fire rated construction indicated to prevent smoke movement, tightly pack voids of service penetrations and around openings with mineral wool insulation and sealant.

3.4 IDENTIFICATION

.1 Identify through-penetration firestop systems with pressure-sensitive, self-adhesive, preprinted vinyl labels. Attach labels permanently to surfaces of penetrated construction on both sides of each firestop system installation where labels will be visible to anyone seeking to remove penetrating items or firestop systems. Include the following information on labels:

.1 The words: "Warning: Through-Penetration Firestop System - Do Not Disturb"

.2 Contractor's name, address and telephone number.

.3 Designation of applicable testing and inspection agency.

.4 Date of installation.

.5 Manufacturer's name for firestop materials.

3.5 MANUFACTURER'S SITE SERVICES

.1 Require site attendance of firestopping product manufacturer during installation of the Work. Schedule manufacturer's review of work procedures at stages listed:

.1 Pre-installation Meeting: 1 review at Site and meeting with authorized Installers.

.2 Installation: 3 reviews at Site: 1 at commencement of Work; 1 at 50% completion of Work; 1 upon completion of Work.

.2 Submit manufacturer's written reports to Consultant describing:

.1 The scope of work requested.

.2 Date, time and location.

.3 Procedures performed.

.4 Observed or detected non-compliances or inconsistencies with manufacturers' recommended instructions.

.5 Limitations or disclaimers regarding the procedures performed.

.6 Obtain reports within three days of review and submit immediately to Consultant.

.3 Monitor and report installation procedures and unacceptable conditions.

.1 Inspect and review materials and workmanship including storage, handling and protection. Advise Consultant and Owner 48 hours in advance of inspections.

.2 Correct identified defects or irregularities.

.4 Remove and replace unacceptable firestopping assemblies.

3.6 SITE QUALITY CONTROL

.1 Owner will engage an independent testing agency to perform the following special inspections and tests, and prepare reports in accordance with ASTM E2174 and ASTM E2393:

.1 Correct size of joint.

.2 Placement and anchorage of mechanical supports.

.3 Thickness of coatings.

.4 Correct use and location of backings and bond breaker materials.

.5 Adherence testing to verify material bond with substrate.

.2 Testing and inspecting of completed joints and seals shall take place in successive stages, and at a rate not less than one test per day for each Installer and material type. Where deficiencies are found or firestopping is damaged or removed because of testing, repair or replace firestopping to conform to requirements.

.3 Do not proceed with installations for the next area until test results for previously completed installations show conformance to requirements.

.4 Products and materials will be considered defective if they do not pass tests and inspections.

.5 Proceed with enclosing firestopping with other construction only after inspection reports are issued and installations conform to requirements.

.6 Submit testing agency's written reports to Consultant.

3.7 CLEANING

.1 Clean installed work.

.2 Clean adjacent surfaces of firestopping materials.

3.8 PROTECTION OF FINISHED WORK

.1 Protect installed work.

.2 Protect adjacent surfaces from damage by material installation.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 Sections of Division 01 apply to this Section.

.2 All references standards specified herein imply the latest edition of the standard.

1.2 RELATED REQUIREMENTS

.1 Coordinate with Work of other Sections having a direct bearing on Work of this Section.

1.3 SUBMITTALS

.1 Action Submittals: Provide the following submittals before starting any work of this Section:

.1 Manufacturer's Data: Submit manufacturer's literature describing each material to be used in the work of this Section. Literature shall contain a statement that the material complies with the specified standard.

.2 Structural Sealant Joint Design: Provide calculations for structural bite, dead load support, glueline thickness, shear, and other parameters. Include confirmation that design data provided by Consultant have been reviewed and approved by sealant manufacturer.

.3 Samples: Submit for approval and colour selection sample of each type of compound, recommended primers and joint filler or fillers proposed to be used.

.2 Submittals for Information:

.1 Qualifications Data: For Manufacturer and Installer.

.2 Installation Data: Manufacturer's special installation requirements.

.1 Indicate special procedures, surface preparation, perimeter conditions requiring special attention, and field quality control testing.

.3 Field reports.

.1 Site quality control report identifying procedures for site testing and verification.

.2 Manufacture site service report identifying materials have been installed in accordance with manufactures recommendations.

1.4 QUALITY ASSURANCE

.1 Applicator qualifications:

.1 Execute Work by applicators trained and approved by the manufacturer and having 5 years proven experience.

.2 Independent inspection and testing agency:

.1 Qualification: In accordance with ASTM C1021.

.2 Conduct field inspection and testing of sealant with the manufacturer’s representative for a minimum of 5% of joints, including mixing of materials, joint preparation, priming, joint profile and thickness, application, adhesion, cohesion, and tooling.

.3 Prepare and submit inspection and test report results after each inspection. Include confirmation by the manufacturer that installation has been satisfactorily completed.

.3 Manufacturer’s representative:

.1 Review Site conditions, joint design, and installer's qualifications. Report unsatisfactory conditions to Consultant.

.2 Check container labels, inspect preparation of substrate materials and review installation procedures 48 hours in advance of installation, and randomly test installed Work.

.4 Pre-installation meetings:

.1 Conduct meetings 7 Days in advance of sealant installation.

.2 Include Consultant, sealant manufacturer's representative, independent inspection and testing agency engaged by Contractor, and parties who are directly affected by the Work of this Section.

.3 Verify Contract requirements, substrate conditions, joint conditions and profile, weather conditions, and the manufacturer's installation instructions.

.4 Within 72 hours following the pre-installation meeting, prepare a pre-installation meeting report and issue to all parties in attendance.

.1 Clearly indicate the recommendations made during the pre-installation meeting, the required actions, and by whom.

1.5 SITE CONDITIONS

.1 Apply sealants only to completely dry surfaces, and at air, substrate and material temperatures above minimum established by manufacturer's written specifications.

1.6 DELIVERY, STORAGE HANDLING AND PROTECTION

.1 Deliver all materials to the jobsite in their original, unopened containers, with all labels intact.

.2 Receive and store materials as recommended by materials manufacturer.

.3 Maintain containers and labels in undamaged condition.

1.7 WARRANTY

.1 Provide a five (5) year warranty to include coverage for failure to meet specified requirements.

.1 Include coverage for installed sealants and accessories which fail to achieve air tight seal, water tight seal, and exhibit loss of adhesion or cohesion, or do not cure.

.2 Provide manufacturer's twenty-year material warranty for installed silicone sealant.

2 Products

2.1 MATERIALS – SEALANTS

.1 Type A:

.1 Single component, non-sag, non-paintable, silicone joint sealant, in accordance with ASTM C920, Type S, Grade NS, minimum Class 25, and non-staining when tested in accordance with ASTM C510 or ASTM C1248.

.2 Colour:

.1 To match adjacent substrate.

.3 Manufacturer's Products:

.1 DOWSIL™ Contractors Weatherproofing Sealant (CWS) by Dow.

.2 Tremsil 400 by Tremco Sealants.

.3 Sikasil-N plus by Sika Canada Inc.

.4 SWS by GE Silicones.

.5 Pecora PCS by Pecora Corporation.

.2 Type B:

.1 Silicone joint sealant, in accordance with ASTM D5893/D5893M and non-staining when tested in accordance with ASTM C510 or ASTM C1248.

.2 Colour:

.1 To match adjacent substrate.

.3 Manufacturer's Products:

.1 Contractors Concrete Sealant (CCS) by Dow.

.2 Spectrem 900 SL by Tremco Sealants.

.3 Sikasil 728 SL by Sika Canada Inc.

.4 300SL by Pecora Corporation.

.3 Type C:

.1 Anti-microbial (mildew-resistant), non-paintable, silicone joint sealant, in accordance with ASTM C920, Type S, Grade NS, minimum Class 25, and non-staining when tested in accordance with ASTM C510 or ASTM C1248.

.2 Colour:

.1 White.

.3 Manufacturer's Products:

.1 DOWSIL 786 by Dow.

.2 Tremsil 200 by Tremco Sealants.

.3 Sikasil-GP/GP HT by Sika Canada Inc.

.4 SCS1700 Sanitary by GE Silicones.

.5 Pecora 898NST by Pecora Corporation.

2.2 ACCESSORIES

.1 Primers:

.1 Type recommended by sealant manufacturer for substrate, to promote adhesion and to prevent staining of adjacent surfaces for conditions encountered.

.2 Joint backing:

.1 Extruded, round, solid section, skinned surface, closed cell, soft polyethylene foam gasket stock, compatible with primer and sealant materials.

.2 30% to 50% oversized.

.3 Shore A hardness of 20, tensile strength 140 kPa to 200 kPa, in accordance with ASTM C1330.

.4 Bond breaker type surface.

.3 Bond breaker tape:

.1 Polyethylene tape or other plastic tape recommended by sealant manufacturer to prevent sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint.

.2 Provide self-adhesive, pressure sensitive tape where applicable.

.3 Do not use material impregnated with oil, bitumen, non-curing polymer or similar deleterious material.

.4 Cleaning agents:

.1 Recommended by sealant manufacturer.

.2 Free of oily residues or other substances capable of staining or harming joint substrates and adjacent surfaces.

.5 Masking tape:

.1 Non-staining, non-absorbent material compatible with joint sealants and surfaces adjacent to joints.

3 Execution

3.1 INSPECTION

.1 Verify at site that joints and surfaces conditions provided will not adversely affect execution, performance or quality of completed work.

.2 Ensure masonry and concrete have cured 28 days minimum.

.3 Ascertain that sealers and coatings applied to substrates are compatible with sealant used and that full bond of the sealant and substrate is attained. Request samples of the sealed or coated substrate from their fabricators for testing of compatibility and adhesion, if necessary.

.4 Verify that specified recommended environmental conditions are present before commending work.

.5 Defective work resulting from application to unsatisfactory joint conditions will be considered the responsibility of those performing the work of this section.

.6 Do not start work of this Section until conditions are satisfactory.

3.2 PREPARATION

.1 Clean joint surfaces using joint cleaner as necessary, to remove dust, paint, loose mortar, and other foreign matter and dry joint surfaces.

.2 Remove dust, silt, scale and coatings from ferrous metals by wire brush, grinding or sandblasting.

.3 Remove oil, grease and other coatings from non-ferrous metals with approved cleaning solvent.

.4 Ensure surfaces are free of frost, rust, lacquers, laitance, release agents, moisture or other matter which might adversely affect adhesion of sealant.

.5 Examine joint sizes and correct as required to allow for anticipated movement and to achieve proper width/depth ratio per manufacturer's written recommendations for specified sealant.

.6 Support joint filler on horizontal traffic surfaces against vertical movement which might result from traffic loads or foot traffic.

.7 Prepare surfaces as recommended by sealant manufacturer.

.8 Fully remove existing sealant scheduled to be removed and replaced with new sealant, in areas indicated on the Drawings.

.1 Follow manufacturers procedures for removal of existing sealant and test areas for adhesion of new sealant. Provide the Consultant with field report identifying results of adhesion testing.

.9 Install joint backing material or apply bond breaker tape to achieve correct joint depth and prevent three-sided adhesion.

.10 To protect adjacent surfaces, mask adjacent surfaces with tape prior to priming and/or sealing.

.11 Prime sides of joints using two cloth method in accordance with manufacturer's directions immediately prior to sealing.

.12 Before any sealing is commended, a test of the material shall be made for indications of staining, poor adhesion or other undesirable effects.

.13 Seal joints in surfaces to be painted before painting. Where surfaces to be sealed are prime painted in shop before sealing, check to make sure prime paint is compatible with primer and sealant. If incompatible inform Consultant, consult the manufacturer, and change primer and sealant to approved compatible types.

.14 Check form release agent used on concrete for compatibility with primer and sealant. If incompatible inform Consultant and change primer and sealant to approved compatible types or clean concrete to Consultant's approval.

3.3 INSTALLATION

.1 Perform Work in accordance with manufacturer’s recommendations for Products and applications indicated, unless more stringent requirements apply.

.2 Use Products without additives or adulteration. Use one manufacturer's Product for each location in accordance with Sealant Location Schedule at end of this section.

.3 Perform Work in accordance with ASTM C1193, and ASTM C919 for Acoustic Sealant.

.4 Joint backing:

.1 Install joint backing to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

.1 Depth of recess: Maintain 2:1 joint width to depth ratio.

.2 Where recess is less than specified depth, cut back surface of recess to specified depth.

.2 Do not leave gaps between ends of joint backings.

.3 Do not stretch, twist, puncture, or tear joint backings.

.4 Remove absorbent joint backings that have become wet before sealant application and replace with dry materials.

.5 Support joint backing on horizontal surfaces against vertical movement which might result from pedestrian or vehicular traffic loads.

.5 Install bond breaker tape between sealant and back of joints where joint backing is not used.

.6 Apply sealant immediately after adjoining Work is in condition to receive sealant Work and as follows:

.1 Apply sealant in a continuous bead using gun with correctly sized nozzle. Use sufficient pressure to completely fill joint recess.

.2 Ensure sealant has full, direct uniform contact with, and adhesion to, side surfaces of recess. Superficial pointing with skin bead is not acceptable.

.7 Tooling:

.1 Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified to form smooth, uniform sealant bead, free from ridges, wrinkles, sags, air pockets, embedded impurities, dirt, stains, or other defects.

.2 At recesses in angular surfaces, finish sealant with flat profile, flush with face of material at each side.

.3 At recesses in flush surfaces, finish sealant with concave face and flush with face of material at each side.

.8 Immediately remove excess sealant and droppings.

.9 Ensure sealant bead is uniform in colour.

.10 Cure in accordance with the sealant manufacturer's recommendations. Do not cover up sealants until proper curing has taken place.

.11 Remove defective sealant and reapply.

3.4 SITE QUALITY CONTROL

.1 Joint Sealants: Perform adhesion tests on exterior sealants in accordance with manufacturer's written instructions and ASTM C1193, Method A – Field-Applied Sealant Joint Hand Pull Tab.

.1 Perform test no later than 21 days after installation at a rate of one test every 300 m of installed sealant.

.2 Structural Sealant: Perform adhesion tests on exterior sealants in accordance with manufacturer's written instructions and ASTM C1401, Method B – Hand-Pull Tab (Non-destructive).

.1 Perform five tests for first 300 meters of applied silicone sealant and one test for each 300 meters seal thereafter or perform one test per floor per building elevation minimum.

.2 For sealant applied between dissimilar materials, test both sides of joint.

.3 Remove sealants failing adhesion test, clean substrates, reinstall sealants and perform retesting.

.4 Maintain test log and submit report to Consultant indicating tests, locations, dates, results, and remedial actions.

.5 Maintain record of conditions and temperatures during application.

3.5 MANUFACTURER'S SITE SERVICES

.1 Require site attendance of each sealant manufacturers, during installation of the Work. Start sealant application in presence of manufacturer's technical representative.

.2 Monitor and report installation procedures and unacceptable conditions.

3.6 CLEANING

.1 Clean surfaces adjacent to joints. Immediately remove sealant smears or other soiling resulting from application of sealants.

.2 Remove masking tape and other residue.

.3 Do not mar or damage finishes on materials adjacent to joints. Repair or replace marred or damaged materials.

3.7 PROTECTION

.1 Protect joint sealants:

.1 During and after curing period from contact with contaminating substrates.

.2 From damages by construction operations or other causes.

.2 If damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated sealants immediately.

3.8 SEALANT LOCATIONS SCHEDULE

Type A	Above grade level, vertical applications
	- General perimeter caulking (window, doors and frames, louver frames, shelf angles, thresholds, bedding of mullions, precast and tilt-up panels). - Vertical expansion, control, lap joints application. - Painted metals. - Mullion joints. - Interior partition head to structure above. - Interior metal frames joints. - Exterior metal flashing. - Locations not indicated on Contract Drawings and required sealant for Work.

Type B	Above grade level, horizontal applications
	- Horizontal expansion joints. - Saw cut horizontal joints. - Precast slab horizontal joints. - Horizontal expansion and control joints in parking garages, plazas, terraces, decks, floors, and sidewalks.

Type C	Above grade level, horizontal and vertical applications
	- Around sinks, urinals, and bathroom fixtures. - Tiled areas' horizontal and vertical control and expansion joints. - Between vanity and mechanical fixtures/fittings. - Between access panels and tiles. - At corners of tiled walls.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 Sections of Division 01 apply to this Section.

.2 All references standards specified herein imply the latest edition of the standard.

1.2 SUMMARY

.1 This Section includes requirements for supply and installation of expansion control systems including; but not limited to, the following:

.1 Exterior expansion joint cover system.

1.3 DESIGN CRITERIA

.1 Joint movement capability: Provide expansion control systems with movement capability as specified Structural Consultant's specifications or as indicated, but not less than plus or minus 50 percent of joint width, without detrimental effects to assembly and adjacent construction.

.2 Design expansion joints to withstanding loads and of accommodating movement, and the other functions for which they are designed including those specified below, without failure.

.1 Vertical Exterior Joints: Maintain continuity of weather enclosure.

.2 Other Joints: Where indicated, provide joint systems that prevent penetration of water, moisture, and other substances deleterious to building components or content.

1.4 SUBMITTALS

.1 Action Submittals: Provide the following submittals before starting any work of this Section:

.1 Product Data: Submit manufacturer's product specifications, construction details, material and finish descriptions, and dimensions of individual components and seals.

.2 Shop Drawings: Indicate joint and splice locations, mitres, layout of the work, line diagrams showing entire route of each expansion control system, affected adjacent construction, anchorage locations, and include a product schedule prepared by or under the supervision of the supplier. Include the following information in tabular form:

.1 Manufacturer and model number for each expansion control system.

.2 Expansion control system location cross-referenced to Drawings.

.3 Nominal joint width.

.4 Movement capability.

.5 Materials, colours, and finishes.

.6 Product options.

.3 Samples for Verification: Full size units 150mm (6") long of each type of joint system indicated; in sets for each finish, colour, texture, and pattern specified, showing the full range of variations expected in these characteristics.

.2 Informational Submittals: Provide the following submittals when requested by the Consultant:

.1 Certificates: Submit certificate signed by manufacturer indicating that Products supplied for work of this Section are appropriate for expected range of performance including engineered judgements for fire rated products not tested to meet ULC requirements.

.2 Source Quality Control Submittals: Submit testing data from a qualified testing agency indicating that expansion control systems meet range of movement and exposure requirements for Project, based on comprehensive testing of current products.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Coordination: Coordinate compatibility of products supplied by this Section with adjoining joint systems specified in other Sections.

.2 Pre-Construction Meeting: Conduct a meeting before starting any concrete or waterproofing work with attendance by Contractor, Subcontractor for work of this Section, Subcontractor's for work affected by this Section to discuss the following:

.1 Expansion joint placement and alignment, and installation of block outs

.2 Establishing minimum nominal joint width to suit ambient conditions at time of installation of expansion joint materials

.3 Protection of expansion joints during construction and after installation of expansion joint materials

.4 Include follow-up agenda item for subsequent progress meetings to identify ongoing coordination and responsibilities relating to installation of expansion joints.

.3 Source Limitation: Obtain expansion joint cover assemblies from one source from a single manufacturer.

1.6 WARRANTY

.1 Provide five year warranty by each manufacturer of expansion joint assemblies covering defects in products and failure to meet specified requirements.

.2 Warranty: Coverage for separation of seals, distortion, and visible defects in finishes.

2 Products

2.1 ACCEPTABLE PRODUCTS

.1 Specified Products: The design for the work of this Section is based on the products specified. Products by other manufacturers similar in function, design, performance, and construction complying with requirements of this Section may be incorporated into the Work subject to Consultant's acceptance.

2.2 MATERIALS

.1 Structural Steel Shapes: ASTM A36.

.2 Steel Plates: ASTM A283 Grade C.

.3 Rolled Steel Floor Plates: ASTM A786.

.4 Aluminium: ASTM B221, alloy 6063-T5 for extrusions; ASTM B209, alloy 6061-T6, sheet and plate.

.1 Aluminium Surfaces In Contact With Cementitious Materials: Finish with heavy metal free high solids primer or chromate conversion coating.

.2 Exposed to View Aluminium Surfaces: Mill finish.

.5 Stainless Steel: ASTM A167, Type 304 with 2B finish, unless otherwise indicate, for plates, sheets and strips.

.6 Accessories: Manufacturer's standard anchors, fasteners, set screws, spacers, flexible vapour seals and filler materials, drain tubes, adhesive and other accessories compatible with material in contact, as indicated or required for complete installations.

2.3 FABRICATION

.1 Fabricate work in design, basic profile, materials, and operation indicated. Select units comparable to those indicated or required to accommodate joint size, variations in adjacent surfaces, and structural movement.

.2 Furnish units in longest practicable lengths to minimize number of end joints. Provide hairline mitred corners where joint changes directions or abuts other materials. Include closure materials and transition pieces, tee joints, corner, curbs, cross-connections, and other accessories as required to provide continuous joint cover assemblies.

2.4 ROOF COVERS

.1 Metal Roof Covers: Continuous extruded aluminium base frame sections fastened to roof curb at 600 mm (24") o.c. with aluminium cover formed from min. 0.078" thick aluminium sheet. Seal frame with continuous extruded PVC gasket and continuous neoprene waterstop. Equip frames with adjustable angle flange folded on site to cover adjacent edge of roof membrane. Factory fabricate transitions and end caps to ensure maximum weather tightness. Seal butt joints with aluminium splice cover bedded on sealant and fasten splice cover on one side only.

.1 Roof-to-Roof (EJ-1): Capable of accommodating 50% movement, SRJ Series by Construction Specialties, Inc.

2.5 EXTERIOR WALL JOINT COVERS

.1 Wall Assemblies: Continuous extruded aluminium frame assemblies of a suitable profile to receive free floating cover plate. Equip with polyethylene vapour barrier.

.1 Wall-to-Wall (EJ-2): Capable of accommodating 50% movement, ASM-X Series by Construction Specialties, Inc.

.2 Wall-to-Corner (EJ-3): Capable of accommodating 50% movement, ASMC-X Series by Construction Specialties, Inc.

2.6 INTERIOR WALL JOINT COVERS

.1 Floor Assemblies: Capable of accommodating movements of plus 50%, minus 50%, continuous extruded aluminium frame assemblies of a suitable profile to receive smooth free floating bottom centre plate and replaceable top preformed extruded seal with rigid edges for positive attachment to frame.

.1 Floor-to-Wall (EJ-4): PCW-2G Series by Construction Specialties, Inc.

2.7 FIRE BARRIER SYSTEMS

.1 Maximum lengths to minimize field splicing, prefabricated flame and insulation barrier and to accommodate the specified dynamic movement, labelled and tested in accordance with ULC S101 for fire resistance rating required, Monoflex by Construction Specialties, Inc.

2.8 METAL FINISHES

.1 Factory apply finishes after products are fabricated. Protect finishes on exposed surfaces with protective covering before shipment.

.2 Aluminium Finishes

.1 Clear Anodize Finish – AA-C204R1; medium matte etched finish with 0.4 mil minimum thick anodic coating.

.3 Concealed Surfaces: Protect concealed metal surfaces that will be in contact with concrete and masonry surfaces when installed by applying a shop coat of manufacturer's standard primer to contact surfaces. Provide minimum dry film thickness of 2.0 mils.

3 Execution

3.1 PREPARATION

.1 Prepare substrates according to expansion control system manufacturers written instructions.

.2 Examine expansion joints for the presence of voids, honeycombing, spalling and to confirm joint dimensions. Report in writing all errors, discrepancies and deficiencies to the Consultant.

.3 Clean joints, ensuring that they are clean, dry, free of dust, dirt, loose materials, grease, oil and other foreign materials detrimental to installation of expansion joint assemblies.

.4 Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary to secure joint systems to in-place construction, including threaded fasteners with drilled-in expansion shields for concrete where anchoring members are not embedded in concrete. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of joint systems.

3.2 INSTALLATION

.1 Comply with manufacturer's written instructions for handling and installing expansion control assemblies and materials, unless more stringent requirements are indicated.

.2 Coordinate installation of expansion control assembly materials and associated work so complete assemblies comply with assembly performance requirements.

.3 Terminate exposed ends of exterior expansion control assemblies with factory fabricated termination devices to maintain waterproof system.

.4 Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required to install joint systems.

.1 Install joint cover assemblies in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.

.2 Allow adequate free movement for thermal expansion and contraction of metal to avoid buckling.

.3 Locate covers in continuous contact with adjacent surfaces.

.4 Securely attach in place with required accessories.

.5 Locate anchors at interval recommended by manufacturer, but not less than 76 mm (3") from each end and not more than 610 mm (24") $^{O}/_{C}$.

.5 Maintain continuity of joint systems with a minimum number of end joints and align metal members.

.6 Cut and fit ends to produce joints that will accommodate thermal expansion and contraction of metal to avoid buckling of frames.

.7 Adhere flexible filler materials, if any, to frames with adhesive or pressure sensitive tape as recommended by manufacturer.

.8 Vapour Barriers: Install vapour barriers to provide continuous, uninterrupted water resistance throughout length of joint, including transitions and end joints.

3.3 CLEANING AND PROTECTION

.1 Do not remove protective covering until finish work in adjacent areas is complete; clean exposed metal surfaces to comply with manufacturer's written instructions when protective covering is removed.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 Sections of Division 01 apply to this Section.

.2 All references standards specified herein imply the latest edition of the standard.

1.2 SUMMARY

.1 This Section includes requirements for supply and installation of the following:

.1 Exterior and interior steel doors and frames.

.2 Fire rated door and frame assemblies.

1.3 DEFINITIONS

.1 Base Metal Thickness: Thickness dimensions are minimums as defined in referenced ASTM standards for both uncoated steel sheet and the uncoated base metal of metallic coated steel sheets.

1.4 SUBMITTALS

.1 Action Submittals: Provide the following submittals before starting any work of this Section:

.1 Product Data:

.1 Submit product data for each type of door and frame indicated, include door designation, type, level and model, material description, core description, construction details, label compliance, fire resistance ratings, and finishes.

.2 Shop Drawings:

.1 Show each type of frame, door, hardware blanking, reinforcing, tapping and drilling arrangements, metal gauges, thicknesses and finishes.

.2 Show details of doors including vertical and horizontal edge details.

.3 Submit door and frame schedule identifying each unit. Each unit shall bear a legible identifying mark corresponding to that listed in the door and frame schedule.

.3 Samples:

.1 Supply for Consultant's review, if requested, sample of frame corner showing construction, workmanship and finish.

.4 Informational Submittals: Provide the following submittals when requested by the Consultant:

.1 Source Quality Control Submittals: Submit information on zinc coating treatment and primer spot treatment, including instructions for surface treatment before site painting and any restrictions or special coating requirements.

.5 Certificates: Submit the following certificates or letters of compliance:

.1 Oversize Compliance: Submit oversize construction evidence indicating compliance with fire labelling for door and frame assemblies required to be fire protection rated and exceeding size limitations of labelled assemblies.

1.5 QUALITY ASSURANCE

.1 Manufacturer: Obtain hollow metal doors and frames from single source of supply and from a single manufacturer, and as follows:

.1 Fabricate work of this Section to meet the requirements of the Canadian Steel Door Manufacturer's Association (CSDMA), and as further modified in this section.

.2 Fabricator shall be a member in good standing of the Canadian Steel Door Manufacturer's Association (CSDMA).

.2 Supplier: Obtain hollow metal doors and frames from single source of supply and from a single manufacturer.

.3 Installer: Use installers who are experienced with the installation of hollow metal doors and frames of similar complexity and extent to that required for the Project.

.4 Testing Agencies: Provide doors produced under label service program of a testing agency acceptable to Authorities Having Jurisdiction, and as follows:

.1 Steel Fire Rated Doors and Frames: Labelled and listed by an organization accredited by Standards Council of Canada for ratings specified or indicated.

.2 Provide fire labelled frame products for those openings requiring fire protection ratings, as scheduled:

.1 List by nationally recognized agency having factory inspection service and construct as detailed in Follow-up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.

.2 Fabricate all rated doors, frames and screens to labelling authority standard.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Coordinate deliveries to comply with construction schedule and arrange ahead for off-the-ground, under cover storage location. Do not load any area beyond the design limits.

.2 Adequately protect units against rust and damage during manufacture, delivery and storage.

.3 Store materials on planks in a dry area and cover to protect from damage. Make good immediately any damage done. Clean scratches and touch-up with rust-inhibitive primer.

1.7 SITE CONDITIONS

.1 Site Measurements: Verify actual dimensions of openings by site measurements before fabrication and indicate measurements on shop drawings; coordinate fabrication schedule with construction progress to avoid delaying the Work.

.2 Established Measurements: Establish dimensions and proceed with fabricating doors and frames without site measurements where site measurements cannot be made without delaying the Work; coordinate construction to ensure that actual site dimensions correspond to established dimensions.

2 Products

2.1 MATERIALS

.1 Sheet Steel:

.1 Exterior Doors and Frames: Metallic Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with minimum ZF180 (A60) zinc-iron-alloy (galvannealed) coating designation.

.2 Interior Doors and Frames: Metallic Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with minimum ZF120 (A40) zinc-iron-alloy (galvannealed) coating designation.

.2 Gauges:

.1 Exterior Door and Screen Frames: 2.00 mm (14 msg).

.2 Interior Door and Screen Frames: 1.60 mm (16 msg).

.3 Doors and Panels (Stiffened Hollow Steel Construction)

.1 Face Sheets: 1.60 mm (16 msg).

.2 Vertical Stiffeners: 0.912 mm (19 msg).

.4 Doors and Panels (Honeycomb or Polystyrene Core):

.1 Face Sheets: 1.2 mm (0.047").

.5 Top and Bottom End Channels: 1.30mm (18 msg).

.6 Reinforcements:

.1 Lock and Strike Reinforcements: 1.60mm (16 msg).

.2 Hinge Reinforcements: 3.51mm (10 msg).

.3 Flush Bolt Reinforcements: 1.60mm (16 msg)

.4 Door Closer or Holder Reinforcements: 2.74mm (12 msg)

.3 Anchors: As required to suit condition.

.4 Rubber Bumpers: 3 per door

.5 Weatherstrip: To requirement in Division 8 hardware sections.

.6 Door Cores:

.1 Honeycomb Core: Structural small cell; 25 mm (1") maximum, kraft paper honeycomb; minimum weight 36 kg/ream; minimum density 16.5 kg/m^3; sanded to required thickness.

.2 Insulation Core: Semi rigid, CAN/ULC S702, Type 1 mineral wool insulation, meeting CAN/ULC S102 flame spread index and Smoke developed index.

.3 Core Adhesives: Heat resistant, single component adhesive recommended by manufacturer.

.7 Touch-Up Primer: Rust inhibitive primer meeting CAN/CGSB 1.132, touch up zinc coatings using shop applied primer; grey or red coloured primer, clear primer not acceptable; provide additional primer for site touch-up to repair damaged zinc and shop applied coatings.

.8 Accessories:

.1 Sealant: To requirement in Division 7 sealant sections.

.2 Door Silencers (Bumpers or Mutes): Manufacturer's standard black or grey neoprene silencers; three silencers on strike jambs of single door frames; two silencers on heads of double-door frames; stick on bumpers are not acceptable.

.9 Materials for fire rated doors shall conform to ULC or ULI requirements.

.10 Thermal Break: Rigid polyvinylchloride extrusion.

2.2 FABRICATION AND MANUFACTURE

.1 Gauges of metal shall be as specified. No deviations or substitutions will be accepted

.2 Reinforcing specified is the minimum acceptable. Provide additional reinforcement where required to ensure a permanent, rigid, trouble free installation able to withstand the stresses of heavy commercial usage.

.3 Cut, shear, straighten and work the steel in manner to prevent disfigurement of the finished work.

.4 Punch frames for rubber door bumpers.

.5 Fill seams, joints and weld depressions with epoxy metal filler, disc sand to a smooth, flat, uniform scratch-free surface, with all arrises sharp and true to line. Drilled and punches holes shall be reamed and have all burrs removed.

.6 Finished work shall be free of warp, open seams, buckles, weld and grind marks and other surface defects detrimental to the production of a good paint finish.

.7 Fastenings shall be concealed.

.8 Welding shall conform to CSA W59.

.9 Hardware Requirements:

.1 Blank, mortise, reinforce, drill and tap doors and frames to receive templated hinges and other hardware as required. Check hardware lists for requirements.

.10 Frames:

.1 Fabricate frames to profiles shown. Frames shall be fabricated to suite the header conditions of masonry work. Mitre corners of frames. Cut frame mitres accurately and weld continuously on inside of frame. Fabricate header frame to suit. Where site welding or splicing is required due to size of unit, the location of field joints shall be shown on the shop drawings and strictly adhered to.

.2 Protect strike and hinge reinforcements and other openings with mortar guard boxes welded to frame.

.3 Cutouts in doors for mortise lock sets shall be fitted with leaf spring clips and back limit stop to facilitate easy positioning and setting of locksets.

.4 Weld floor clip angles to inside of each jamb profile, two holes in each for anchorage to floor. Where required provide adjustable type floor clip angles.

.5 Fit frames with channel or angle spreaders, two per frame, to ensure proper frame alignment. Install stiffener plates or spreaders between frame trim where required, to prevent bending of trim and to maintain alignment when setting and during construction.

.6 Where frames occur in masonry provide and adjustable T-strap type or wire type anchor for every 610mm (2'-0") of jamb length. Special anchors for frames to be set in concrete shall be as detailed.

.7 Construct door frames of labelled fire doors as approved by ULC or ULI. Ratings for frames shall match doors. Locate label on the frame jamb midway between the top hinge and the head of door frame so that it is concealed when the door is closed.

.8 Provide continuous weatherstripping at head and jambs of exterior door frames. Properly secure in place with screws and adjust as required.

.9 Insulate exterior frames to provide continuous thermal barrier in exterior frames.

.10 Fabricate thermally broken frames for exterior doors, separating exterior portion of frame from interior portion with polyvinyl chloride thermal breaks.

.1 Reinforce strike and hinge jambs with crimped 100 mm x 1.6 mm thick (4” x 0.060” thick) steel reinforcement spot welded to jamb returns at locations corresponding to hinge heights. Weld reinforcement to inside of jambs. Set reinforcement flush with outside of jambs.

.11 Doors:

.1 Fabricate doors to present one continuous face free from joints, tool markings and abrasions.

.2 Reinforce, stiffen honeycomb doors with small cell honeycomb core laminated to the inside faces of panels. The core shall completely fill the inside hollow of the door.

.3 Exterior doors shall be completely filled with polystyrene foam core.

.4 Reinforce door edges with channel reinforcing. Bevel stiles 3 mm (1/8"). Assemble by tack welding and fill.

.5 Provide flush top edge on exterior doors.

.6 Fabricate fire rated door assemblies in accordance with ULC or ULI requirements. Provide labels for all fire rated doors. Locate label on the door midway between the top hinge and the head of the door so that it is concealed when the door is closed.

.12 Finishing

.1 Shop apply zinc rich primer to repair damaged zinc coatings arising from fabrication; cure primer fully before shipping to site; include compatible primer for site finishing and correction of surface abrasions to zinc coatings and factory applied primer.

.2 Remove weld slag and splatter from exposed surfaces.

.3 Fill and sand smooth tool marks, abrasions and surface blemishes to present smooth uniform surfaces.

3 Execution

3.1 EXAMINATION

.1 Examine substrates, door swing arcs, areas of installation and conditions affecting installation for compliance with requirements for manufacturer's installation tolerances and other conditions affecting performance of work of this Section.

.2 Verify roughing-in for embedded and built-in anchor locations before installing frames.

.3 Verify door and frame size, door swing and ratings with door opening number before installing frames.

.4 Installation of hollow metal doors and frames will denote acceptance of site conditions.

3.2 INSTALLATION

.1 Install steel doors, frames, and accessories in accordance with reviewed shop drawings, ANSI A250.11, CSDMA Installation Guide, manufacturer's data, and as specified in this Section.

.2 Door Frames:

.1 Remove temporary spreaders before installing door frames, leaving exposed surfaces smooth and undamaged.

.2 Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set; limit of acceptable frame distortion 2 mm (1/16") out of plumb measured on face of frame, maximum twist corner to corner of 3 mm (1/8"); align horizontal lines in final assembly.

.3 Brace frames rigidly in position until adjacent construction is complete; install wooden spreaders at third points of frame rebate to maintain frame width, install centre brace to support head of frames 1220mm (4') and wider in accordance with ANSI A250.1; do not use temporary metal spreaders for bracing of frames.

.4 For frames over 1220mm (4') in width, provide vertical support at the centre of head.

.3 Frame Tolerances: Install frames to tolerances listed in ANSI A250.11, and as follows:

.1 Squareness: Maximum 0.8mm (1/32”) measured across opening between hinge jam and strike jamb.

.2 Plumbness: Maximum 0.8mm (1/32”) measured from bottom of frame to head level.

.3 Alignment: Maximum 0.8mm (1/32”) measured offset between face of hinge jamb and strike jamb relative to wall construction.

.4 Twist: Maximum 0.8mm (1/32”) measured from leading edge of outside frame rabbet to leading edge of inside frame rabbet.

.4 Doors:

.1 Fit hollow metal doors accurately in frames within clearances required for proper operation; shim as necessary for proper operation.

.2 Install hardware in accordance with manufacturers' templates and instructions.

.3 Adjust operable parts for correct clearances and function.

.4 Install door silencers.

.5 Install fire rated doors within clearances specified in NFPA 80-2010.

.5 Adjusting and Cleaning

.1 Immediately after installation, sand smooth any rusted or damaged areas of prime coat and apply touch up of air-drying primer compatible with factory applied primer, and as follows:

.1 Clean exposed surfaces with soap and water to remove foreign matter before site touch-up.

.2 Finish exposed site welds to a smooth uniform surface and touch-up with site applied rust inhibitive primer.

.3 Site apply touch-up primer on exposed surfaces where zinc coating or factory applied primer has been damaged during installation or handling.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 Sections of Division 01 apply to this Section.

.2 All references standards specified herein imply the latest edition of the standard.

1.2 SUMMARY

.1 Section Includes

.1 Prefabricated steel access doors, with integral support curbs, safety railings, operable hardware, and counter flashings.

1.3 SUBMITTALS

.1 Shop Drawings:

.1 Submit shop drawings showing construction and anchorage of each access doors and accessories including, details of all elements of assembly and construction as specified.

.2 Related items shown on shop drawings which are not intended to be supplied as part of the work of this Section, shall be so identified. All dimensions shall be clearly noted and methods of fastening and anchoring detailed. Show accurately and identify all adjacent materials.

.2 Maintenance:

.1 On completion of work of this Section, supply maintenance instructions for insertion into Operating and Maintenance Manual.

1.4 QUALITY ASSURANCE

.1 Manufacturer Qualifications: Use a manufacturer that has completed access door assemblies having similar extent and complexity as required for the Work of this Contract.

.2 Installers Qualifications: Use experienced installers having experience with access door assemblies similar in material, design and extent as required for Work of this Contract with a record of successful in-service performance.

1.5 WARRANTY

.1 Warrant the work of this section in accordance with General Conditions but for a period of two (2) years and agree to repair or replace faulty materials or work which becomes evident during the warranty period without cost to the Owner and at the Owner's convenience.

2 Products

2.1 MATERIALS

.1 Aluminium Plates: 6061-T6 alloy, anodizing quality.

.2 Aluminium Extrusions: 6063 alloy, T5 temper, anodizing quality.

.3 Stainless Steel Sheet, Strip, Plate, and Flat Bars: ASTM A666, Type 304 or 316; with minimum sheet thickness indicated representing specified thickness in accordance with ASTM A480/A480M.

.4 Fasteners: Manufacturer’s standard to suit intended use, non-corrosive and compatible with in-contact metals.

.5 Grout: Non-shrink, non-metallic, flowable, 24h, 15 MPa (2100 psi), pull-out strength 7.9 MPa (1150 psi).

2.2 WALL ACCESS DOORS

.1 Flush, non-Insulated, wall access doors and frames with exposed trim. UF-5000 by Acudor Canada.

.1 Door Panel: Flush panel with a core of manufacturer's standard insulation enclosed in minimum 2.0 mm thick stainless steel sheet metal.

.2 Frame: Minimum 2.0 mm thick stainless steel sheet metal with 25 mm wide, surface mounted trim.

.3 Gaskets: Continuous neoprene gaskets.

.4 Hinges: Concealed continuous type.

.5 Automatic Closer: Spring type.

.6 Lock: Manufacturer's standard key operated lock with interior release.

.7 Stainless Steel Finish: No. 4 finish.

3 Execution

3.1 EXAMINATION

.1 Verify dimensions and conditions of previously installed work, upon which this Section depends, and coordinate repairs, alterations, and rectification if necessary.

.2 Obtain Consultant's written approval prior to field cutting or altering of structural members.

3.2 INSTALLATION

.1 Install in accordance with manufacturer's instructions. Co-ordinate with installation of related flashings.

.2 Install work level, true, square, straight, and accurate to sizes detailed, free from distortion or defects detrimental to appearance or performance.

.3 Perform drilling of concrete as required to fasten work of this Section.

.4 Grout work in concrete with non-shrink grout. Trowel surface smooth and flush with adjacent surfaces.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 Sections of Division 01 apply to this Section.

.2 All references standards specified herein imply the latest edition of the standard.

1.2 SUMMARY

.1 This Section includes requirements for supply and installation of the following types of electric motor operated overhead coiling doors:

.1 Insulated Service Doors

1.3 SUBMITTALS

.1 Action Submittals: Provide the following submittals before starting any work of this Section:

.2 Product Data: Submit product data for each type and size of overhead coiling door and accessories.

.1 Shop Drawings:

.1 Submit shop and erection drawings in accordance with General Conditions.

.2 Show and describe in detail special door assemblies, including elevations, sections and detail of doors, track, hardware and operating components, and of relationship of door to adjacent construction including dimensions, gauges, thickness, description of materials, finishes, as well as all other pertinent data and information.

.2 Samples for Initial Selection: Submit manufacturer's colour charts showing full range of colours available for units with factory applied finishes for initial selection.

.3 Certificates: Submit certification for oversize door assemblies having fire ratings that exceed size limitations of labelled assemblies.

.4 Maintenance Data and Operating Instructions: Upon completion of installation, supply copies of data all as per General Conditions.

1.4 QUALITY ASSURANCE

.1 Regulatory Agencies: Provide laboratory tested products acceptable to the Authority Having Jurisdiction for the following criteria:

.1 Electrical: Provide electrical components, devices and accessories, motors, controls and wiring conforming to CSA Standards and CSA labelled.

.2 Qualifications:

.1 Work shall be executed by a firm having minimum five (5) years experience in successful manufacture and installation of work of type and quality shown and specified.

.3 Job Conditions:

.1 Protect during installation any adjacent finished surfaces from contamination and damage due to work under this section.

1.5 SITE CONDITIONS

.1 Site Measurements: Verify dimensions by site measurements before fabrication and indicate measurements on shop drawings where overhead coiling doors are required to fit within openings; coordinate fabrication schedule with construction progress to avoid delaying the Work.

.2 Established Dimensions: Establish dimensions and proceed with fabricating overhead coiling doors without site measurements where site measurements cannot be made without delaying the Work; coordinate construction to ensure that actual site dimensions correspond to established dimensions.

1.6 WARRANTY

.1 Warrant work of this section against defects in materials and workmanship in accordance with General Conditions but for three (3) years. Agree to make good promptly any defects which occur within this period.

2 Products

2.1 MATERIALS

.1 Basis of Design Materials and Manufacturers:

.1 Exterior insulated overhead coiling doors:

.1 Thermiser Insulated Rolling Service Door, Model ESD20 by Cookson Company

.2 RapidSlat Model 626 Stormtite Insulated Doors by Overhead Door Corporation

.3 ThermoTite Model 800C by Wayne-Dalton Corporation

2.2 PERFORMANCE REQUIREMENTS

.1 Operation Cycle Requirements:

.1 Provide overhead coiling door components and operators capable of operating for not less than 20,000 cycles and for 10 cycles per day

.2 Provide fire rated overhead coiling door components and operators tested to operate for a minimum of 50,000 cycles and 500 closing trip tests.

2.3 COMPONENTS AND FABRICATION

.1 Curtain:

.1 Interlocking, galvanized steel slats of 20 GSG .096mm (2") wide, flat surface interlocking slats and free of sharp breaks or curves.

.1 Exterior Door: Fill slat with manufacturer's standard rigid cellular polystyrene or polyurethane foam type thermal insulation; enclose insulation completely within metal slat faces.

.2 Slats shall be of uniform width and easily replaced.

.3 Bottom bar shall consist of 2 steel angles minimum 3mm (1/8") thick equal weights, installed one each side of bottom slat and securely fastened to slat.

.4 The ends of each interlocking slat shall be fitted with malleable steel end locks to prevent lateral movement and act as wearing surface.

.2 Guides:

.1 Guides shall be of standard rolled or fabricated steel angles and channels minimum 5mm (3/16") thick, to form slot of sufficient depth to retain curtain against reasonable impact. Flare upper ends of guides for curtain entry.

.2 Guides shall be securely anchored to jambs, (welding will not be permitted). Bolts used for anchoring shall be provided with fibre washers.

.3 Counterbalance:

.1 Curtain shall be coiled on a pipe of size sufficient to carry the door load with deflection not to exceed 1mm (0.03") per ft. of opening width and to evenly balanced by oil tempered helical counter-balancing steel springs of sufficient size to balance the width of curtain, including a minimum 25% overload factor.

.2 Fit one end of barrel with governor sprocket and other end with large gear for hand chain hoist.

.3 Springs shall all be anchored to the same tension rod and held in position by easily accessible adjusting mechanism.

.4 Install ball bearings at rotating support points.

.4 Escapement Gears:

.1 Fabricate escapement gears to disengage operating mechanism, allowing the door to close by fusible link and/or electromechanical release units. Escapement gears to be covered by minimum 24 gauge galvanized steel sheet cover.

.5 End Brackets:

.1 Fabricate from heavy steel plate and bar designed to support ends of coils and various mechanisms in accordance with manufacturer's standards and design.

.6 Hoods:

.1 Fabricate from galvanized steel sheet of not less than 24 gauge commercial galvanized steel and formed to fit contour of end brackets. Reinforce top and bottom edges with returned hem and intermediate supports to prevent sagging.

.2 Provide continuous internal hinged flame baffle.

.7 Operation:

.1 Door will be operated by means of motor operation. Optional pneumatic sensing edge to be attached to bottom bar to stop and reverse the door when it contacts an object during the closing cycle.

.8 Electronic Door Operators:

.1 Motorized Operator: 2 HP, 110 Volt Single Phase, with automatic reset current sensing overload protection of size and capacity recommended by manufacturer for specified door; factory pre-wired motor controls, starter, gear reduction unit, solenoid operated brake, clutch, control devices, integral gearing for locking door, and accessories required for proper operation, having the following characteristics:

.1 Speed: Sized to open door from any position, at minimum 200 mm and maximum 300 mm per second.

.2 Limit Switches: Adjustable switches, interlocked with motor controls set for automatic door stop at fully opened and fully closed positions.

.2 Disconnect Device: Hand operated disconnect to automatically engage chain and sprocket operator to release brake for emergency manual operation and disconnect from motor, without affecting timing of limit switch; mounted in and accessible location; with interlock device to automatically prevent motor from operating when emergency operator is engaged.

.3 Door Operator Type: Wall mounted, jackshaft, gear head type door operator unit consisting of electric motor, enclosed worm gear running in oil primary drive, and chain and sprocket secondary drive; with auxiliary chain hoist and floor level disconnect.

.9 Locking:

.1 Electric-motor operation doors will lock through the operator gearing.

.10 Finish:

.1 Steel and Galvanized Steel Finishes: Manufacturer's standard powder coat finish consisting of primer and topcoat; colour selected from manufacturer's complete colour line.

.11 Accessories:

.1 Weather Seals: Combination bottom weather seal and sensor edge for motor operated doors.

.2 Provide all anchors, bolts, washers, shims, expansion shields and other miscellaneous items necessary to complete the work.

.3 Vision Windows: 6 mm thick, clear polycarbonate meeting CGSB 12.12; set in manufacturer's standard vinyl, rubber, or neoprene glazing channel secured to curtain slats.

3 Execution

3.1 EXAMINATION

.1 Examine areas of work that affect the work of this section. Report in writing all errors, defects and discrepancies immediately to the Consultant.

.2 Commencement of work implies acceptance of surfaces and conditions.

3.2 INSTALLATION

.1 Secure guides to frame as recommended by door manufacturer with maximum spacing of 914mm/ 1m (3'-0") on centers.

.2 Doors shall fit snugly to all edges of jambs and heads of frames and shall operate smoothly and freely under all conditions of operation. Door shall sit in any position in door opening and shall not drift upward or downward. All necessary appurtenances relating to the door installation, required on the door frames shall be supplied and installed under this section.

3.3 ADJUSTMENT AND CLEANING

.1 Adjust work to ensure free-running, tightly closing and properly counterbalanced operation. Ensure that installation is free from warp, twist or other distortion. Lubricate operating hardware only as recommended by the manufacturer.

.2 Refinish damaged or defective work so that no variation in surface appearance is discernible. Refinish work at site only if approved by the Consultant.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 Sections of Division 01 apply to this Section.

.2 All references standards specified herein imply the latest edition of the standard.

1.2 SUMMARY

.1 Provision of all labour, materials, equipment and incidental services necessary to supply finish hardware, including the following:

.1 Supply and delivery to the project all items of architectural finishing hardware specified herein.

.2 Supply and installation of low-energy door operators and hardware.

.3 Supply and installation of all electrical hardware items including, but not limited to; low voltage wire (FT6 plenum-rated when not in conduit), maglocks, electric strikes, electric exit devices, current transfer devices, wall switches, jamb switches, keypads, controllers, power supplies.

.4 Completion of all low voltage terminations by the hardware supplier.

1.3 RELATED REQUIREMENTS

.1 Coordinate with Work of other Sections having a direct bearing on Work of this Section.

1.4 DEFINITIONS

.1 Architectural Hardware Consultant (AHC): person or persons skilled in selecting, coordinating and specifying architectural hardware, and certified by the Door and Hardware Institute.

.2 Hardware Supplier: company or group of companies whose purpose is the manufacture and supply of architectural finish hardware.

.3 Hardware Distributor: company whose purpose is the distribution of architectural finish hardware.

1.5 QUALITY ASSURANCE

.1 Products

.1 Products specified herein are minimum standard. Approved substitutions are listed. Products proposed as substitutions must be accepted by addenda prior to Bid Closing.

.2 Hardware for doors in fire separations and exit doors must be certified by a Canadian Certification Organization accredited by Standards Council of Canada. Supply only ULC and/or CSA listed electrical components.

.3 Hardware Suppliers

.1 Hardware Suppliers must have in their employ a certified Architectural Hardware Consultant (AHC) certified by the Door and Hardware Institute.

.2 The Hardware Supplier will provide following services to the Contract:

.1 preparation of the hardware schedule issued for tender,

.2 review of all shop drawings,

.3 provision of requested samples,

.4 review of hardware substitution submittals, and

.5 provision of all inspections and reports as specified herein.

.4 Hardware Distributors

.1 The Distributor must have a minimum of five (5) years documented experience in the supply of Finish Hardware for similar projects.

.2 Hardware Distributors must have in their employ a certified Architectural Hardware Consultant (AHC) certified by the Door and Hardware Institute.

.3 The Hardware Distributor will assume responsibility that the Products supplied under this section meet or exceed the minimum requirements of the specifications, the hardware schedule, and all authorities having jurisdiction.

.5 Installers

.1 Hardware Installers must have a minimum of five (5) years' experience in installation of hardware. The Contractor shall provide verification of installer's qualification to the Consultant for approval. Installers to attend all review meetings with the Hardware Supplier and Distributor.

.6 Pre-installation Meeting

.1 Convene a pre-installation meeting for the work specified in this section. Attendees must include, as a minimum, representatives of the following:

.1 Contractor (Site Superintendent & Project Manager)

.2 Installation Subcontractor (Site Foreman & Project Manager)

.3 Hardware Supplier (AHC)

.4 Hardware Distributor (AHC and Installer)

.5 Related Subcontractors (ie. Electrical, Security Systems)

.6 Consultant

1.6 SUBMITTALS

.1 Updated Finish Hardware Schedule

.1 Prepare and submit complete detailed hardware schedules prepared in 216mmx279mm DHI format.

.2 Product Data

.1 Provide product data sheets with the finish hardware schedule showing all items of hardware to be used on the project.

.3 Templates

.1 Provide hardware templates for related fabricating and installation.

.4 Keying Schedule

.1 Provide keying schedule for review. Include all special keying notes and stamping instructions. Locks and cylinders are not to be ordered until the key schedule has been approved by the Owner.

.5 Wiring Diagrams

.1 Provide a written description of the functional use of all electrical hardware. Include door and frame elevations showing the location of each item of electrical hardware to be installed, including a diagram showing number and size of all conductors. Include drawings showing all terminal connections. Where electrical hardware is to be supplied and installed provide the Contractor with riser diagrams listing the correct wire runs and back box sizes as well as 115V AC requirements.

.6 Operations and Maintenance Data

.1 Prior to Substantial Performance, provide following, but not limited information for inclusion in Operation And Maintenance Manuals:

.1 Maintenance instructions for each hardware item.

.2 Catalogue cut sheets and Product Specifications or each product.

.3 Parts list for each product.

.4 Copy of final “as-built” finish hardware schedule.

.5 Copy of final keying schedule.

.7 Maintenance Materials

.1 Provide five (5) of each installation tool used for locks/passage/privacy, all type of door closers, and all exit devices.

1.7 DELIVERY, STORAGE, AND HANDLING

.1 Deliver each hardware item in its original package complete with all fasteners, keys, templates, and installation instructions required for installation.

.2 Package hardware separately for each door or unit and state clearly on each package the number and description of the door or unit for which the hardware therein is intended. Group items accordingly.

.3 Clearly mark each container with the door opening number and the hardware schedule item or heading number.

.4 Store hardware in a locked room or other secure area, accessible by only the Contractor. Storage area must contain adequate storage provision to hold all hardware off the floor (temporary shelving or wood pallets). Ensure area is kept dry and clean.

.5 When requested, package items of hardware separately for delivery to other fabricators for their installation.

.6 Deliver and assist in unloading and sorting of hardware. All hardware must be checked in on site by the Contractor's Site Supervisor.

1.8 COORDINATION WITH OTHER TRADES

.1 Supply finish hardware to those who are to install it, complete with templates and other complete installation instructions in sufficient time to avoid delaying the progress of the work.

.2 Supply complete templates and instructions to all door and frame manufacturers for factory machining of products to receive Hardware.

1.9 INSPECTION

.1 Hardware Distributor must perform the following inspections:

.1 Check all hardware when it has been installed and notify the Consultant of improper installation, defective materials, or products installed that were not specified. Replace defective hardware promptly.

.2 Check all door closers after they have been installed to make sure that all adjustments such as back-checking degree have been properly made. Notify the Consultant of any closers which have not been properly adjusted.

1.10 MAINTENANCE

.1 Maintenance Service

.1 Following occupancy of the building by the Owner, arrange with the Owner's maintenance staff for instruction of proper use, servicing, adjusting and lubrication of all finish hardware. Submit to the Consultant a list of attendees and meeting date.

1.11 EXTENDED WARRANTIES

.1 Provide the following manufacturer's warranties beyond the date of expiration of the Contract warranty:

.1 Hinges - Lifetime

.2 Mortise locksets - Seven (7) years

.3 Electrified Locksets – Two (2) years

.4 Exit Devices - Five (5) years

.5 Door closers - Ten (10) years

2 Products

2.1 ACCEPTABLE MANUFACTURERS

.1 Subject to conformance to requirements provide hardware manufactured by the following:

.1 Dorma Group of Companies.

.2 ASSA-ABLOY Group of Companies.

.3 Allegion Group of companies.

2.2 MATERIALS

.1 Fabricate all hardware to template. Provide templates and template hardware together with the instructions necessary for door and frame preparation.

.2 Supply all hardware with necessary screws, bolts or other fastening devices to anchor hardware in position neatly and properly in accordance with best practices.

.3 Only products listed in the hardware schedule or the approved alternates noted in the following list are to be used on this project.

.4 Use one manufacturer's products only for all similar items.

.5 All exterior doors shall be fitted with complete perimeter weatherstripping and threshold where not provided by door or frame manufacturer.

.6 No substitutions are allowed for the following products, due to integration with existing hardware:

.1 Locksets, Latchsets, and Privacy Sets.

.2 Exit Devices.

.3 Door Closers.

2.3 FASTENINGS

.1 Supply all required bolts, screws, expansion shields, anchors, and other related accessories for satisfactory attaching or installing of all finish hardware.

.2 Exposed fasteners shall match finish of, and be of compatible material with hardware.

.3 Where push/pull hardware is scheduled, door pull must be through-fastened and have fasteners concealed by push plate on opposite side.

2.4 HINGES

.1 Butt Hinges: ANSI/BHMA-A156.1, Grade 1.

.1 Supply hinges with non-removable pin (NRP) option on all doors where the hinge barrel is exposed on the secured exterior side of the door.

.2 Use two hinges on doors up to 1525mm and an additional hinge for each additional 760mm or fraction thereof.

.3 Doors 914mm wide and less: 114mm high hinges; doors greater than 914mm to 1220 mm wide: 127mm high hinges; all standard weight.

.4 Supply standard weight and heavy weight concealed bearing hinges on all doors equipped with door closers; stainless steel for all doors as listed in the hardware groups.

2.5 LOCKSETS, LATCHSETS, DEADLOCKS

.1 Grade 1 Cylindrical

.1 ANSI/BHMA-A156.2, Grade 1 extra heavy duty residential, commercial, institutional and industrial applications. Latch bolts to be steel with minimum 13mm throw deadlocking on keyed and exterior functions. 19mm throw anti-friction latchbolt on pairs of fire doors. Provide manufacturer’s standard wrought box strike for each latch or lock, with curved lip extended to protect frame. Lock case to be steel. Locks to incorporate one piece spring cage and spindle. Precision solid brass 6-pin cylinder with nickel silver keys. All levers to be solid with no plastic inserts. Locks and latchsets tested to exceed 3,000,000 cycles.

.2 All Grade 1 and Grade 2 cylindrical lever locksets shall have a free wheeling or clutch mechanism so the lever moves when in the locked position without retracting the latch bolt.

2.6 EXIT DEVICES

.1 Heavy Duty: ANSI/BHMA-A156.3, Grade 1 ULC listed for panic hardware and fire exit hardware. Supply exit devices and fire exit devices featuring coil compression springs on all device mechanism subassemblies and dead latching mechanisms for all active latchbolts. Supply exit devices with smooth mechanism case and “the quiet one” fluid dampener to eliminate noise associated with exit device operations. Non-handed device with touchpad assemblies with no

exposed fasteners and cast end caps, reinforced aluminum with stainless steel touchpad and raised edge to minimize pinching. Roller strikes to be standard on all rim and surface vertical rod devices. Doors greater than 914mm wide supply long bar exit devices, doors 2134mm high and greater supply extension rods. 1,000,000 cycle testing independently certified by ETL.

.2 Device Trim

.1 Supply device trim featuring recessed cylinder mounting and coil compression spring design with shear pin protection for all lever designs. Similar lever designs for exits as specified for locksets.

.3 Exit devices installed on exterior doors must have dead latching bolts to ensure tamper proof security.

2.7 DOOR CLOSERS

.1 Door closers to be Grade 1 ANSI/BMHA A156.4, and have the following features (see separate closer sections below for further information):

.1 Fully hydraulic, rack and pinion action with high strength cast iron cylinders and one piece forged steel pistons.

.2 Hydraulic fluid of a type requires no seasonal adjustments, and has constant temperature control from 49ºC to –35ºC.

.3 Hydraulic regulation controlled by tamper-proof, non-critical screw valves, adjustable with a hex wrench.

.4 Separate adjustments for backcheck, general speed and latch speed.

.5 Include high efficiency, low friction pinion bearings.

.6 Size 1 manual door closers to provide less than 22N opening force on a 914mm door leaf.

.7 Closers with painted finishes shall exceed a minimum 100-hour salt spray test, as described in ANSI/BHMA-A156 and ASTM B117.

.8 Closers detailed with plated finishes shall include plated covers (or finish plates), arms and visible fasteners.

.9 Provided with all mounting plates required to mount on any special door and frame conditions.

.2 Heavy Duty Mechanical (Multiple Applications)

.1 ANSI/BHMA-A156.4, non-sized (1-6) and non-handed cylinder body to have 38mm piston diameter with 17.5mm double heat-treated shaft and certified to exceed ten million (10,000,000) full load operating cycles by a recognized independent testing laboratory with power-adjust speed dial to show spring size power. Track closers non-sized 1-4. Closers to have stamped main arm and forearm (forged steel main arm and forearm EDA and CUSH type arms). Optional arms to be interchangeable within the series of closers, except track arm type closers. Track arm type closers to have single lever arm with low friction track and roller assembly and provisions for an optional bumper to assist backcheck.

2.8 DOOR OPERATORS

.1 Heavy Duty Electric Operator (Push Side Mount)

.1 ANSI/BHMA-A156.19, Grade 1, non-sized (2-5) and non-handed cylinder body to have 38mm piston diameter with 17.5mm double heat-treated shaft. With forged steel main arm. Power operator to include:

.1 Provisions for separate conduits to carry high and low voltage wiring in compliance with the National Electrical code.

.2 Second Chance Function: program within the on-board computer monitoring resistance during opening cycle. If resistance is present operator pauses for a few seconds, then attempts to open door again. If resistance does not exist door will open normally. However if resistance still exists, door will pause and the unit will time out and door will close.

.3 Breakaway Drive System: System within the motor/clutch assembly. If the door is forced closed while in the opening cycle, the clutch slips preventing damage to the operator, door and frame.

.4 Soft Start Motor Control: required for controlled start once actuator is depressed to extend the service life of all drives components.

.5 Built in Power Supply to deliver 12V and 24V outputs up to a maximum of 1.0 amp.

.6 Certified by ULC for use on labeled doors.

.7 Independent adjustments for all electrically controlled functions within controller module.

.2 Actuators

.1 Wave sensor activator

.1 Wall mount type activator to be hard-wired either 12V DC or 24V DC actuator, 114 mm square stainless steel plate with sensor window locate in the centre of the plate. Engrave with hand wave symbol, and letter “WAVE TO OPEN” in black colour. Units to include heavy grade components for vandal resistant mounting and weather resistant.

.3 Low energy door operators will be supplied and installed by factory trained installers. Hardware supplier will coordinate the installation of the door operators and include the cost of labour for this work.

2.9 PULLS AND PLATES

.1 Supply door trim as listed in hardware schedule. Supply pulls with back to back (BTB) or through bolt mounting as required. When push plates are listed with door pulls, install the push plate to conceal the through bolt.

.2 All kickplates, push plates, and bumper plates must have all sides beveled and corners rounded to ensure no sharp edges. Supply plates with counter sunk screw holes. Supply double-sided tape for adhesive-mount.

.3 Kick plates will be minimum 0.127mm thick unless listed otherwise; size to be door width less 35mm for single door, and less 25mm for pairs of doors. Heights as scheduled.

2.10 DOOR STOPS AND HOLDERS

.1 Overhead stops and mechanical holders shall be surface mounted unless a conflict exists with door closers or other hardware. Provide door stays with friction action in locations that do not have door closers. Install all overhead stops and holders for 90° stop unless otherwise specified.

2.11 DOOR SEALS

.1 Supply perimeter seals to fully cover all gaps between door, frame, and floor condition to seal against weather, sound, or smoke as required and scheduled.

.2 Frame gaskets shall be closed cell neoprene. Extruded housing must have a rib to prevent distortion during installation. Aluminum frames will be provided with weather stripping inserts by the frame supplier.

.3 Door bottoms will be heavy-duty and have an adjustment screw to ensure proper contact with flooring. Supply correct drop insert for carpet where required.

2.12 THRESHOLDS

.1 Supply extruded aluminum thresholds to ensure the sweep or door bottom makes full contact. Supply thermally broken thresholds for all exterior door openings.

.2 Threshold height shall not exceed 13mm for barrier-free path of travel.

2.13 ELECTRONIC HARDWARE

.1 Power Supplies

.1 Power supplies to be Underwriter Laboratories (UL) listed for general-purpose use tested to meet UL1012 specifications. Power supplies to have 12/24V DC field selectable output voltage with output current of 3 amps at 12V DC and 2 amps at 24V DC with supply output voltage filtered and regulated. The power supply to be inherently modular by design for ease of installation and to provide flexibility for future system modifications when necessary.

.2 Access control will be frame-mounted stand-alone keypad complete with adjustable time delay. Units will have all functions keypad programmable, 12 or 24 volt AC/DC with a code length of 3-6 digits.

.3 Electronic hardware will be supplied and installed by this section, including all low voltage device wiring.

.4 Coordinate installation Work of electronic hardware with electrical drawing and specification.

2.14 FINISHES

.1 As indicated on Finish hardware schedule.

2.15 KEYING

.1 General

.1 Architectural Hardware Consultant (AHC) will meet with the Owner to obtain and finalize all keying requirements, and will subsequently issue copies of the keying schedule for review.

.2 Provide temporary construction keying system during construction period. Permanent keys will be furnished to the Owner prior to occupancy. The Owner or Owner's Agent will void the operation of the construction keys.

.3 Key Material: Provide manufacturer's standard embossed keys of nickel silver to ensure durability.

.4 Key Quantity: Furnish keys in the following quantities:

.1 Temporary construction keys: 10 each.

.2 Grand Master keys per grand master group: 6 each.

.3 Master keys per master group: 6 each.

.4 Change keys per cylinder or keyed alike group: 4 each.

.5 5 Extractor tools each.

.5 Deliver all permanent key blanks and security keys direct to Owner from factory by secure courier, return receipt requested. Failure to properly comply with these requirements may be cause to require replacement of all or any part of the cylinders and keys involved as deemed necessary at no additional cost to the Owner.

.6 Furnish one key control system complete with indexed door numbers, key codes, bittings, building numbers, room numbers, lock function, design, and finish. In addition, include model numbers, handing, design, and functions of exit devices and door closers. Transmit to the Owner by secure carrier, return receipt requested.

.7 Provide complete cross-index system, place keys on markers and hooks in the cabinet as determined by the finial key schedule. Provide one each key cabinet and hinged panel type cabinet for wall mounting as noted in detailed hardware schedule.

.2 Construction Keying

.1 Equip lock cylinders in construction system.

.2 The construction key system to be inoperative once the Owner's keys are inserted in the cylinders.

.3 Provide 12 construction master keys.

.3 Permanent Keying

.1 Interior locks and cylinders shall be furnished in a key system to match existing facility.

.2 Exterior locks and cylinders to be high-security removable core cylinders with level-three side-bit milling to allow integration with existing standard key systems.

.3 Permanent cylinders to be factory-keyed, combinated in sets or subsets, master keyed or great grand master keyed, as directed by Owner. Permanent keys and cylinders shall be marked with the keyset symbol on all keyblanks for identification. Visual key control marks or codes will not include the actual key cuts.

3 Execution

3.1 EXAMINATION

.1 Ensure that doors and frames are properly prepared and reinforced to receive finish hardware prior to installation.

.2 Ensure that door frames and finished floor are sufficiently plumb and level to permit proper engagement and operation of hardware.

.3 Submit to Consultant in writing a list of deficiencies determined as part of inspection required in FILED QUALITY CONTROL as specified herein, prior to installation of finished hardware.

3.2 INSTALLATION

.1 Install hardware to ANSI/DHI-A115.1G.

.2 Install hardware at mounting heights as specified in the manufacturer's templates or specific references in approved hardware schedule or approved elevation drawings. Where mounting height is not otherwise specified herein, install hardware at the following mounting heights:

.1 Locksets: 1015mm.

.2 Exit device: 1015mm.

.3 Push/Pull: 1065mm.

.3 Install hardware using only manufacturer supplied and approved fasteners in strict adherence with manufacturers published installation instructions.

.4 Ensure that all locksets / latchsets / deadlocks are of the correct hand before installation to ensure that the cylinder is in the correct position. Handing is part of installation procedure.

.5 Ensure that all exit devices are of the correct hand and adjust device cam for proper outside trim function prior to installation. Handing is part of installation procedure.

.6 Follow all manufactures installation instructions. Adjustment is inclusive of spring power, closing speed, latching speed and back-check at the time of installation.

.7 Delayed action door closers are to be adjusted to forty (40) second delay for handicapped accessibility and movement of materials. Time period to be approved by Owner.

.8 Install head seal prior to installation of parallel arm mounted door closers and push side mounted door stops/holders.

.9 Counter sink through bolt of door pull under push plate during installation.

.10 Mount all closers, automatic operators and hold-open devices with through bolts, as indicated in the finish hardware schedule.

.11 Where door stop contacts door pulls, mount stop to strike bottom of pull.

.12 Remove construction locks when directed by Consultant; install permanent cores and check operation of all locks.

.13 Other trades installing hardware must follow all manufacturer's instructions including door closer adjustment, handing of locksets as required, and degree of door swing.

.14 Hardware Distributor will include all labour to terminate secondary low voltage wire runs at all door control devices supplied by this section, including but not limited to; door operators, magnetic locks, push button code entry units (keypads), request to exit switches, electric strikes and any associated electrical equipment. Ensure system is tested and complete for Owner's use. Provide staff training for push button code system (keypads) including all programming function and maintenance.

.15 Hardware Distributor will instruct the installer as to how various newer or unusual items that are required to be installed for proper performance.

3.3 FIELD QUALITY CONTROL

.1 Hardware distributer to perform bi-monthly on-site inspections during hardware installation and provide inspection reports listing progress of work, unacceptable work and corrective measures. Repair or replace as directed by the Consultant.

.2 Upon completion of hardware installation, arrange with the Owner and Consultant demonstration and training in the proper operation, adjustment, and maintenance of all finish hardware supplied under this Contract.

.3 Before completion of the Work but after finish hardware installation has been completed, submit a certificate to the Consultant stating that final inspection has been made and that all hardware has been checked for installation and operation by representatives of both the Hardware Supplier and the Hardware Distributor, and that operation and maintenance of all hardware has been fully demonstrated to the satisfaction of the Owner, and verified by Consultant.

3.4 ADJUSTING AND CLEANING

.1 Check and make final adjustments to each operating item of hardware on each door to ensure proper operation and function.

.2 All hardware to be left clean and free of disfigurements.

.3 Check all locked doors against approved keying schedule.

3.5 PROTECTION

.1 Protect hardware from damage during construction period by removing and reinstalling or where necessary, using temporary hardware to maintain finish in new condition and maintain manufacturer's warranty.

3.6 HARDWARE SCHEDULE

.1 Hardware group 1

.1 3 Butt Hinges, 5BB1 x 4.5 x 4.5 x 630

.2 1 Push Plate, 8200 x 4 x 16 x 630

.3 1 Pull Handle, 8302 x 8 x 4 x 16 x 630

.4 1 Door Operator, 9531 MS x aluminium clear anodized

.5 1 Rocker Switch, 8310-806R x 689

.6 2 Actuators, 8310-810D x 630

.7 1 Kickplate, 8400 x 205 x less door width x 630

.2 Hardware group 2

.1 3 Butt Hinges, 5BB1 x 4.5 x 4.5 x 630

.2 1 Cylindrical Lockset, ND80PD x interchangeable less core x SPA x 626

.3 1 Door Closer, 4040XP Reg x 689

.4 1 Overhead Stop, 100S x 630

.5 1 Kickplate, 8400 x 205 x less door width x 630

.3 Hardware group 3

.1 3 Butt Hinges, 5BB1 x 4.5 x 4.5 x 630

.2 1 Passage Set, ND10S x SPA x 626

.3 1 Door Closer, 4040XP Reg x 689

.4 1 Overhead Stop, 100S x 630

.5 1 Kickplate, 8400 x 205 x less door width x 630

.4 Hardware group 4

.1 3 Butt Hinges, 5BB1 x 4.5 x 4.5 x 630

.2 1 Push Plate, 8200 x 4 x 16 x 630

.3 1 Pull Handle, 8302 x 8 x 4 x 16 x 630

.4 1 Door Closer, 4040XP Reg x 689

.5 1 Overhead Stop, 100S x 630

.6 1 Kickplate, 8400 x 205 x less door width x 630

.5 Hardware group 5

.1 3 Butt Hinges, 5BB1 x 4.5 x 4.5 x NRP x 630

.2 1 Exit Device, 9875 x EL x 990TP x 630

.3 1 Power Supply, PS902

.4 1 Door Operator, 9531 MS x aluminium clear anodized

.5 1 Rocker Switch, 8310-806R x 689

.6 2 Actuators, 8310-810D x 630

.7 1 Weatherstripping, W-13 x aluminium clear anodized x 1 opening width x 2 opening height

.8 1 Door Sweep, W-13S x aluminium clear anodized x 1 opening width

.9 1 Threshold, CT-66 x aluminium clear anodized x 1 opening width

.10 1 Kickplate, 8400 x 205 x less door width x 630

.6 Hardware group 6

.1 3 Butt Hinges, 5BB1 x 4.5 x 4.5 x NRP x 630

.2 1 Cylindrical Lockset, ND80PD x interchangeable less core x SPA x 626

.3 1 Door Closer, 4040XP SCUSH x 689

.4 1 Overhead Stop, 100S x 630

.5 1 Weatherstripping, W-13 x aluminium clear anodized x 1 opening width x 2 opening height

.6 1 Door Sweep, W-13S x aluminium clear anodized x 1 opening width

.7 1 Threshold, CT-66 x aluminium clear anodized x 1 opening width

.8 1 Kickplate, 8400 x 205 x less door width x 630

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 Sections of Division 01 apply to this Section.

.2 All references standards specified herein imply the latest edition of the standard.

1.2 SUMMARY

.1 This Section includes requirement for supply and installation of components required for a complete wall and ceiling assembly with proprietary components as follows:

.1 Non-Loadbearing Steel Framing.

.2 Gypsum board panels.

1.3 DESIGN CRITERIA

.1 Deflection Criteria: Limit metal framing systems deflection under load to the following:

.1 Deflection, Support Framing Gypsum Board Partitions: Deflection of support framing for gypsum board partition systems shall be limited to L/240 of the span in height, except as otherwise shown or specified.

.1 In areas where room side finish is veneer plaster or ceramic tile, deflection of partitions shall be limited to L/360 of the span in height.

.2 Deflection, Support Framing Gypsum Board Ceilings: Gypsum board interior suspended ceilings, and partitions supporting tile, shall be designed for deflection not to exceed L/360 of the distance between supports

.2 Design Modifications: Make design modifications only as may be necessary to meet performance requirements and coordinate the Work. Variations in details and materials which do not adversely affect appearance, durability or strength shall be submitted to the Consultant for review.

1.4 QUALITY ASSURANCE

.1 Contractor executing work of this Section shall have a minimum of five (5) years continuous Canadian experience in successful installation of work of type and quality shown and specified. Submit proof of experience upon Consultant's request.

.2 Perform Work in accordance with ASTM C840, GA-214, GA-216 and GA-600.

.3 Handling Gypsum Board: Comply with GA-801.

1.5 SUBMITTALS

.1 Shop Drawings: Submit shop drawings showing the design, construction and relevant details of furring, enclosures and partitions which require a fire rating.

.2 Product Data: Submit manufacturer's current technical literature for each component.

.3 Samples: Supply for Consultant's review, if requested, samples of the following:

.1 Board: Submit sample of each panel product specified, 150mm (6") square.

.2 Trim: Submit sample of each type of trim specified, 305mm (12") long.

.3 Texture: Submit sample, 305mm (12") square, of textured coated gypsum board.

.4 Quality Assurance Submittals:

.1 Design Data, Test Reports: Provide manufacturer's test reports indicating product compliance with indicated requirements.

.2 Manufacturer's Instructions: Provide manufacturer's written installation instructions.

1.6 DELIVERY, STORAGE, HANDLING AND PROTECTION

.1 Coordinate deliveries to comply with construction schedule and arrange ahead for off the ground, enclosed, under cover storage location. Do not load any area beyond the design limits.

.2 Materials shall be carefully checked, unloaded, stored and handled to prevent damage. Protect materials with suitable non-staining waterproof coverings.

.3 Store material in original, undamaged containers or wrappings with manufacturer's seals and labels intact, in accordance with GA-238 and manufacturer's recommendations.

.4 Protect bagged products from excessive moisture or wetting. Store metal component sections in crates to prevent damage to material. Do not use bent or deformed material.

1.7 PROJECT CONDITIONS

.1 Establish and maintain environmental conditions for application and finishing gypsum wallboard to comply with ASTM C 840 and in accordance with manufacturer's written instructions.

.2 In cold weather (outdoor temperatures less than 13 °C), controlled heat in the range of 13 °C to 21 °C must be provided. This heat must be maintained both day and night, 24 hours before, during, and after entire gypsum board joint finishing and until the permanent heating system is in operation or the building is occupied. Minimum temperature of 10 °C shall be maintained during gypsum board application.

.3 Ventilate building spaces to remove excess moisture and humidity during the drying process. Avoid drafts during dry, hot weather to prevent materials from drying too rapidly.

2 Products

2.1 MATERIALS - WALLBOARD

.1 Gypsum Ceiling Board:

.1 Sag Resistant Gypsum Board: Meeting requirements of ASTM C1396M, 12.7 mm (1/2”) thick ceiling board manufactured to have more sag resistance than regular type gypsum board with long edges tapered, and as follows:

.1 Location: Ceiling surfaces.

.2 Acceptable Materials:

.1 Sheetrock UltraLight Sag-Resistant Interior Ceiling Board by CGC Inc.

.2 ToughRock Span 24 Lite-Weight Ceiling Board by Georgia Pacific Canada.

.3 Easi-Lite Lightweight Interior Ceiling Gypsum Board by CertainTeed Canada.

2.2 MATERIALS - STEEL FRAMING

.1 Non-Loadbearing Steel Framing:

.1 General:

.1 Steel sheet components shall comply with ASTM C645 requirements for metal, unless otherwise indicated.

.2 Steel for non-loadbearing members shall have metallic coats that conform to ASTM A653M or ASTM A792M with minimum metallic coating weighs (mass) of Z120 and AZM150 respectively.

.3 Framing members shall comply with the CAN/CSA S136 - North American Specification for the Design of Cold Formed Steel Structural Members, for conditions indicated.

.2 Metal Studs:

.1 Minimum 0.45mm (25 gauge), screwable with crimped web and returned flange. Provide knockout openings in web at 150mm (6") O.C. to accommodate (if required) horizontal mechanical and electrical service lines, and bracing. Widths as indicated on drawings. Provide structural studs where indicated.

.2 Where metal stud framing forms walls are to be thermally insulated as indicated on drawings, provide metal studs with integrated fastening system for glass fibre/mineral fibre insulation.

.3 Provide special shapes indicated on drawings as part of steel stud/drywall assemblies.

.3 Furring Members:

.1 Hat-shaped, rigid furring channels shall comply with the ASTM C645 and shall have a minimum base steel thickness of 0.45mm (25 gauge) and a minimum depth of 22mm (7/8") the minimum width of furring attachment flanges shall be 13mm (1/2").

.2 Resilient furring channels designed to reduce sound transmission shall have a minimum base steel thickness of 0.45mm (25 gauge) and have a minimum depth of 13mm (1/2").

.3 Furring members shall be used for furring out any surface for application of gypsum wallboard finish and for secondary furring member in suspended ceilings/soffits.

.4 All furring members shall be hot-dipped galvanized.

.4 Drywall Grid Suspension for Ceilings: Conforming to ASTM C645 and ASTM C754, direct hung system composed of main beams and cross furring members that interlock and as follows:

.1 Tie Wire: Tie wire shall comply with ASTM A641/A641M zinc-coated, soft annealed.

.1 4.1mm (8 gauge) used for hangers in suspended ceiling grid work.

.2 2.6mm (12 gauge) for drywall suspension system.

.3 1.2mm (18 gauge) for wire-tying channels in wall furring and ceiling construction.

.2 Furring Runners: Manufactured from 0.5mm (0.020”) thick steel, 35mm (1-3/8”) wide with knurled face by 38mm (1-1/2”) high by 305mm (12’) long, with factory punched cross tee slots, hanger holes and non-directional bayonet end tab couplings.

.3 Furring Tees: Manufactured from 0.45mm (25 gauge) thick steel, 35mm (1-3/8”) wide with knurled face by 38mm (1-1/2”) high by 1220mm (4’) long with stab-type end tab couplings, with factory punched cross tee slots, and hanger holes.

.4 Furring Cross Channels: Manufactured from 0. 45mm (25 gauge) thick steel, 35mm (1-3/8”) wide with knurled face by 22mm (7/8”) high by 1220mm (4’) long with straight locking end tabs.

.5 Cross Tees: Manufactured from 0. 45mm (25 gauge) thick steel, 24mm (15/16") wide by 22mm (7/8") high by 1220mm (4') long with stab-type end tab couplings, with factory punched cross tee slots, and hanger holes.

.6 Wall Track: Manufactured from 0. 45mm (25 gauge) thick steel, 39mm (1-9/16") high by 3048mm (10') long with a 25mm (1") top and bottom flange.

.7 Basis of Design System:

.1 660-C Stab Drywall Grid Suspension System by Rockfon.

.2 FrameAll Drywall Grid by Armstrong World Industries Inc.

.2 Acoustic Hangers for STC Rated Ceilings: Purpose made double deflection neoprene hanger with eyebolts for ceiling isolation.

.1 Product: WHD Architectural Ceiling Hanger or similar selected for required load rating by Mason Industries, or approved equivalent.

.3 Acoustic Isolation Hangers: Purpose made double deflection neoprene hanger with eyebolts for ceiling isolation.

.1 The isolation hanger deflection shall be selected from manufacture pre-engineered system to provide a maximum natural frequency of 3.3 Hz.

.2 Hangers shall be tested by an independent laboratory

.3 Cold Rolled Channel: Provide 38 mm x 13 mm, 16-gage cold-rolled steel channel provided by this section and incorporated into hanger assembly.

.4 The hanger assembly bracket shall be designed to accept cold-rolled channel. Provide APB (Air Performance Bracket) Hanger bracket by listed manufacture including a 9.5 mm (3/8") threaded insert for attaching threaded rod below the hanger for optional equipment suspension below drywall ceiling.

.5 Basis of design product and manufacture: 'KSCH-Hangers' manufactured by Kinetics Noise Control, Inc.

.4 Acoustic Isolation Clips for STC Rated Walls and Ceilings: Purpose made isolation clips consisting of a rubber element into which a standard galvanized steel furring channel is captured without any metal-to-metal or other rigid contact; spaced as required for STC rating and load rating manufactured.

.1 Product:

.1 GenieClip by Pliteq Inc.

.2 Iso-Max Sound Isolation Clips by Kinetics Noise Control,

.3 or approved equivalent.

2.3 ACCESSORIES

.1 Concrete Anchors:

.1 Self-drilling tie wire anchors, Red-Head No. T-32 by Phillips Drill Company, Division of ITT Industries of Canada Ltd., or approved equal.

.2 Concrete Inserts:

.1 Hot-dip galvanized "turtle back" type concrete inserts to suit conditions as approved by Consultant, by Acrow-Richmond National Concrete Accessories, Division of Premetalco Inc., or approved equal.

.3 Gypsum Wallboard Accessories:

.1 In general, gypsum wallboard accessories shall conform to ASTM C1047.

.2 Corner Beads:

.1 Made from galvanized steel sheet conforming to ASTM A653, minimum 0.0179" (25 gauge). Minimum width of flanges 28mm for 13mm (1-1/8" for 1/2") thick wallboard and 32mm for 16mm (1-1/4" for 5/8") thick wallboard.

.3 Casing Beads:

.1 Made from galvanized steel sheet conforming to ASTM A653, minimum 30 gauge, U-shaped designed for finishing with joint compound.

.4 Control Joints:

.1 Made from galvanized sheet steel conforming to ASTM A653, minimum 0.0179" (25 gauge), or roll-formed zinc-alloy to resist corrosion, with expansion joint material perforated flanges.

.1 Zinc Control Joint No. 093 by CGC Inc.

.2 or approved equal.

.5 Reveals:

.1 Galvanized sheet steel conforming to ASTM A653, minimum 0.0179" (25 gauge), in profiles as indicated on drawings.

.4 Wallboard Screws:

.1 Corrosion resistant, self-drilling, self-tapping gypsum wallboard screws conforming to ASTM C1002 (Type S) and ASTM C954 (Type S-12), 25mm (1") long No. 6 for single layer application, 41mm (1-5/8") long No. 7 for double layer application.

.2 At fire rated construction, type and size of wallboard screw shall be same as used in fire-rating test.

.5 Joint Compound for Interior Gypsum Board:

.1 Conforming to ASTM C475 and as recommended by gypsum wallboard, fire-rated gypsum wallboard and exterior wallboard manufacturers to suit conditions.

.6 Resilient Sponge Tape:

.1 Closed cell neoprene sponge type tape with self-sticking adhesive on one side. Permastik 122X by Jacobs and Thompson Ltd., or foamed vinyl type tape, Arnofoam by Arno Adhesive Tape Incorporated.

.7 Adhesive:

.1 Conforming to CGSB 71-GP-25M, and as recommended by manufacturer and compatible with contacted surfaces.

.8 Bituminous Paint: Acid and alkali resistant bituminous isolation coating.

.9 Butyl Tape: Extruded, High grade macro-polyisobutylene tape of width and shore hardness to suit conditions.

.10 Building Paper: No.15 asphalt saturated, organic felt in accordance with CSA A123.3.

3 Execution

3.1 EXAMINATION

.1 Examine gypsum wallboard panels for damage and existence of mould. Install only undamaged panels.

.2 Examine gypsum wallboard in accordance with GA-231 for water damage.

.3 Examine areas and substrates, with installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance.

.4 Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

.1 Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

.2 Coordinate installation of gypsum board suspension systems with installation of acoustical ceiling tiles (ACT) suspension systems. Where gypsum board suspension systems abut ACT systems, ensure that ceiling tiles grid fit into gypsum grid without affecting overall design and appearance.

.3 Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

3.3 INSTALLATION - GENERAL

.1 Conform to ASTM C840, except as otherwise specified herein. Co-operate with mechanical, electrical and other trades to accommodate fixtures, fittings and other items in wallboard areas.

.2 Review extent of temporary heat provided. Carry out the work of this Section only when temperature is maintained and controlled in the range of 13 deg. C to 21 deg. C for at least 24-hours before installing gypsum wallboard and is maintained or can be maintained until joint compound and adhesives are dried or cured.

.3 Metal studs in partitions and bulkheads are to be continuous to underside of steel deck, except where noted otherwise on drawings. Continue framing around ducts penetrating partitions above ceiling.

.4 Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

.5 Install bracing at terminations in assemblies.

.6 Do not bridge building control and expansion joints with non-loadbearing steel framing members. Frame both sides of joints independently.

.7 Bring gypsum board into contact, but do not force into place.

3.4 CEILING FURRING

.1 Install in accordance with ASTM C754, GA-216 and manufacturer's written instructions.

.2 Install suspension system components in sizes and spacings indicated on drawings, but not less than those required by referenced installation standards for assembly types and other assembly components indicated.

.3 Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

.4 Hangers:

.1 Hangers for suspended gypsum wallboard ceiling, bulkheads and duct furring shall support the grillage independent of walls, columns, pipes, ducts, conduit and similar components.

.2 Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.

.3 Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, counter splaying, or other equally effective means.

.4 Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.

.1 Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.

.5 Wire Hangers: Secure by looping and wire tying, either directly to structure or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.

.6 Do not attach hanger to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.

.7 Powder actuated fasteners are not approved.

.8 Do not attach hangers to or through steel deck. Attach hangers to steel joists. Where joist spacing is not suitable and where ducts and other equipment interfere, provide adequate cross channels between joists and securely wire tie in position for support of hangers.

.9 Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.

.10 Do not connect or suspend steel framing from ducts, pipes, or conduit.

.11 Recessed ceiling fixtures which exert a load in excess of 48.824 kg/m^2 (10 lbs/ft^2) shall be suspended independent of ceiling furring for gypsum wallboard application.

.12 Prior to installation of suspension system confirm that ceiling heights called for on room finish schedules and drawings can be maintained and that all recess lighting can be accommodated and shall not interfere with piping, ductwork and the like.

.13 Space hangers at maximum 1220mm (4') O.C. along the runner channels and not more than 150mm (6") from the ends to support weight of ceiling and superimposed loads such as lighting fixtures, diffusers and grilles.

.14 Where ducts are large or where combination of ducts, or combination of ducts and other items interfere so that hanger spacing exceeds 1220mm (4'), increase size of main runner channels and hangers accordingly to sustain increased loading and span.

.15 For fire-resistant rated assemblies, wire tie furring channels to supports.

.16 Install suspension systems that are level to within 3mm (1/8") measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

.5 Carrying Channels:

.1 Space carrying channels at maximum 1220mm (4') O.C. and not more than 150mm (6") from boundary walls, interruptions of continuity and changes in direction.

.2 Run channels at right angles to structural framing members where splices are necessary, lap members at least 200mm (8") and wire each end with minimum double strand of tie wire. Avoid clustering or lining up splices.

.3 Attach channels to rod hangers by bending hanger sharply under bottom of flange of runner and securely wire in place with a saddle tie.

.6 Cross Furring:

.1 Erect furring channels at right angles to carrying channels.

.2 Space furring channels at 610mm (24") O.C. and not more than 150mm (6") from boundary walls, interruptions in ceiling continuity and change in direction.

.3 Secure furring channels to each support with a double strand of tie wire or with clip approved by manufacturer of furring components. Splice joints by nesting and tying channels together.

.4 The wallboard furring channels shall be level to a maximum tolerance of 3mm over 3658mm (1/8" over 12') non-cumulative.

3.5 BOARD INSTALLATION – GENERAL

.1 Install gypsum board in accordance with ASTM C840, GA-216 and GA-600, and manufacturer's instructions.

.2 Vertically, with edges and ends occurring over firm bearing. Erect single layer gypsum board in non-fire rated partitions in most economical direction, with ends and edges occurring over firm bearing.

.3 Erect single layer fire rated gypsum board

.4 Use screws when fastening gypsum board to metal furring or framing.

.5 Place control joints consistent with lines of building spaces as indicated. Where not indicated install as directed at maximum 3.5 m spacing. Construct joints using back-to-back casing beads filled with a low modulus sealant capable of flexible joint movement. Maintain fire-resistance rating of wall assemblies.

.6 Place corner beads at external corners. Use longest practical length. Place edge trim where gypsum board abuts dissimilar materials and as indicated.

3.6 SOUND ISOLATION CLIPS

.1 Install isolation clips to substrate with approved fastener for a minimum pull out and shear of 120lbs.

.2 Ceiling Installation:

.1 Install sound isolation clips a maximum 2440 mm (48”) on center. (horizontal)

.2 Spacing between the furring channels (hat channel) shall not exceed 450 mm (16”). Install furring channels perpendicular to the joists.

.3 Fasten the sound isolation clips to the substrate with a fastener approved for a minimum pull out and shear of 54 kg (120 lbs).

.4 Locate the first row of furring channel within 75 mm to 150 mm (3” to 6”) of the wall edge and install in a checker pattern.

.5 Furring channel shall not be cantilevered more than 150 mm (6”) beyond the last sound control clip.

.6 Snap furring channel into sound isolation clip and make joins between clips with a 150 mm (6”) overlap. Secure with 1.2 mm (18 ga.) wire or framing screws.

.7 Stagger seams of gypsum board in double layer applications.

.8 Caulk around entire perimeter of gypsum board, filling the space with non hardening acoustic caulk. Use fire and smoke rated caulking sealant where required. Do not install caulking so that it is ‘proud’ of the gypsum board surface.

3.7 CONTROL JOINTS

.1 Install control joints using metal control joint strip as specified where:

.1 A partition, furring or column fireproofing abuts a structural element, dissimilar wall or partition assembly, or other vertical penetration, or ceiling.

.2 A ceiling or soffit abuts a structural element, dissimilar wall or partition assembly or other vertical penetrations.

.3 Wings of "L", "U" and "T"-shaped ceiling/soffit areas are joined;

.4 Construction changes within the plane of the partition or ceiling or soffit.

.5 Partition, restrained ceiling or furring run exceeds 9144mm (30').

.6 Unrestrained ceiling dimensions exceed 15240mm (50') in either direction.

.7 Expansion or control joints occur in the base exterior wall.

.8 Wallboard is installed over masonry control joints.

.9 And elsewhere as indicated on the drawings.

.2 Install in accordance with manufacturer's instructions. Where application is on furring members and double furring members at control joints, place one furring member on each side of the control joint.

3.8 BULKHEADS

.1 Fur out bulkheads in areas indicated and as required to conceal mechanical, electrical or other services in rooms where drywall finishes are scheduled, and elsewhere if called for on drawings.

.2 Ensure hangers are installed as to prevent splaying.

3.9 PRESSED STEEL (HOLLOW METAL) FRAMES

.1 Install pressed steel (hollow metal) frames where they occur in gypsum wallboard partitions.

.2 Anchor frames securely to studs using a minimum of three (3) anchors per jamb for jambs up to 2134mm (7') high and minimum of four (4) anchors per jamb for jambs over 2134mm (7') high.

3.10 FINISHING

.1 Before proceeding with installation of finishing materials ensure the following:

.1 Wallboard is fastened and held close to framing and furring.

.2 Fastening heads in wallboard are slightingly below surface in dimple formed by driving tool.

.2 Levels of Gypsum Wallboard Finish:

.1 Level 0: Temporary construction only.

.2 Level 1: Plenum areas and above ceilings. Where a fire-resistance rating is required finishing should be in accordance with reports of fire tests of assemblies that have met the requirements of the fire rating imposed.

.3 Level 2: Areas of water resistant gypsum backing board under tile, exposed areas where appearance is not critical.

.4 Level 3: Service corridors and areas to receive heavy or medium textured coatings or heavy-duty wall coverings.

.5 Level 4: Areas to receive light textured coatings or lightweight wall coverings.

.6 Level 5: Areas to receive gloss, semi-gloss or flat sheen paints and critical lighting conditions. Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges, and apply skim coat over entire surface for corridors,

long hallways, walls and ceilings longer than 7500 mm or walls higher than 3600 mm , and for all curved or angled wall surfaces.

.3 Finish gypsum wallboard in strict accordance with ASTM C840, GA-214 and GA-216 and as follows:

.1 Fill and tape joints and internal corners and fill screw depressions in board face and smooth out along corner beads and metal strip with joint compound.

.2 Mix joint compound (powder) in accordance with manufacturer's written instructions.

.3 Prefill "V" grooves of rounded edges with special setting type joint compound using a 127mm to 150mm (5" to 6") joint finishing knife. Finish flush with tapered surface ready for tape reinforcing application. Allow prefill material to dry thoroughly before application of embedding compound and tape.

.4 Apply joint compound in thin uniform layer. Embed reinforcing tape accurately centred on joint and securely pressed in, leaving sufficient compound under tape to provide proper bond. Immediately apply skim coat over tape application. Allow to dry thoroughly before application of next coat.

.5 Apply fill coat finishing the tapered depression flush with board surfaces. Allow to dry thoroughly before application of finish coat.

.6 Apply finish coat extending slightly beyond the filler coat and feathered out onto the board surface. Do not apply finish coat to gypsum board scheduled to be sprayed with acoustic surfacing finish.

.7 Sand between coats and following the finishing coat, where necessary, and leave surface smooth and ready for painting.

.8 Finish screw depressions with filler material and finish coat as specified above.

.9 Joint and depression finish shall in no case protrude beyond the plane of the board surface.

.10 Furnish corner beads and metal trim flush with board surface using filler and finishing coats feathered out approximately 50mm (2") and 100mm (4") respectively onto the board surface.

.11 Provide metal casing beads at exposed edges, at junctions of gypsum/cement board with dissimilar material, at control joints and at junction with columns. Casing beads are required at perimeter of gypsum/cement wallboard ceilings and soffits. Fasten with screws at 305mm (12") O.C. along entire length.

.12 Finish gypsum board to receive a Level 4 finish.

3.11 REPAIRS

.1 After taping and finishing has completed, and before decoration, repair all damaged and defective work, including non-decorated surfaces.

.2 Patch holes or openings 13mm (1/2") or less in diameter, or equivalent size, with a setting type finishing compound or patching plaster.

.3 Repair holes or openings over 13mm (1/2"), or equivalent size, with 16mm (5/8") thick gypsum wallboard secured in such a manner as to provide solid substrate equivalent to undamaged surface.

.4 Tape and refinish scratched, abraded or damaged finished surfaces including cracks and joints in non-decorated surface to provide smoke tight construction, fire protection equivalent to the fire rated construction and STC equivalent to the sound rated construction.

3.12 PROTECTION

.1 Protect installed products from damage during remainder of construction period.

.2 Remove and replace panels that are damaged.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 Sections of Division 01 apply to this Section.

.2 All references standards specified herein imply the latest edition of the standard.

1.2 SUMMARY

.1 The work in this section includes supply and installation for floor and wall tile finishes and the following:

.1 Waterproof membrane

.2 Tile bonding accessories

.2 Site quality control

1.3 PERFORMANCE REQUIREMENTS

.1 Tile products manufactured and tested to ISO 10545 Series and ANSI A137.1.

.2 Slip Resistance: Minimum dynamic coefficient of friction (DCOF) of 0.42 wet to ANSI A137.1.

.3 Floor Traffic Load Bearing Performance: ASTM C627, meeting minimum moderate duty, and outlined in this section and the TTMAC Guide Specification.

.4 Surface Flatness Tolerances:

.1 Standard Format Floor Tile 100 x 100 mm to 400 x 400 mm: Floor flatness measured to a minimum FF35; equivalent to 5 mm with maximum 2 gaps under a 3 m straightedge measurement.

.2 Wall Tiles: Wall levelling similar to floors tiles having similar sizes listed above.

1.4 PRE-INSTALLATION CONFERENCE

.1 Contractor shall hold pre-installation conference 2 weeks prior to commencing work of this Section. Conference shall be attended by the Contractor, Owner, Consultant, concrete finishing subcontractor, tile installers and tile manufacturer's representative, setting bed and grout manufacturer's representative to discuss the following, but not limited to the following;

.1 Substrate conditions, non-structural cracks, structural cracks and preparation requirements.

.2 Floor and wall surface irregularities and levelness tolerances, including all remedial requirements.

.3 Installation of tiles and grouting.

.4 Edge details and treatments.

.5 Installation of tile and grout sealers.

.2 Contractor shall ensure that manufacturer's representatives issues written installation instructions at the pre-installation conference, to all parties attending the pre-installation conference and the Consultant, for all tile types, setting beds, grouts and sealers required for the work of this Section.

.3 Contractor shall within 72 hours of the pre-installation conference, prepare minutes of the conference, and issue minutes to all parties attending the pre-installation conference and the Consultant. Contractor shall clearly indicated required actions and by which party.

1.5 SUBMITTALS FOR REVIEW

.1 Product Data: For each product. Include installation instructions for using setting materials and grouts.

.2 Samples:

.1 Submit sample panel of each type and colour tile, 610 mm x 610 mm (24" x 24"). Adhere to a rigid board with setting compound, grout and a dummy control joint showing sealant as specified. Identify samples by project number, date, name of sub-contractor and tile type. Tile and grout used in the building shall correspond to appearance of approved samples in all respects. Do not install tile until samples are approved.

.2 Upon Consultant's request submit samples of base, trim and fittings.

1.6 SUBMITTALS FOR INFORMATION

.1 Installation Data: Manufacturer's special installation requirements.

.2 Tile setting material manufacturer's review report.

.3 Field test reports.

1.7 CLOSEOUT SUBMITTALS

.1 Operation and Maintenance Data: Include recommended cleaning methods, cleaning materials, stain removal methods, and polishes and waxes.

1.8 QUALITY ASSURANCE

.1 Perform work in accordance with TTMAC Specification Guide, Tile Installation Manual.

.2 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

.3 Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience.

.4 Tile Setting Material Manufacturer's Review:

.1 Prior submitting Submittals obtain tile setting manufacturer’s review and approval for conformance of tile installation methods and procedures with warranty requirements.

.2 Prepare and submit report signed by the tile setting manufacturer.

.3 Review of waterproofing membrane installation, and provide required testing ensuring waterproofing membrane manufactures recommended thickness is achieve.

1.9 DELIVERY, STORAGE, HANDLING AND PROTECTION

.1 Co-ordinate deliveries to comply with construction schedule and arrange ahead for off the ground, under cover storage location. Do not load any area beyond the design limits.

.2 Materials shall be carefully checked, unloaded, stored and handled to prevent damage. Protect materials with suitable non-staining waterproof coverings.

.3 Store material in original, undamaged containers or wrappings with manufacturer's seals and labels intact.

.4 Restrict traffic by other trades during installation.

.5 Provide adequate protection of completed tiled surfaces to prevent damage by other trades until final completion of this project. Minimum protection shall consist of 4 mil polyethylene sheets lapped 100 mm (4") and taped.

.6 Heavily travelled areas shall have additional 13 mm (1/2") thick fibreboard sheet protection with taped joints over polyethylene sheet protection as specified above.

.7 Protect exposed edges of floor tile with same thickness as tile x 100 mm (4") wide tapered strip of plywood adhered to floor until adjoining floor finish is to be installed.

1.10 SITE CONDITIONS

.1 Ambient Conditions: Apply tile after completion of work by other Sections is complete; to surfaces sufficiently dry, clean, firm, level, plumb and free from oil or wax or any other material deleterious to tile adhesion and as follows:

.1 Temperature: Maintain tile materials and substrate temperature between TTMAC recommended minimum and maximum temperature range; unless indicated otherwise by manufacturer, for 48 hours before and during installation until materials are fully set and cured; provide additional heat during winter months or at any other time when there is a risk that surface temperatures may drop below minimum recommended temperatures.

.2 Ventilation: Maintain adequate ventilation where Work of this Section generates toxic gases or where there is a risk of raising relative humidity to levels that could damage building finishes and assemblies.

1.11 WARRANTY

.1 Warrant the work of this Section against defects in materials and workmanship in accordance with the General Conditions, but for a period of five (5) years from date of Substantial Performance, and agree to promptly make good defects which become evident during the warranty period without cost to the Owner. Defects shall include but not be limited to the following; cracking, crazing, discolouration, staining, pitting, splitting and deformation of tiles and grout.

2 Products

2.1 MATERIALS – CERAMIC MOSAIC TILE (CMT)

.1 ANSI 137.1, Table 6; cushion edges.

.2 Ceramic Mosaic Tile:

.1 Finish Texture:

.2 Factory-Mounted Backing: Dots not to exceed 12 percent area of each tile, and located minimum 2 mm below surface of tile at joint.

.3 Slip Resistance: Required.

.4 Wet Area Tiles Abrasive Content: Minimum 7.5 percent. Applies to 100% of all Wet Areas.

.5 Tile Trim: Provide coved tile bases, nosings, finger grip, toe grip, moulded trimmers for external and internal angles and projections as shown in Drawings.

.6 Product size, colour and finish textures to be selected by Consultant.

2.2 MATERIALS – PORCELAIN TILE (PCT)

.1 ANSI 137.1; cushion edges; colour through rectified porcelain tiles.

.2 Slip Resistance: Required.

.3 Tile Trim: Provide coved tile bases, nosings, finger grip, toe grip, moulded trimmers for external and internal angles and projections as shown in Drawings.

.4 Product size, colour and finish textures to be selected by Consultant.

2.3 MORTAR AND GROUT MATERIALS – GENERAL

.1 Acceptable Tile Setting Materials: Subject to conformance to requirements, mortar and grout materials listed below shall be of a uniform quality for each adhesive, and grout component from a single manufacturer and each aggregate from one source or producer as follows:

.1 Laticrete International Inc.,

.2 Mapei Corporation,

.3 TEC Incorporated Building Products Group, an H.B. Fuller Company,

.4 Flextile Ltd.

.2 Setting and Grouting Materials: Conform to material standards in ANSI's Specifications for the Installation of that apply to materials and methods specified.

.1 Grout Colours: Unless otherwise indicated, to be selected by Consultant.

.2 Grout joints: for stone floor tiles provide grout material capable of maintaining maximum 3 mm grout joints.

.3 Source limitations: All materials shall be from one manufacturer, forming a complete system.

.4 Products: Provide like products from same production run. Install products in sequence from sequentially numbered dye lots.

2.4 MORTAR AND GROUT SETTING SYSTEMS

.1 Materials General: to ANSI A108/A118/A136.1 and TTMAC Detail indicated:

.1 Thinset Mortar:

.1 4237 latex additive and 211 Crete filler powder by Laticrete.

.2 Kerabond with Keralastic by Mapei.

.3 TA 382 Ultimate LFT by TEC, HB Fuller.

.4 51 Premium Wall & Floor Thin-Set Mortar with 44 Acrylic Additive by Flextile.

.2 Trowelable Underlayment and screed Compound:

.1 226/3701 mortar mix by Laticrete.

.2 Topcem by Mapei.

.3 TA 305 Fast Set Deep Patch by TEC, HB Fuller.

.4 FAST-SET SCREED BY Flextile.

.3 Grout: ANSI A108/A118/A136.1:

.1 Standard for dry locations:

.1 SPECTRALOCK PRO Premium Grout by Laticrete.

.2 Mapei UltracolorPlus.

.3 PowerGrout by TEC, HB Fuller.

.4 1600 RSG by Flextile.

.2 Epoxy Grout: Washrooms locations.

.1 SPECTRALOCK PRO Premium Grout by Laticrete.

.2 Kerapoxy by Mapei.

.3 AccuColour EFX by TEC, HB Fuller.

.4 FLEX-EPOXY 100 GROUT by Flextile.

2.5 TILE SETTING SYSTEMS FOR WET AREAS

.1 Materials General: to ANSI A108/A118/A136.1 and TTMAC Detail indicated:

.1 Scratch/Skim/ Bond Coat:

.1 211/4237 by Laticrete.

.2 Kerabond mixed with Keralastic additive by Mapei.

.3 TA392/393 SUPERFLEX ULTRA PREMIUM THIN SET by TEC.

.4 #51 FLOOR & WALL PREMIUM MORTAR MIXED #44 ACRYLIC ADDITIVE by Flextile.

.2 Mortar Bed/levelling coat: For bed thicknesses over 40 mm, suspend reinforcing mesh within mortar bed.

.1 226/3701 mortar mix by Laticrete.

.2 Topcem with Planicrete AC by Mapei.

.3 TA305 FAST SET DEEP PATCH WITH PATCH ADDITIVE by TEC.

.4 FAST-SET SCREED or 4:1 DRY PACK with #44 Acrylic Additive by Flextile.

.3 Waterproof Membrane: ANSI A118.10

.1 Hydroban by Laticrete.

.2 Aquadefense by Mapei.

.3 TA 316 Hydraflex by TEC, HB Fuller.

.4 WP-900 HYDRO-BLOCK by Flextile.

.4 Grout: ANSI A108/A118/A136.1 Epoxy Grout:

.1 SPECTRALOCK PRO Premium Grout by Laticrete.

.2 Kerapoxy by Mapei.

.3 AccuColour EFX by TEC, HB Fuller.

.4 FLEX-EPOXY 100 GROUT by Flextile.

.5 Fibreglass reinforcing mesh and cleavage membrane, as recommended by manufacture.

2.6 ACCESSORIES

.1 Water: Fresh, clean, potable, free from deleterious matter, acids or alkalis.

.2 Sealant: movement and joint sealants to requirement of Division 07 Sealants.

.3 Trims:

.1 Transition Edge Strips: Extruded clear satin anodized aluminum edge strips; height as required to suit tile installation; with integral perforated anchoring leg for setting the strip into the setting material and sloped, narrow profile transition

.1 Basis-of-Design Materials: Schlüter Reno U.

.4 Provide fillers, primers, reinforcing fabric and all other materials and accessories as recommended by the crack suppression membrane manufacturer.

.5 Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers and as follows:

.1 Job Site Cleaner: Phosphoric acid/nitric acid based cleaning solution mixed in accordance with cleaner manufacturer's recommendations and as recommended by tile manufacturer.

.2 Maintenance Cleaner: Non-toxic, electrolytic, biodegradable, non-ammonia containing, pH controlled cleaning solution mixed in accordance with manufacturer's recommendations.

2.7 MORTAR AND GROUT MIXING

.1 Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

.2 Add materials, water, and additives in accurate proportions.

.3 Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated or specified.

3 Execution

3.1 EXAMINATION

.1 Verify existing conditions before starting work.

.2 Verify that surfaces are ready to receive work.

.1 Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated or specified.

.2 Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.

.3 Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Consultant.

.3 Verify sealants and grout are cured for manufactured recommended periods at required temperatures and relative humidity conditions, before water immersion.

.4 Crack Suppression Membranes:

.1 Prepare all surfaces of non-structural and structural cracks in strict accordance with the crack suppression membrane manufacturer's written instructions.

.2 Prime and fill all surfaces of non-structural and structural cracks in strict accordance with the crack suppression membrane manufacturer's written instructions.

.5 Commencement of installation shall signify complete acceptance of surfaces and conditions.

3.2 PREPARATION

.1 Surface Preparation:

.1 Make backing surfaces level and true to a tolerance in plane of $\pm$ 3 mm in 2 m (1/8" in 8') for walls and $\pm$ 3 mm in 3 mm (1/8" in 10') for floors using levelling bed mortar.

.2 Surfaces shall be structurally sound, well fastened, clean and free from dust, oil, grease, paint, tar, wax, curing agents, primers, sealers, form release agents or any deleterious substances that may act as bond barriers.

.3 Backing surfaces shall be dry and fully cured. Dampness must not exceed 5% by volume.

.2 Examine concrete substrate, repair as required to produce level, clean surface for new tile installation. Repair Work shall include levelling, filling, grinding or cutting.

.3 Ensure work of other trades shall be installed, complete and approved before tile installation.

.4 Fill cracks, holes, and depressions in concrete substrates for tiling installed with thin-set mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

.5 Check as per ASTM F710 for Concrete Preparation for excessive moisture levels & pH of the slab.

3.3 INSTALLATION - GENERAL

.1 Installation of the tile shall be by thin-set method, as indicated on the drawings and as specified herein;

.1 Apply floor tile and prepare floor slabs in strict accordance with tile manufacturers written installation instructions as per the pre-installation conference.

.2 Install mortar bed, tile, and grout to referenced TTMAC Manual and TTMAC systems listed.

.3 Thoroughly clean surfaces to which tile is to be applied.

.4 Back butter all floor tile.

.5 Neatly cut tile around fitments, fixtures, access panels, and the like. Splitting of tile is expressly prohibited except where no alternative is possible. Form intersections, corners and returns accurately.

.6 Finish surfaces flat and level or, sloped and graded as required.

.7 Joint Widths: Install tile with the following joint widths, unless indicated on drawings:

.1 Ceramic Mosaic Tile: 2 mm (1/16”)

.2 Wall Tile: 2 mm (1/16”)

.3 Floor Tile: 6 mm (1/4”), unless otherwise indicated on the Drawings.

.4 Make joints consistent width and alignment within tile area.

.5 Maintain 2/3 of grout joint depth free of setting material.

.8 Joints in base shall match floor patterns. Joints shall be watertight without voids, cracks or excess grout.

.9 Lay out tile so that fields or patterns are centred on wall areas or architectural features and so that no tile less than 1/2 size occurs.

.10 Arrange and set recessed accessories in tile work so that they are evenly spaced, centred with joints and set true with correct projection. Rigidly install accessories.

.11 Provide manufacturer's standard trim pieces at changes of direction and at terminations. Unless otherwise indicated provide the following corner and edge conditions:

.1 Internal horizontal corners: Coved.

.2 External vertical and horizontal corners: Bullnosed.

.3 Internal vertical corners and unexposed edges: Square.

.12 Install tiles in patterns and locations as indicated on drawings.

.13 Install wall tile full wall height unless shown otherwise.

.14 Coordinate work of this Section with work of other Sections for items requiring to be recessed into work of this Section.

.15 Sound tiles after setting and remove and replace tiles not fully bedded.

.16 Re-point joints after cleaning to eliminate imperfections. Avoid scratching tile surfaces.

.17 Finished tile work shall be clean and free of tiles which are pitted, chipped, cracked or scratched. All damaged tile shall be removed and replaced.

.18 Where indicated on Drawings or as required, install continuous single piece metal edge trims centred under doors in closed position and other locations where tile meets other floor finishes.

.19 Allow tile to set for a minimum of 48 hours prior to grouting.

3.4 GROUTING

.1 Grout tiles in accordance with ANSI A108.10 and as specified herein.

.2 When grouting a fresh laid floor, make certain that traffic and grouting will not cause movement of floor in setting bed. Protect floor by using kneeling boards or gypsum board to defend floor against traffic while grouting.

.3 Mix grouts and install in strict accordance with the manufacturer's instructions.

.4 Excess grout shall be removed from the surface of tiles using the edge of a rubber float held at a 45 deg angle, moving it diagonally to the joints. Fill all gaps and air holes.

.5 Do not allow grout to harden on face of tile. Refer to manufacturer's instructions for thorough removal.

.6 Floors which required damp curing shall be cured for the required length of time using heavy kraft paper, not polyethylene sheets. Consult manufacturer for instructions.

3.5 WATERPROOFING

.1 Install waterproofing in accordance with waterproofing manufacturer's written instructions to produce a waterproof membrane of uniform thickness bonded securely to substrate.

.2 Do not install tile over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

3.6 CLEANING AND FINISHING

.1 Clean tiled areas after grouting has cured, using compatible solutions and methods as recommended by the manufacturer.

.2 Remove grout residue from tile as soon as possible.

.3 Unglazed tile may be cleaned with acid solutions only when permitted by tile and grout manufacturer's written instructions, but no sooner than 10 days after installation.

.4 Protect metal surfaces, cast iron, and vitreous plumbing fixtures from effects of acid cleaning.

.5 Flush surface with clean water before and after cleaning.

.6 Leave finished installation clean and free of cracked, chipped, broken, unbonded, or other tile deficiencies.

3.7 PROTECTION OF FINISHED WORK

.1 Protect installed work.

.2 Do not permit traffic over finished floor surface for 4 days after installation.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 Sections of Division 01 apply to this Section.

.2 All references standards specified herein imply the latest edition of the standard.

1.2 SUMMARY

.1 This Section includes requirements for supply and installation of:

.1 Acoustical panel ceiling systems (ACT).

.2 Suspended metal grid ceiling system and perimeter trim.

.3 Supplementary acoustic insulation over system units.

.4 Site quality control.

1.3 DESIGN AND PERFORMANCE REQUIREMENTS

.1 Suspension System:

.1 Determine the superimposed loads that will be applied to suspension systems by components of the building other than the ceiling and ensure that adequate hangers are installed to support the additional loads in conjunction with the normal loads of the system.

.2 Design supplemental suspension members and hangers where width of ducts and other construction within ceiling plenum produces hanger spacing that interferes with location of hangers at required spacing to support standard suspension system members:

.3 Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

.4 Rigidly secure acoustic ceiling system including integral mechanical and electrical components with maximum deflection of L/360.

.5 Seismic Performance: Acoustical ceiling shall withstand the effects of earthquake motions determined according to applicable code.

.6 Surface-Burning Characteristics: Conform to CAN/ULC S102 or ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Coordinate layout and installation of ceilings with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, and fire-suppression system.

1.5 REGULATORY REQUIREMENTS

.1 Conform to applicable code for combustibility requirements for materials.

.2 Conform to applicable code for seismic requirements for ceiling system.

1.6 SUBMITTALS FOR REVIEW

.1 Provide submittals bearing stamp or seal and signature of the Professional Engineer responsible for the design of the work of this Section.

.2 Product Data: Submit product data for each type of product specified.

.3 Coordination Drawings: Reflected ceiling plans drawn to scale and coordinating penetrations and ceiling mounted items indicating the following:

.1 Ceiling suspension system members.

.2 Method of attaching suspension system hangers to building structure.

.3 Ceiling mounted items including light fixtures; air outlets and inlets; speakers; sprinklers; and special mouldings at walls, column penetrations, and other junctures of acoustic ceilings with adjoining construction including seismic design.

.4 Samples:

.1 Submit two 300 x 300 mm samples illustrating material and finish of each type of acoustic unit.

.2 Submit two 300 mm long samples of suspension system main runner, cross runner, and perimeter moulding.

1.7 SUBMITTALS FOR INFORMATION

.1 Qualifications Data: For Installer.

.2 Installation Data: Manufacturer's special installation requirements, including perimeter conditions requiring special attention.

.3 Professional Structural Engineer’s Letters of Assurance:

.1 Provide letters or completed Owner-prescribed forms signed by the professional structural engineer used to prepare the shop drawings, stating that the ceiling system has been designed accordance with the structural performance requirements of the applicable codes, including verification that:

.1 Specified products have been used.

.2 Designs and installations as tested, have been installed on the Project.

.3 Loads and movement requirements have been achieved.

1.8 QUALITY ASSURANCE

.1 Conform to Ceilings and Interior Systems Contractors Association (CISCA) Ceiling Systems Handbook requirements.

.2 Qualifications of Installer: Approved by suspension system manufacturer.

1.9 DELIVERY, STORAGE, HANDLING AND PROTECTION

.1 Coordinate deliveries to comply with construction schedule and arrange ahead for off-the-ground, under cover storage location. Do not load any area beyond the design limits.

.2 Materials shall be carefully checked, unloaded, stored and handled to prevent damage. Protect materials with suitable non-staining waterproof coverings.

.3 Store material in original, undamaged containers or wrappings with manufacturer's seals and labels intact.

1.10 SITE CONDITIONS

.1 Ambient Conditions: Install acoustic unit ceilings only when building is enclosed, has sufficient heat, when overhead mechanical and electrical work is complete, and dust and moisture producing activities are complete; maintain uniform temperatures and relative humidity within range recommended by material manufacturer from the time of installation until Substantial Performance for the project; make adjustments to temperature and humidity gradually within tolerances indicated by manufacturer.

1.11 WARRANTIES

.1 Provide two (2) year warranty by manufacturer of acoustic panels covering defects in products and failure to meet specified requirements.

2 Products

2.1 MANUFACTURERS

.1 Acceptable Materials Manufacturers: Subject to compliance with requirements specified in this Section, manufacturers offering products that may be incorporated into the Work include the following:

.1 Armstrong World Industries Canada Ltd,

.2 CertainTeed Gypsum Canada Inc. a Division of Saint-Gobain, or

.3 CGC Inc. a USG Company.

.4 Rockfon LLC.

2.2 METAL SUSPENSION SYSTEMS

.1 Grid Components: ASTM C635/C635M, intermediate duty; exposed, downward access removable T; components die cut and interlocking; minimum 38 mm high bulb tee design.

.1 Recycled Content: minimum 50 %

.2 Grid Materials: Hot dip galvanized steel with factory paint finishes.

.3 Grid Finish: White, manufacturer’s standard.

.4 Module: Sized as appropriate to acoustic panel size.

.5 Mouldings:

.1 Perimeter Moulding: Formed to provide shadow reveal profile moulds unless shown otherwise in baked white enamel finish.

.6 Exposed Suspension System (Type 1): Provide standard exposed 'T' bar system: zinc-coated steel with baked white enamel finish for exposed surfaces in colour to match acoustic panels.

.1 Acceptable Products:

.1 Prelude XL HRC manufactured by Armstrong World Industries Canada Ltd.

.2 15/16” Classic Stab System by CertainTeed Gypsum Canada.

.3 DONN Brand Suspension System, 25 mm exposed face; Donn DX/DXL HRC by CGC Inc.

.4 Chicago Metallic 1200HRCMax 15/16” Stab System by Rockfon LLC.

2.3 ACOUSTIC CEILING PANELS (ACT)

.1 Provide manufacturer's standard panels of configuration indicated that comply with ASTM E1264 classifications as designated by the nominal values for types, patterns, acoustic ratings, and light reflectance class, unless otherwise indicated.

.2 Surface burning properties, all types: Flame spread of 25 or less and smoke developed of 50 or less when tested in accordance with CAN/ULC S102, substantiated by ULC labels on materials supplied.

.3 Acoustic Panel (ACT): ASTM E1264, Type XII, Form II, Pattern G:

.1 Performance:

.1 NRC: Min. 0.85.

.2 Thickness: 19 mm.

.3 Surface Texture: Fine.

.4 Surface Colour: White.

.2 Edge Profile: Square.

.3 Sizes: 610mm x 610mm.

.4 Approved Products:

.1 OPTIMA Open Plan series manufactured by Armstrong World Industries Canada Ltd.

.2 Symphony f series by CertainTeed Gypsum Canada.

.3 Halcyon ClimaPlus series manufactured by CGC Inc.

.4 Sonar by Rockfon LLC.

2.4 ACCESSORIES

.1 Accessories: Stabilizer bars, clips, perimeter mouldings and splices required for suspended grid system.

.2 Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

.3 Ties Wire: minimum 1.98 mm (14 ga.) Ø steel wire, galvanized.

.1 Hanger Attachments to Concrete: 1 #12 galvanized annealed steel wire for support of a maximum weight of 68 kg. per hanger; #9 galvanized annealed steel wire for support of a maximum weight of 140 kg. per hanger; 4.5 mm diameter galvanized annealed steel rod to support a maximum weight of 250 kg. per hanger.

.4 Anchors: Fabricated from corrosion-resistant materials capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E488 by an independent testing agency; Minimum tensile strength 390 MPa.

.5 Acoustic Sealant for Perimeter Mouldings: To requirement of Division 07 Sealants.

.6 Edge Trim: As required and listed by suspension system manufacturers.

.1 Height: 50 mm and 102 mm high as indicated.

.2 Colour: White.

3 Execution

3.1 EXAMINATION

.1 Verify existing conditions before starting work.

.2 Verify that layout of hangers will not interfere with other work.

3.2 INSTALLATION – GENERAL

.1 Install acoustical ceilings according to CISCA publication Ceiling Systems Handbook.

3.3 INSTALLATION - LAY-IN GRID SUSPENSION SYSTEM

.1 Install suspension system to manufacturer instructions and ASTM C636/C636M, and as supplemented in this section.

.2 Install system in accordance with ASTM E580/E580M.

.3 Install system capable of supporting imposed loads to a deflection of L/360 maximum.

.4 Lay out system to a balanced grid design with edge units no less than 50 percent of acoustic unit size, unless otherwise detailed.

.5 Install after major above ceiling work is complete. Coordinate the location of hangers with other work.

.6 Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

.7 Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

.8 Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability. Support fixture loads by supplementary hangers located within 150 mm of each corner; or support components independently.

.9 Do not eccentrically load system, or produce rotation of runners.

.10 Perimeter Moulding:

.1 Install edge moulding at intersection of ceiling and vertical surfaces into bed of acoustic sealant.

.2 Use longest practical lengths.

.3 Overlap corners.

.4 Provide at junctions with other interruptions.

3.4 INSTALLATION - ACOUSTIC UNITS

.1 Install acoustic units to manufacturer's instructions.

.2 Fit acoustic units in place, free from damaged edges or other defects detrimental to appearance and function.

.3 Install units after above ceiling work is complete.

.4 Install acoustic units level, in uniform plane, and free from twist, warp, and dents.

.5 Cutting Acoustic Units:

.1 Cut to fit irregular grid and perimeter edge trim.

.6 Where round obstructions occur, provide preformed closures to match perimeter moulding.

.7 Where indicated, lay acoustic insulation for a distance of 1 200 mm either side of acoustic partitions.

.8 Install panel hold-down clips, where specified, to retain panels tight to grid system.

3.5 ERECTION TOLERANCES

.1 Maximum Variation from Flat and Level Surface: 3 mm in 3 m.

.2 Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

3.6 SITE QUALITY CONTROL

.1 Engage a professional structural engineer experienced in design and installation of this work and licensed in the Province where the Project is located to:

.1 Perform timely and regular inspections.

.2 Verify installation conforms to applicable code.

.3 Prepare and submit inspection reports.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 Sections of Division 01 apply to this Section.

.2 All references standards specified herein imply the latest edition of the standard.

1.2 SUMMARY

.1 Trowel application of epoxy flooring, including surface preparation, primer, aggregate topping, grout coat, and finish coat.

.2 All work required to result in a first class installation for the Owner's intended use. No substitution of materials or installation methods will be accepted.

1.3 RELATED WORK SPECIFIED ELSEWHERE

.1 Contractor shall be responsible for co-ordinating this section with all related sections.

1.4 EXAMINATION

.1 Examine all areas and conditions affecting work of this Section and report any discrepancies or defects which would affect finished results.

1.5 QUALITY ASSURANCE

.1 Subcontractor executing work of this Section shall employ installers having a minimum of five (5) years continuous Canadian experience in successful installation of work of type and quality shown and specified. Submit proof of experience upon Consultant's request.

.2 Work of this Section shall be executed by workers especially trained and experienced in this type of work. Have a full time, senior, qualified representative at the Site to direct the work of this Section at all times. Representative shall meet Consultant's approval.

.3 Ensure proper use of proprietary materials in strict accordance with the material manufacturer's directions. It shall be the responsibility of the material manufacturer or supplier to furnish these directions to the Contractor and to check periodically at the site to ensure that they are being carried out.

.4 Testing of Concrete Floors: Test floors that have been cured for minimum 28 days, and after preparation for Product installation is complete and patching or levelling compound is fully cured. Conduct testing simultaneously on floors free of sealer, curing compounds, oil, grease and other agents detrimental to the test and Product performance. Locate test sites evenly to cover representative installation areas. Do not proceed with work when the test results do not conform to the specified allowable.

.1 Cohesive Strength: Minimum 1.45 MPa (210 psi) by tensile load as tested to CSA A23.2-6B. Do one test for every 9 sq.m. (1000 sq.ft.) or fraction thereof.

.2 Moisture Vapour Emission: Maximum moisture content of 1.36 kg/93 sq.m. (3 lbs/1000 sq.ft.) per 24 hour as tested to ASTM F1869 using anhydrous calcium chloride method. Provide 3 test sites for floor area up to 93 sq.m. (1000 sq.ft.), add one test site for each additional 93 sq.m. (1000 sq.ft.) or fraction thereof.

.3 Surface Temperature: Minimum 3 degree C above the measured dew point.

1.6 PRE-INSTALLATION CONFERENCE

.1 Contractor shall hold pre-installation conference two (2) weeks prior to commencing work of this Section. Conference shall be attended by the Contractor, Owner, Consultant, concrete finishing subcontractor, Epoxy installers and Epoxy manufacturer's representative to discuss the following, but not limited to the following;

.1 Substrate conditions, non-structural cracks, structural cracks and preparation requirements.

.2 Floor surface irregularities and levelness tolerances, including all remedial requirements.

.3 Installation of Epoxy Flooring.

.4 Edge details and treatments.

.5 Inspections during the work.

.6 Protection of Epoxy work.

.2 Contractor shall ensure that manufacturer's representatives issues written installation instructions at the pre-installation conference, to all parties attending the pre-installation conference and the Consultant, for all Epoxy required for the work of this Section.

.3 Contractor shall within 72 hours of the pre-installation conference, prepare minutes of the conference, and issue minutes to all parties attending the pre-installation conference and the Consultant. Contractor shall clearly indicated required actions and by which party.

1.7 SUBMITTALS

.1 Provide submittals specified and as required to assess conformance with the Contract Documents, in accordance with the General Conditions and Division 01 of the Specifications.

.2 Safety Data Sheets:

.1 Submit WHMIS safety data sheets for inclusion with project record documents. Keep one copy of WHMIS safety data sheets on Site for reference by workers.

.3 Maintenance Instructions:

.1 Upon completion of the Work, furnish Consultant with copies of maintenance instructions, containing complete detailed and specific instructions for maintaining, preserving and keeping clean the surfaces of this Work and in particular, giving adequate warning of maintenance practices of materials detrimental to the work of this Section for inclusion in the Operation and Maintenance Manual.

1.8 DELIVERY, STORAGE, HANDLING AND PROTECTION

.1 Co-ordinate deliveries to comply with construction schedule and arrange ahead for off the ground, under cover storage location. Do not load any area beyond the design limits.

.2 Materials shall be carefully checked, unloaded, stored and handled to prevent damage. Protect materials with suitable non-staining waterproof coverings.

.3 Store material in original, undamaged containers or wrappings with manufacturer's seals and labels intact.

.4 Restrict traffic by other trades during installation.

.5 Provide adequate protection of completed epoxy surfaces to prevent damage by other trades until final completion of this project. Minimum protection shall consist of 4 mil polyethylene sheets lapped 100mm (4") and taped.

1.9 WARRANTY

.1 Warrant the work of this Section against defects in materials and workmanship in accordance with the General Conditions, but for a period of two (2) years, and agree to promptly make good defects which become evident during the warranty period without cost to the Owner. Defects shall include but not be limited to the following; cracking, crazing, discolouration, staining.

2 Products

2.1 GENERAL

.1 All components and products of the epoxy flooring system shall be manufactured and supplied by a single manufacturer, to ensure compatibility between components.

2.2 MATERIALS

.1 Epoxy Flooring System: Two-component, 100% solids, fast cure, solvent free, low VOC.

.1 Sikafloor Fastflor CR by Sika Canada.

.2 Epoxal 100WH by Niagara Protective Coatings.

.3 Stonkote GS4 by Stonhard Limited.

.2 Moisture Barrier, Slab-on-Grade: Coating manufacturer's standard, to reduce moisture transmission to 1.36 kg/93 sq.m. (3 lbs/1000 sq.ft.).

.3 Primer: As recommended by manufacturer supplying flooring material for types of surface to be primed.

.4 Subfloor Filler: Compatible to floor coating and as recommended by coating manufacturer.

.5 Joint Backing: Preformed, compressible strips of closed cell polyethylene or urethane foam, rubber tubing or non-migrating plasticized vinyl, oversized 25%, compatible with sealant, primer, epoxy surfacing and substrate.

.6 Joint Sealant: ASTM C920, Type M, Grade P, Class 25, Use T, multi component modified urethane base chemical curing; material compatible with floor finish and as recommended by flooring manufacturer.

3 Execution

3.1 EXAMINATION

.1 Examine surfaces and conditions under which flooring is to be applied. Moisture content of surfaces and building air temperatures must be within limits recommended by the flooring manufacturer. Do not start work until unsatisfactory conditions have been corrected. Application of materials indicates acceptance of surfaces.

.2 Surfaces shall be free of membrane curing compounds, laitance, dust, dirt, grease, oil and other contaminants that may affect proper adhesion of the coating.

.3 Do not apply coating system if ambient temperature is below 10 deg C (50 deg F) or above 32 deg C (90 deg F) or if relative humidity is above 80%.

3.2 SURFACE PREPARATION

.1 Remove projections and other conditions that may affect the installation of the flooring system.

.2 Protect adjacent surfaces, fixtures and equipment with drop cloths or masking as necessary to prevent damage from surface preparation.

3.3 INSTALLATION

.1 Mix and apply work in strict accordance manufacturer's printed directions in specified thickness, with integral cove bases, uninterrupted except at sawn joints or other types of joints required, free of laps, pin holes, voids, crawls, skips or other marks or irregularities are visible, and to provide uniform appearance.

.2 Work coating into corners and other restricted areas, up and over bases, and into recesses in floors to ensure full coverage.

.3 Make clean true junctions with no visible overlap between adjoining applications of coatings.

.4 Moisture Barrier: Apply moisture barrier coating on prepared slab-on-grade substrate before primer application, to manufacturer's instruction.

.5 Primer: Apply primer over prepared substrate, at manufacturer's recommended spreading rate with timing of application co-ordinated with subsequent application of topping mix to ensure optimum adhesion between flooring materials and substrate.

.6 Finish coats: Apply minimum of two finish coats at spreading rate recommended by manufacturer to achieve minimum total thickness of 0.5 mm (0.020") DFT. Allow minimum recommended drying time between coats.

.1 Base Coat: Apply base coat and immediately broadcast aggregates and back roll to obtain slip-resistant texture finish. Let dry.

.2 Top Coat: Apply top coat to dry base coat for consistent appearance.

.7 Cove Base: Provide 150 mm (6") high cove base struck straight to provide line for wall finish.

3.4 CLEANING AND FINISHING

.1 Clean flooring areas after completion, using compatible solutions and methods as recommended by the manufacturer.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 Sections of Division 01 apply to this Section.

.2 All references standards specified herein imply the latest edition of the standard.

1.2 SUMMARY

.1 Provide labour, materials, tools and other equipment, services and supervision required to complete painting work for the new and repainting surfaces.

.2 Surface preparation for this section will be limited to priming and back-priming, and specific pre-treatments noted in this section or as specified in the Master Painters Institute (MPI) Painting Specification Manual.

1.3 RELATED REQUIREMENTS

.1 Other sections of the specification requiring painting refer to this section. Coordinate requirements of referencing sections.

1.4 DEFINITIONS

.1 Gloss Levels: Standard coating terms defined by MPI Manual apply to products of this Section as follows:

Gloss Level	Description	Gloss Units @ 60 Degrees	Sheen Units @ 85 Degrees
G1	Matte or Flat Finish	Max. 5	Max. 10
G2	Velvet Finish	Max. 10	10 to 35
G3	Eggshell Finish	10 to 25	10 to 35
G4	Satin Finish	20 to 35	Min. 35
G5	Semi-Gloss Finish	35 to 70	
G6	Gloss Finish	70 to 85	
G7	High-Gloss Finish	More than 85	

1.5 SUBMITTALS

.1 Provide required information in accordance with Section 01 33 00 – Submittal Procedures.

.2 Action Submittals: Provide the following submittals before starting any work of this Section:

.1 Product Data: Submit list of all painting materials used for the Work to the Consultant for review prior to ordering materials for each paint system indicated, including block fillers and primers.

.1 Material List: An inclusive list of required coating materials indicating each material and cross reference specific coating, finish system, and application; identify each material by manufacturer's catalogue number and general classification.

.2 Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.

.2 Samples: Provide stepped samples, defining each separate coat, including block fillers and primers using representative colours required for the project; label each sample for location and application, and as follows:

.1 Drawdown Samples: Provide three (3) drawdown sample charts (cards) for each type, texture and colour of finish specified for verification purposes before ordering paint materials.

.3 Informational Submittals: Provide the following submittals when requested by the Consultant:

.1 Certification: Submit certification reports for paint products indicating that they meet or exceed low VOC and coloured base requirements listed in this Section.

1.6 PROJECT CLOSEOUT SUBMISSIONS

.1 Operation and Maintenance Data: Submit copies of paint manufacturer's written maintenance information for inclusion in the operations manual in accordance with Section 01 33 00 – Submittal Procedures, including specific warning of any maintenance practice or materials that may damage or disfigure the finished Work.

.2 Maintenance Materials: Deliver maintenance materials to Owner in quantities indicated and in accordance with Section 01 33 00 – Submittal Procedures, that match products installed; packaged with protective covering for storage, and identified with labels describing contents and building location and as follows:

.1 Paints and Coatings: Minimum of 4-4L containers of field colours and 4-1 L containers of each accent colour, and all remnants.

1.7 QUALITY ASSURANCE

.1 Conform to the standards contained in the MPI Manual.

.2 Applicator Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in service performance, and as follows:

.1 Have a minimum of five (5) years proven satisfactory experience and shall show proof before commencement of work that he will maintain a qualified crew of painters throughout the duration of the work.

.2 When requested provide a list of the last three comparable jobs including, name and location, specifying authority, start and completion dates and cost amount of the painting work.

.3 Apprentices may be employed provided they work under the direct supervision of a qualified journeyman in accordance with trade regulations.

.3 Source Limitations: Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats and as follows:

.1 Use only paint manufacturers and products as listed under the Approved Products section of the MPI Manual Architectural Painting Specification Manual.

1.8 ENVIRONMENTAL REQUIREMENTS

.1 Conform to MPI Manual and manufacturers requirements.

.2 Perform no painting or decorating work when the ambient air and substrate temperatures, relative humidity and dew point and substrate moisture content is below or above requirements for both interior and exterior work.

.3 Apply paint only to dry, clean, properly cured and adequately prepared surfaces in areas where dust is no longer generated by construction activities such that airborne particles will not affect the quality of finished surfaces.

.4 Ensure adequate continuous ventilation and sufficient heating and lighting is in place.

.5 Paint, stain and wood preservative finishes and related materials (thinners, solvents, caulking, empty paint cans, cleaning rags, etc.) shall be regarded as hazardous products. Recycle and dispose of same subject to regulations of applicable authorities having jurisdiction.

.6 To reduce the amount of contaminants entering waterways, sanitary/storm drain systems or into the ground retain cleaning water and filter out and properly dispose of sediments.

.7 Set aside and protect surplus and uncontaminated finish materials not required by the Owner and deliver or arrange collection for verifiable re-use or re-manufacturing.

1.9 WARRANTY

.1 Special Warranty: Provide an MPI two (2) year guaranty, or a 100% two (2) year Maintenance Bond in accordance with MPI Manual requirements; painting subcontractors choosing the Maintenance Bond option must provide a maintenance bond consent from a reputable surety company licensed to do business in Canada as follows:

.1 Warrant that painting work has been performed in accordance with MPI Manual requirements.

.2 Provide a cash value to repair or replace defective coatings in the event that the original installer is not able to perform warranty work.

2 Products

2.1 MANUFACTURERS

.1 Subject to compliance with requirements, manufacturers that have attained the prerequisites for ecologically sustainable labelling mark on their products and may be incorporated into the Work include; but are not limited to, the following:

.1 Sherwin-Williams LLC

.2 Benjamin Moore and Co. Limited

.3 ICI Paints (Canada) Inc.

.4 Para Paints

.5 PPG Canada Inc.- Architectural Finishes

.6 SICO Inc.

2.2 MATERIALS

.1 Primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, and other painting materials shall be in accordance with the MPI Manual “Approved Product” listing and shall be from a single manufacturer for each system used.

.2 Materials such as linseed oil, shellac, and other accessory materials shall be the highest quality product of an approved manufacturer listed in the MPI Manual and shall be compatible with other coating materials.

.3 All materials and paints shall be lead and mercury free and shall have low VOC content where possible.

2.3 FINISH AND COLORS

.1 The Consultant will issue a schedule indicating colours, gloss value and sheen. Colour may be selected from the lines of up to 3 manufacturers. A maximum of 6 base colours and 6 bright colours in differing gloss and sheen will be selected.

.1 Allow for a maximum of 3 colours on each wall in each room unless otherwise noted.

.2 Where required by authorities having jurisdiction, finish exit and vestibule doors in contrasting color to walls and a different color than any other door in the same area.

.3 Access doors, prime coated butts and other prime painted hardware, registers, radiators and covers, exposed piping and electrical panels: To match adjacent surfaces, unless otherwise noted or where pre-finished.

3 Execution

3.1 PREPARATION OF SURFACES:

.1 Prepare surfaces in accordance with MPI Manual requirements. Refer to the Manual for specific surface preparation requirements for each substrate material.

3.2 APPLICATION

.1 Paint when substrates and environmental conditions (heating, ventilation, lighting and completion of other work) are acceptable for applications of products specified in this Section.

.2 Paint surfaces requiring paint or stain finish to Premium MPI Manual finish requirements with application methods in accordance with best trade practices for type and application of materials used.

.3 Continue paint finishes through behind wall mounted items.

.4 Painting coats specified are intended to cover surfaces satisfactorily when applied at proper consistency and in accordance with manufacturer's recommendations.

.5 Apply a minimum of four coats of paint where deep or bright colours are used to achieve satisfactory results.

3.3 EXTERIOR SURFACES

.1 Paint exterior surfaces in accordance with the MPI Manual painting systems listed in this section.

.2 Finish exterior new and existing surfaces in accordance with MPI Painting Manual requirements:

.3 Galvanized Metal (doors, frames, railings, misc. steel, pipes, overhead decking, ducts, gutters, flashing, etcetera):

.1 EXT 5.3L: Pigmented polyurethane semi gloss finish (over epoxy primer).

3.4 INTERIOR SURFACES

.1 Paint interior surfaces in accordance with the MPI Manual painting systems listed in this section.

.2 Finish interior new and existing surfaces in accordance with MPI Painting Manual requirements:

.3 Concrete Masonry Units (smooth and split face block and brick):

.1 INT 4.2D: High Performance Architectural Latex semi gloss coating.

.4 Structural Steel and Metal Fabrications:

.1 INT 5.1G: Pigmented polyurethane semi gloss finish (over high-build epoxy).

.5 Galvanized Metal (doors, frames, railings, misc. steel, pipes, overhead decking, ducts, etcetera):

.1 INT 5.3D: Epoxy semi gloss finish (over epoxy primer).

.6 Plaster and Gypsum Board (gypsum board, drywall, and other sheet gypsum materials):

.1 INT 9.2B: High performance architectural latex semi gloss finish.

.7 Site Painting for Structural Steel: Interior acrylic polyurethane paint system:

.1 Structural Steel Members (Shop Primed).

.1 Shop Priming: Surface preparation to SSPC SP6. One coat of organic zinc-rich epoxy primer Zinc Clad III HS B69A100 Series by Sherwin-Williams at 125 um (5 mils) DFT.

.2 Site clean surface to SSPC SP2 or SP3. Touch up with shop primer.

.3 One coat of semi-gloss acrylic polyurethane Acrolon 218 HS B65-650 Series by Sherwin-Williams at 152 um (6 mils) DFT.

.2 Metal Deck.

.1 Surface preparation to SSPC SP1.

.2 One coat of water based wash primer DTM Wash Primer B71Y1 by Sherwin-Williams at (25 um (1 mil) DFT.

.3 One coat of semi-gloss acrylic polyurethane Acrolon 218 HS B65-650 Series by Sherwin-Williams at 152 um (6 mils) DFT.

3.5 MECHANICAL AND ELECTRICAL EQUIPMENT

.1 Paint “unfinished” conduits, piping, hangers, ductwork and other mechanical and electrical equipment with colour and texture to match adjacent surfaces, in the following areas:

.1 In exposed-to-view exterior and interior areas.

.2 In interior high humidity interior areas.

.3 In boiler room, mechanical and electrical rooms.

.2 Leave conduits, piping, hangers, ductwork and other mechanical and electrical equipment in original finish and touch up scratches and marks in unfinished areas.

.3 Paint inside of ductwork where visible behind louvers, grilles and diffusers beyond sight line with primer and one coat of matt black (non-reflecting) paint.

.4 Paint the inside of light valances gloss white.

.5 Refer to Mechanical and Electrical specifications for painting, banding, stencilling of other surfaces/equipment, and generally as follows:

.1 Paint gas piping gas standard yellow where visible in service spaces.

.2 Paint both sides and all edges of plywood backboards for equipment before installation.

.3 Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.

.4 Do not paint over nameplates.

3.6 SITE QUALITY CONTROL

.1 Painted surfaces will be considered to lack uniformity and soundness if any of the following defects are apparent at time of field review when viewed from a distance of 4’ from the painted surface:

.1 Runs, sags, hiding or shadowing by inefficient application methods

.2 Evidence of poor coverage at rivet heads, plate edges, lap joints, crevices, pockets, corners and re-entrant angles

.2 Painted surfaces will be considered as deficient if any of the following defects are apparent at time of field review, regardless of viewing distance.

.1 Damage due to touching before paint is sufficiently dry or any other contributory cause.

.2 Damage due to application on moist surfaces or caused by inadequate protection from the weather.

.3 Damage or contamination of paint due to windblown contaminants (dust, sand blast materials, salt spray, etcetera)

.3 Painted surfaces found as unacceptable shall be replaced or repaired at no cost to the Owner or Consultant:

.1 Small affected areas may be touched up

.2 Large affected areas or areas without sufficient dry film thickness of paint shall be repainted.

.3 Runs, sags or damaged paint shall be removed by scraper or by sanding before application of new paint coats.

3.7 PROTECTION

.1 Protect newly painted exterior surfaces from rain and snow, condensation, contamination, dust, salt spray and freezing temperatures until paint coatings are completely dry.

.2 Curing periods shall exceed the manufacturers recommended minimum time requirements.

.3 Erect barriers or screens and post signs to warn of or limit or direct traffic away or around work area as required.

3.8 CLEANUP

.1 Remove all paint where spilled, splashed, splattered or sprayed as work progresses using means and materials that are not detrimental to affected surfaces.

.2 Keep work area free from an unnecessary accumulation of tools, equipment, surplus materials and debris.

.3 Remove combustible rubbish materials and empty paint cans each day and safely dispose of it in accordance with requirements of authorities having jurisdiction.

.4 Clean equipment and dispose of wash water or solvents, and other cleaning and protective materials (rags, drop cloths, masking papers, etcetera), paints, thinners, paint removers and strippers in accordance with the safety requirements of authorities having jurisdiction.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 Sections of Division 01 apply to this Section.

.2 All references standards specified herein imply the latest edition of the standard.

1.2 SUMMARY

.1 Furnish all labour and materials necessary for the completion of work in this Section as shown on the Contract Drawings and specified herein.

.2 Work in this Section includes but is not limited to:

.1 Solid Phenolic Toilet Partitions

.2 Hardware

1.3 SUBMITTALS

.1 Shop Drawings:

.1 Submit shop drawings showing and describing in detail materials, finishes, dimensions, details of connections and fastenings elevations, plans, sections, thicknesses, hardware and any other pertinent information.

.2 Samples:

.1 Submit necessary templates and instructions where supports or anchors have to be built-in by others.

.2 Submit one sample of each of the following:

.1 Hinge, latch, panel fitting.

.2 Corner section, 300mm x 300mm (12" x 12") showing colour, corner, edge and core construction.

1.4 DELIVERY, STORAGE, HANDLING AND PROTECTION

.1 Coordinate deliveries to comply with construction schedule and arrange ahead for off the ground, under cover storage location.

.2 Do not permit delivery of work to job site until building is sufficiently dry, wet trades are completed and the moisture readings of surfaces in proposed storage area is less than 18%.

.3 Materials shall be carefully checked, unloaded, stored and handled to prevent damage. Store materials flat on level surface. Protect materials with suitable non-staining waterproof coverings, but allow for air circulation at sides.

1.5 WARRANTY

.1 Warrant that the solid phenolic partitions and screens shall be free from defects in materials or workmanship in accordance with General Conditions for a period of ten (10) years and agree to promptly make good defects by replacing defective solid phenolic partitions and screens in finish to match original finish and in a manner satisfactory to Owner. Defects shall include, but not be limited to, bubbling, delamination of faces, or edges, warp, twist, bow exceeding 1/4" and telegraphing of core. "Replace" as used herein includes installing panels, pilasters, hardware, shoes including hanging and fitting doors.

2 Products

2.1 MANUFACTURERS

.1 Basis-of-Design products are named in this Section; additional manufacturers offering similar solid phenolic toilet partition systems may be incorporated into the work provided they meet the performance requirements established by the named products.

.2 Acceptable Materials Manufacturers: Subject to compliance with requirements specified in this Section and as established by the Basis-of-Design Materials, manufacturers offering products that may be incorporated into the Work include; but are not limited to, the following:

.1 Floor Anchored Toilet Partitions:

.1 Solid Phenolic Core Partitions by Bradley Corp.

.2 Black Core Phenolic by ASI Global Partitions.

.2 Floor Anchored Privacy Partitions:

.1 Solid Phenolic Core 72” high door by Bradley Corp

.2 Phenolic Ultimate Privacy 72 by ASI Global Partitions.

2.2 MATERIALS

.1 Solid Phenolic, Melamine Surfaced, Panels, Pilasters and Doors:

.1 Plastic Laminate Face Sheets: High pressure, paper based, melamine surfaced, laminated plastic sheets, conforming to CAN3-A172-M, with thickness tolerances in accordance with Table 1 of CAN3-A172-M and plastic laminate grades as follows:

.1 Cores: Solid phenolic type core material. Thicknesses as specified herein.

.2 Bituminous Paint: Acid and alkali resistant bituminous isolation coating.

.3 Butyl Tape: Extruded, High grade macro-polyisobutylene tape of width and shore hardness to suit conditions.

.4 Building Paper: No.15 asphalt saturated, organic felt in accordance with CSA A123.3.

.5 Hardware and Fittings (Institutional):

.1 Hinges: 1.6 mm thick (16 gauge) x 2" wide continuous stainless steel piano hinge with 1/8" diameter stainless steel pin and extends full height of doors.

.2 Door Latches: 2 mm thick (14 gauge) stainless steel type slide type on nylon track. Provide "C" type pulls at compartments for handicapped.

.3 Door Keepers: 2.9 mm thick (11 gauge) stainless steel type.

.4 Coat Hooks: Stainless steel type with rubber bumper on end.

.5 Door Stops: 2.9 mm thick (11 gauge) stainless steel type designed to prevent the door from being kicked out of compartment.

.6 'U' Channels: 1.2 mm thick (18 gauge) continuous 'U' shaped stainless steel channel extending full height of panels and screens.

.7 Hardware Material and Finish: Stainless steel shall be AISI 18-8 type 304 alloy conforming to ASTM A167.

.8 Hardware Fasteners: Vandal resistant, torks stainless steel machine screws installed from inside compartments. Door hardware shall also have factory installed threaded metal inserts in doors and pilasters.

.9 Provide reinforcement for washroom accessories as required to preserve integrity of partition panels and as required to ensure secure attachment of accessories.

.10 Top connection of pilaster for ceiling hung partitions shall consist of 19 mm (3/4") diameter threaded rods complete with spacer and nuts and a 3" die-formed stainless steel pilaster shoe. Stainless steel shall be 0.6 mm (0.024") thick, AISI type 304 stainless steel alloy conforming to ASTM A167.

.11 Install matching 19 mm (3/4") thick x 100 mm (4") wide overhead bracing between pilasters for reinforcing. Fasten with stainless steel plates and screws on the inside of each stall.

2.3 FINISHES

.1 Toilet Partition Panel Colours:

.1 Colours, textures and manufacturers as indicated on drawings and schedules.

.2 Stainless Steel:

.1 AISI No.4 brushed finish.

2.4 FABRICATION AND MANUFACTURE

.1 Shop fabricate toilet partitions. Take site measurements for areas where partitions are to be located and fabricate to suit site dimensions.

.2 Fabricate doors, panels and pilasters from solid phenolic core material with high pressure matte plastic laminate surfaces fused to core. Edges shall be "black". Stiles and doors shall have a finished thickness of 19 mm (3/4") thick. Panels shall be 13mm (1/2") thick.

.3 Check sizes and locations for washroom accessories and if necessary, reinforce panels.

.4 Prepare panels to accept tissue dispensers and grab bars where indicated on drawings.

.5 Design supports to withstand, within acceptable deflection limitations, their own weight, the weight of the toilet partitions, loads imposed by the motion of partition doors and all live loads, which might be applied to the toilet partitions in the course of their normal function. Design supports as required to accommodate structural deflection. Build in reinforcing to support the grab bars and withstand a downward pull of 227 kg (500 lbs). at any point on the grab bar. Provide additional stainless steel brackets as required to stabilize pilasters to consultant's approval.

3 Execution

3.1 INSPECTION

.1 Check areas scheduled to receive partitions and urinal screens for correct dimensions, plumbness of walls and soundness of surfaces that would affect installation of holding brackets.

.2 Verify spacing of plumbing fixtures to assure compatibility with installation of partitions.

.3 Do not begin installation of partitions until conditions are satisfactory and agreement on details with the owners or contractors were well understood.

3.2 INSTALLATION

.1 Install partitions and urinal screens in strict accordance with manufacturer's installation recommendations.

.2 Install partitions and urinal screens plumb, level and securely fastened in the locations shown on the drawings.

.3 Perform drilling of steel, masonry and concrete necessary to install the work of this Section.

.4 Co-ordinate installation with the work of trades providing wall and floor finishes, washroom accessories and other adjacent partitions and constructions.

.5 Isolate contact surfaces to prevent electrolysis due to metal contact with masonry, concrete or dissimilar metal surfaces. Use bituminous paint, building paper, butyl tape or other approved means.

.6 Install hardware supplied under this Section and ensure that it is visually aligned.

.7 Securely install panels to walls and pilasters with fittings to make a strong and rigid installation.

.8 Locate wall channels so that holes for mounting occur in ceramic tile joints.

.9 Install urinal screens to locations on walls as indicated on drawings, plumb, level and rigidly secured in place.

.10 Install partitions allowing the following clearances and tolerances:

.1 Between panel edges and wall: 25 mm +3 mm (1" +1/8").

.2 Between partition panel edge and pilaster panel: 13 mm +3 mm (1/2" +1/8").

.3 Between pilaster panel edge and door edge: 5 mm +1.5 mm (3/16" +1/16"). Ensure that partitions are visually aligned from all view points.

3.3 ADJUSTMENT

.1 Upon completion of the work or when directed, remove all traces of protective coating or paper, and polish compartments.

.2 Test hinges, locks and latches and where necessary, adjust and lubricate. Set hinges so that doors stand open 30 deg when compartment is not in use. Ensure that compartments are in working order.

3.4 CLEANING

.1 Clean and make good surfaces soiled or otherwise damaged in connection with the work of this Section. Replacing finishes or materials that cannot be satisfactorily cleaned.

.2 Upon completion of the work, remove all debris, equipment and excess material resulting from the work of this Section from the site.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 Sections of Division 01 apply to this Section.

.2 All references standards specified herein imply the latest edition of the standard.

1.2 SUMMARY

.1 Furnish labour, materials and other services to complete the fabrication and installation of washroom accessories and framed mirrors, including attachment hardware.

.2 Include all materials and fitments required for the operation of any unit furnished, in the manner, direction and performance shown on the shop drawings and specified herein.

1.3 SUBMITTALS

.1 Product Data: For each product, indicate manufacturers and product name, including installation requirements and instructions.

.2 Shop Drawings: Show and describe in detail, materials, finishes, dimensions, details of connections and fastenings, elevations, plans, sections, metal gauges, hardware and any other pertinent information.

.3 Coordinate the work of this Section with the placement of internal wall reinforcement.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Coordinate deliveries to comply with construction schedule and arrange ahead for off the ground, under cover storage location.

.2 Materials shall be carefully checked, unloaded, stored and handled to prevent damage. Protect materials with suitable non-staining waterproof coverings.

.3 Store materials in original, undamaged containers or wrappings with manufacturer's seals and labels intact.

.4 Unsatisfactory materials shall be removed from the site.

.5 Adequately protect the structure and work of other Sections during delivery, storage, handling and execution of the work of the Section.

.6 Provide tools, plant and other equipment required for the proper execution of the work of this Section.

2 Products

2.1 MANUFACTURERS

.1 Basis-of-Design Products: Products named in this Section were used as the basis-of-design for the project; additional manufacturers offering similar products may be incorporated into the work of this Section provided they meet the performance requirements established by the named products and provided they submit requests for substitution.

.2 Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include; but are not limited to, the following:

.1 ASI Watrous - Global Partitions

.2 Bobrick

.3 Frost

.4 Koala Kare

.5 Dyson

2.2 MATERIALS

.1 Provide one of the products indicated for each designation in the Washroom and Custodial Accessory Schedule below, subject to compliance with specified requirements.

.2 Stainless Steel: In accordance with ASTM A666, Type 304, with No. 4 finish (satin); minimum nominal thickness as established by product type.

.3 Sheet Steel: Steel: In accordance with ASTM A1008/A1008M, cold rolled, commercial quality; minimum nominal thickness as established by product type; surface preparation and metal pretreatment as required for applied finish.

.4 Galvanized Steel Sheet: In accordance with ASTM A653/A653M, minimum Z180 coating designation.

.5 Galvanized Steel Mounting Devices: In accordance with ASTM A153/A153M, hot dip galvanized after fabrication.

.6 Fasteners: Screws, bolts, and other devices of same material as accessory unit, tamper and theft resistant when exposed, and of galvanized steel when concealed.

2.3 FABRICATION

.1 Washroom and Custodial Accessories:

.1 Surface Mounted:

.1 Fabricate units with tight seams and joints, and exposed edges rolled.

.2 Hang doors and access panels with continuous stainless steel hinge.

.3 Provide concealed anchorage where possible.

.2 Recessed Mounted:

.1 Fabricate units of all welded construction, without mitred corners.

.2 Hang doors and access panels with full length, stainless steel hinge.

.3 Provide anchorage that is fully concealed when unit is closed.

.2 Workmanship shall be best grade of modern shop practice known to recognized manufacturers specializing in this work. Joints and intersecting members shall be accurately fitted, made in true planes with adequate fastening. Wherever possible fastenings shall be concealed.

.3 Isolate where necessary to prevent electrolysis between dissimilar metal to metal or metal to masonry or concrete contact.

.4 Fabricate and erect work square, plumb, straight, true and accurately fitted. Provide adequate reinforcing and anchorage.

.5 Drilling shall be reamed and exposed edges left clean and smooth.

.6 Include anchors and fastenings necessary to anchor work of this Section.

.7 Coordinate with Section 06 10 00 – Rough Carpentry, for wood blocking for attachment of washroom accessories.

.8 Keys: Provide universal keys for internal access to accessories for servicing and re-supplying. Provide minimum of six (6) keys to Owner's representative.

3 Execution

3.1 EXAMINATION

.1 Inspect surfaces over which the work of this Section is dependent for any irregularities detrimental to the application and performance of the work. Notify Consultant in writing of all conditions which are at variance with those in the Contract Documents and/or detrimental to the proper and timely installation of the work of this Section. The decision regarding corrective measures shall be obtained from the Consultant prior to proceeding with the affected work.

.2 Commencement of work of this Section implies acceptance of surfaces and conditions.

3.2 INSTALLATION

.1 Make thorough examination of drawings and details, determine the intent, extent, materials, conditions of interfacing with other work and be fully cognizant of requirements.

.2 Work of this Section shall include complete installation of items specified herein. Installation shall be in strict accordance with manufacturer's printed instructions.

.3 Securely fasten accessories, level and plumb in the locations shown on the drawings and specified herein. All fastenings shall be concealed.

.4 Co-ordinate the work of this Section with the work of other Sections to provide the necessary recesses, edge conditions wood blocking for the accessories as required.

.5 Do all drilling of steel, masonry and concrete necessary for the anchorage of the work.

.6 Installed grab bars shall be capable of supporting a downward pull of 500 lbs. per lineal foot.

3.3 ADJUSTING

.1 Check mechanisms, hinges, locks and latches, adjust and lubricate to ensure that accessories are in perfect working order.

3.4 CLEANING

.1 Upon completion of the work of this Section or when directed by Consultant, remove all protective coatings, and coverings. Clean and polish exposed surfaces.

3.5 WASHROOM AND CUSTODIAL ACCESSORY SCHEDULE

No.	Description	Model
CH	Coat Hooks: Satin finished stainless steel, double hooks profiled with concealed mounting, provide 1 for each toilet stall and 2 for shower and locker area, located as directed by Consultant.	7345-S by ASI B-672 by Bobrick
MH	Mask Hooks: Satin finished stainless steel, 610 mm (24”) wide back plate with three hooks, hook project 75 mm (3”) from wall and 163 mm (6.5”) high, locate as indicated in the Drawing.	Interion 695714 by Global Industrial
FND	Feminine Napkin Disposal: Surface mounted, concealed fastening, self closing disposal opening with leak proof plastic receptacle and 10 disposable liners for initial stocking purposes for each unit.	0852 by ASI B-270 by Bobrick 622 by Frost
GB1	Grab Bar: Horizontal 1.2mm (0.048") thickness; 610mm (24") long x 38mm (1-1/2") Ø, straight, stainless steel, slip resistant grip, concealed mounting, cap secured with vandal resistant set screws.	3801-24P by ASI B-6806.99x24 by Bobrick
GB2	Grab Bar: Vertical 1.2mm (0.048") thickness; 765mm (30") long x 38mm (1-1/4") Ø, straight, stainless steel, slip resistant grip, concealed mounting, cap secured with vandal resistant set screws.	3801-30P by ASI B-6806.99x30 by Bobrick

No.	Description	Model
GB3	Grab Bar: Horizontal 1.2mm (0.048") thickness; 1067mm (42") long x 38mm (1-1/2") Ø, straight, stainless steel, slip resistant grip, concealed mounting, cap secured with vandal resistant set screws.	3801-42P by ASI B-6806.99x42 by Bobrick
GB4	Grab Bar: Side "L"-shape grab bar, 760mm (30") long x 760mm (30") high 38mm (1-1/2") dia., stainless steel, slip resistant grip, concealed mounting, cap secured with vandal resistant set screws.	3804P-Type04 by ASI B-6898.99 by Bobrick
RPTD	Paper Towel Dispenser and Disposal: Recess mounted, handicap accessible, capable of holding 600 C-fold or 800 multi-fold or 1100 single-fold paper towels, with leak proof waste container.	64676 by ASI B-38034 by Bobrick
MR	Mirror (Flat): Framed, 910mm (36") high x 460mm (18") wide, fixed installation, mounted 1000mm (40") to bottom of frame.	0600-1836 by ASI B-290x1836 by Bobrick
TPD	Toilet Tissue Dispenser: Double roll, surface mounted, tissue dispenser with concealed mounting, stainless steel construction, bright polished finish with theft resistant spindles.	7305-2B by ASI B-6867 by Bobrick
SD2	Wall-Mounted Soap Dispenser: Heavy-duty all-purpose valve, wall-mounted stainless steel soap dispenser, 1.2L capacity with visible viewing window.	0347 by ASI B-2111 by Bobrick
JS	Janitor's Shelf complete with Mop and Broom Holders and Hooks: 864mm (34") long x 330mm (13") high x 200mm (8") deep. Shelf constructed of minimum 18-8 stainless steel, type 304, 18 gauge. Utility hooks fabricated of 2.9 mm (11 gauge) stainless steel, and mop holders fabricated of cadmium plated steel. Pivoting, spring-loaded serrated rubber cam shall hold round handles of 22mm to 32mm (7/8" to 1-1/4") dia.	1308-3 by ASI B-239 x 34 by Bobrick
SHC	Shower Curtain: Opaque, matte white vinyl, 0.2mm (.008") thick, containing antibacterial and flame retardant agents. Complete with grommets every 150mm (6"), and hemmed top, bottom and sides.	1200-V by ASI B-204-2 by Bobrick
SHCH	Shower Curtain Hook: Fabricated of type 304 stainless steel alloy 18-8, solid formed wire 2.5mm (0.98") in diameter. Hook shall accommodate 25mm to 32mm (1" to 1-1/4") diameter curtain rods.	1200-SHU by ASI B-204-1 by Bobrick
SHCR	Shower Curtain Rod: Extra-heavy duty rod, 32mm (1-1/4") diameter fabricated of alloy 18-8 stainless steel, type 304, 1.2mm (18 gauge). Flanges fabricated from 0.9mm (20 gauge) stainless steel. Satin Finish. Length: As determined on the Drawings.	1204 by ASI B-6047 by Bobrick
SHSD	Shower Soap Dish: Type 304 stainless steel, matte polished finish. Surface mount. Unit 108mm W x 102mm D (4.25" W x 4" D).	7320-S by ASI B-6807 by Bobrick
SHS	Shower Seat: Constructed of durable, water-resistant, ivory colored, 8mm (5⁄16") thick solid phenolic. Frame and mounting bracket are Type 304 stainless steel and self-locking mechanism. Supports up to 227 kg (500 lbs) when properly installed. Seat 560mm (22") wide, projects 400mm (15 13⁄16") from wall.	8203 Series by ASI B-5192 by Bobrick

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 Sections of Division 01 apply to this Section.

.2 All references standards specified herein imply the latest edition of the standard.

1.2 SUMMARY

.1 Supply and install facility fall protection system for maintenance work in roof areas and as indicated on Drawings.

1.3 QUALITY ASSURANCE

.1 Installation and Design Responsibility: Work of this Section to be executed by a firm thoroughly conversant with laws, by-laws and regulations which govern, and capable of workmanship of best modern shop and field practice known to recognized manufacturers specializing in this work.

.2 Have work of this Section engineered by a professional engineer registered in the Province of the Work. Engineer work to Ministry of Labour requirements for facility fall protection systems. Be responsible for:

.1 Layouts and quantities, to requirements of the authorities having jurisdiction, and CSA-Z91.

.2 Co-ordination and ensure compatibility with building structure.

.3 Obtain all necessary permits and approvals from the authorities having jurisdiction.

.4 Installer Qualifications: Trained and approved by the manufacturer and having a minimum three years' experience in the installation of the work described in this Section and can show evidence of satisfactory completion of projects of similar size, scope and type. If requested, provide letter of certification from manufacturer stating that installer is certified applicator of its products, and is familiar with proper procedures and installation requirements required by the manufacturer.

.5 Maintenance Seminars: Engage a factory authorized service representative to train Owner's maintenance personnel on proper procedures and schedules for adjusting, operating, troubleshooting, servicing, and maintaining the work.

.6 Pre-Installation Meeting: Two weeks prior to commencing work of this Section, arrange for manufacturer's technical representative to visit the site and review preparatory and installation procedures to be followed, conditions under which the work will be done, and inspect the surfaces to receive the work of this Section. Advise the Consultant of the date and time of the meeting.

.7 Manufacturer's Site Inspection: Have the manufacturer's technical representative inspect the Work at suitable intervals during application and at conclusion of the work of this Section, to ensure the Work is correctly installed. Submit manufacturer's inspection reports and verification that the work of this Section is correctly installed.

.8 Source Limitations: Obtain each type of product from a single manufacturer.

1.4 SUBMITTALS

.1 Shop Drawings: Bearing professional seal and signature of a professional engineer responsible for the engineering design of work of this Section. Show track profile, layout, materials, construction, and securement method to building structure.

.2 Maintenance Manuals: Include complete written and illustrated instruction manuals relative to the care, adjustment and operation of all parts of the equipment, a complete description and listing of components, with recommended frequency of service and maintenance to ensure maximum efficiency, reliability and long life of the equipment.

.3 Facility Fall Protection Reports: Include approved ceiling joist layout plan, anchor details, test reports, special liability insurance certificate, warranty certificate, and authorized Letter of Acceptance from the Ministry of Labour.

.1 Special Liability Insurance: Currently dated and duly authorized certificate, indicating that the subcontractor has valid, special liability insurance policy in place to warranty the fabrication and installation of the work of this Section.

1.5 PROTECTION

.1 Protect the structure and its finishes from damage due to installation, testing and operation of work of this Section.

.2 Make good components or surfaces soiled or otherwise damaged in connection with the work of this section.

1.6 MAINTENANCE INSPECTIONS

.1 Provide three (3) years of facility fall protection system maintenance inspections as part of the Contract, from the date of the Substantial Performance, at no additional cost to the Owner. Maintenance inspections shall include but not limited to load tests, structural inspection and weld inspections.

1.7 WARRANTY

.1 Provide a written and signed warranty in the name of the Owner, that work of this Section shall be free of defects in materials, workmanship and installation for a period of three (3) years from the date of Substantial Performance of the Work.

.2 Defects shall include but not be limited to:

.1 Weld failure.

.2 Excessive deformation of parts and components while under imposed loading.

.3 Metal fatigue.

2 Products

2.1 MATERIALS

.1 Stainless Steel Plates, Round Bars and Flat Bars: Structural quality with Fy = 50,000 psi.

.2 Stainless Steel Sheet: 18 gauge, AISI type 304 stainless steel with No.4 finish.

.3 Stainless Steel Plates: New stock (not weathered or rusted), to CAN/CSA-G40.21, Grade 300W. Hot-dip galvanize steel plates after fabrication to CAN/CSA-G164.

.4 Galvanized Steel Sheet: Commercial quality, stretcher levelled, 6 mm (0.24") thick to ASTM A446 with minimized spangle zinc coating Z275 to ASTM A526.

.5 Stainless Steel Welding Materials: CAN/CSA-W59. Use electrodes compatible with and of the same properties as the stainless steel.

.6 Isolation Coating: Alkaline and acid resistant bituminous paint.

.7 Stainless Steel Lock Washers and Hex Nuts: High strength AISI 300 or 400 Series austenitic grade stainless steel types.

.8 Provide at each interior entry area leading to the roof, a reduced laminated as-build drawing showing anchor location, in accordance with requirements of Authorities having jurisdiction.

.1 Drawing shall be metal framed with clear polycarbonate scratch resistant cover and securely fasten to the wall.

2.2 ACCEPTABLE PRODUCTS

.1 Roof Guardrail System: Comply with building code, CSA Z259. Prefinished aluminium tubing guardrail assembly with counterweight base.

.1 VSS Compact Roof Guardrail System by Delta Prevention.

3 Execution

3.1 PREPARATION

.1 Examine work of other sections where such work influences the work of this Section and report unsuitable conditions to the Consultant.

.2 Ensure surface where counterweights will be located must be free of all debris and allow sufficient adhesion to avoid sliding of the systems.

.3 Have a qualified manufacturer's representative on site to direct and supervise the installation of materials which are installed by other trades.

.4 Apply isolation coating of approximately 0.76 mm (30 mils) dry film thickness, or other suitable permanent separator on concealed contact surfaces of dissimilar materials, before assembly or installation where there is possibility of corrosive or electrolytic action with concrete, masonry, mortar, or steel.

3.2 INSTALLATION - EQUIPMENT

.1 Install work by the manufacturer or its authorized representative.

.2 Install railing system in accordance to the manufacturer’s installation guide and inspection criteria.

.3 Install railings minimum 300 mm (12”) offset from the edge of the roof.

.4 Place railings at locations as indicated in the contract drawings.

.5 Replace defective materials and components at no cost to the Owner.

END OF SECTION

1 General

1.1 GENERAL

.1 Design, manufacture, supply, installation, testing, and commissioning of fully operational 3 axis personnel pneumatic lifts, and of festooning system complete with compressed air supply hose, for use in an abrasive blasting room , equipped with recirculating dust collection.

.2 Coordination with all other trades as required.

.3 The blasting operations include:

.1 Dry blasting:

.1 From compressed air pressure pot, mounted on lift.

.2 Using various media

1.2 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedure

.2 Section 01 74 11 - Cleaning

.3 Section 01 74 21 – Construction Demolition Waste Management and Disposal

.4 Section 01 77 00 – Closeout Procedure

.5 Section 01 78 00 – Closeout Submittals

.6 Section 01 79 00 – Demonstration and Training

.7 Section 05 12 23 – Structural Steel for Buildings

1.3 REFERENCES

.1 Refer to the current versions of:

.2 American Institute of Steel Construction (AISC):

.1 AISC 325 Steel Construction Manual, Thirteenth Edition.

.3 American Society for Testing and Materials (ASTM):

.1 ASTM A325M, Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength (Metric).

.2 ASTM A563M, Specification for Carbon and Alloy Steel Nuts (Metric).

.3 ASTM-A668 – Specification for Steel Forging, Carbon & Alloy for General Industrial Use.

.4 American Welding Society

.5 Canadian Standards Association (CSA):

.1 CSA Standard C22.1, Canadian Electrical Code.

.2 CAN/CSA G40.20/G40.21-04 General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.3 CAN/CSA-S136, North American Specification for the Design of Cold Formed Steel Structural Members.

.4 CSA-S136.1 Commentary on CSA Standard S136.

.5 CSA W47.1, Certification of Companies for Fusion Welding

.6 Steel Structures.

.7 CSA W48, Filler Metals and Allied Materials for Metal Arc Welding.

.8 CSA W59, Welded Steel Construction (Metal Arc Welding) Metric.

.6 Occupational Safety and Health Administration (USA)

.1 OSHA guideline 1910.212 – General requirements for Machine Guarding.

.2 OSHA guideline 1910.219 – General requirements for guarding safe use of mechanical power transmission apparatus.

1.4 DESIGN RESPONSIBILITY

.1 The lift and runway shall be designed by a Professional Engineer, registered in the State or Province of fabrication, with a minimum of 10 years of experience in the design of this type of equipment.

.2 The Professional Engineer shall be responsible for establishing design requirements, compliance to applicable codes, standards and regulations, testing and commissioning of system and providing final certification of system.

1.5 SUBMITTALS

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Shop Drawings shall include all the major systems including and not limited to the following information:

.1 General arrangement drawing showing:

.1 Overall layout in relation to the building

.2 Overall dimensions and clearances.

.3 Lift capacity.

.4 Lift reach coverage, including dimensions relative to the nearest building gridline(s).

.5 Runway and festooning arrangement.

.2 Total weights, wheel loads, reaction loads at structural connections.

.3 Compressed air schematic, and supply requirements.

.4 Bill of materials, with detailed part description, make and model.

.3 All structure related shop drawings shall be prepared and stamped by Professional Engineers of respective disciplines registered in the Province of Ontario.

1.6 QUALIFICATIONS

.1 Supplier, and Installing Contractor, and its personnel shall have a minimum five years of demonstrated experience in the related field of design, fabrication, installation, testing and certification of this type of equipment.

1.7 QUALITY ASSURANCE

.1 Manufacturer's technical representatives shall supervise the installation, testing and commissioning of the respective equipment and components.

1.8 DESIGN REQUIREMENTS

.1 Design lifts in accordance with the applicable standards and codes.

.2 Design lifts to be capable of supporting and lifting the specified loads at any location along the runway.

.3 Lift systems shall be designed to fit within the space allocated on the drawings.

1.9 PRE-START HEALTH AND SAFETY:

.1 Submit Pre-Start Health and Safety Review Report in accordance with the requirements of Ontario Regulation 851/90 Industrial Establishments and of this Section.

1.10 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling.

2 Products

2.1 THREE AXIS PERSONNEL LIFTS

.1 Provide one (1) travelling 3 axis personnel lift system on each side of the room.

.2 Approved for use in:

.1 Class 2 hazardous locations during dry blasting.

.2 Provide suitable protection for all components, including but not limited to mast, filter-regulator, controls,

.3 Compressed air driven for all axes of motion.

.4 Design to include means to minimize accumulation of dust on structures and especially on any moving/wearing parts.

.5 Overall Dimensions:

.1 Retracted lateral dimension: maximum 48 inches (1200 mm) from wall

.2 Extended lateral extension: minimum 9 ft (2700 mm) from wall

.3 Vertical: minimum lifted platform floor height: 10 ft. (3000 mm)

.4 X-axis travel length travel to within:

.1 3 ft (900 mm) of end of room, or

.2 1ft (300mm) of any side wall pedestrian doors, unless otherwise approved.

.6 Lift Performance:

.1 X-Axis (along wall):

.3 Design to include towing capacity for fully equipped festooning system.

.4 Variable speed to approximately 40 ft./min. (11.5 metres per minute (mpm),

.5 Position holding brake.

.2 Y-Axis (perpendicular to wall):

.1 Variable speed to 15 ft/min. (4.5 mpm) (approx.),

.2 Position holding brake to counteract blast hose forces.

.3 Z-Axis (up/down):

.1 Variable speed to 15 ft/min. (4.5 mpm) (approx.),

.2 Air/hydraulic cabled lift system.

.3 Position holding brake

.4 Shall perform as specified at 90 psig (620 kPa) minimum compressed air pressure.

.7 Lift Assembly Guides and Support System:

.1 Refer to drawings.

.2 Floor based bottom support

.3 Wall/column mounted top rail support

.1 Include connection plates for connection to structural standoffs (by Structural discipline)

.4 Guide rails shall be within 12 in. (300 mm) of wall unless approved by ONTC.

.8 Base and frame:

.1 Non sparking rail wheels with wheel sweeps for uncovered rails.

.2 Rubber or shock absorbing travel end stops.

.3 Sealed mast system, with service access covers

.4 Abrasive Blast Pressure pot support:

.1 Frame mounted (x-axis travel only on lift structure)

.2 Open bottom design.

.3 Pot retention system

.1 To allow direct top access for pot filling or removal.

.4 Suitable for pot with:

.1 Minimum diameter 20 in. (500 mm)

.2 Maximum weight: 600 lbs.(270 kg)

.9 Platform:

.1 Capacity: minimum 500 lbs (225 kg), plus blast pot.

.2 Access ladder/steps.

.3 Minimum 30 in. x 48 in. (450 mm x 1200 mm) floor size, with 4 in (100 mm) kick plate.

.4 Grating type floor

.5 Minimum 36 in. (900 mm) high guard rails with self closing self latching gates

.6 Factory fall protection tie-off location.

.7 Permanently mounted female quick disconnect outlets for:

.1 Compressed air, and

.2 Breathing air.

.1 Quick disconnect to match breathing air system specified products.

.8 Hook system for blast hose support.

.10 Lift Control System

.1 On board in-line Filter/Regulator/Lubricator, in closed cabinet, with access door.

.2 Forward facing operator controls on platform.

.1 X-axis foot control

.2 Y and Z-Axis hand control

.3 All with suitable means to prevent inadvertent control operation.

.3 Hand actuated Emergency stop

.4 Safety edge / bump strip on the 3 accessible sides of the platform to stop all travel in the event of contact with vertical or horizontal obstructions on any of the 3 non-wall sides.

.5 Elimination of pinch points, by design or suitable protective means, including but not limited to guards, bellows, etc.

.6 Safety interlock to prevent operation if platform door is not closed and latched.

.7 Safety brake/hold mechanism for vertical travel with Emergency lowering.

.8 Auxiliary base mounted control to raise/lower platform.

.9 Release for manual Y axis retraction in case of air failure.

.10 X-axis holding brake to prevent creep when not travelling.

.11 Air Festooning system:

.1 Overhead rigid track and wheeled dollies with hose saddles.

.2 Suitable for a minimum of 3 hoses with following inside diameters:

.1 One 1 in. (25mm)

.2 One ¾ in (19mm).

.1 One ½ in. (13mm).

.3 Designed for minimal festoon stacking/storage length.

.4 Provide festooning hose as follows:

.1 One 1” (25mm) diameter rubber compressed air hose, approved for rated pressure and application.

.6 Coordinate supply of festooned hose for Breathing Air with Purified Breathing Air system supplier:

.1 Anticipated size: ½” (13mm).

.12 Lift Compressed air supply:

.1 On-board distribution and connections from festoon supply hose to all air powered components and controls.

.2 Outlet on operator platform.

.1 Minimum 1/2 inch (13mm) supply

.2 Threaded end for suitable quick disconnect (by others)

.13 Lift Breathing air supply:

.1 On-board breathing air distribution line on from top of lift to rear panel on operator’s platform.

.2 Threaded ends for connection to festooned Breathing Air hose (top) and Breathing Air quick disconnect (bottom)

.1 Minimum 3/8 in. (9mm) interior diameter

.14 Factory applied paint in manufacturer's standard colour for all exposed and non-wearing components.

.15 Acceptable product suppliers:

.1 LPI

.2 Approved Equivalents.

2.2 MAINTENANCE AND SERVICING DESIGN

.1 Make all parts subject to servicing, adjustment, or replacement by operating or maintenance personnel readily accessible. Design which renders servicing, adjustment, or replacement unduly difficult under field conditions will not be acceptable.

.2 Provide any special tools required for servicing or adjustment.

.3 Plan manufacturing, delivery, installation, testing, commissioning, and certification of crane systems to meet the approved construction schedule.

.4 Execute work by methods to avoid damage to other work, and which will provide proper surfaces to receive patching and finishing.

3 Execution

3.1 INSTALLATION

.1 Install lift systems and festooning systems in accordance with manufacturer's recommendations, and in conformance with the requirements of all applicable codes, standards, specifications, and regulations.

.2 Provide all necessary material, labour, tools and equipment for the installation.

.3 Ensure that installation is carried out within the tolerances specified in this Section, and applicable codes and standards.

.4 Complete all necessary compressed air and breathing air supply connections to lift and building connection points.

.5 Upon completion of installation, touch up and restore to new condition, damaged or defaced factory finished surfaces.

.6 Remove protective coverings and clean exposed surfaces after completion.

3.2 TESTING, COMMISSIONING, CERTIFICATION AND TRAINING

.1 All equipment shall be operated through a complete travel and lift/lowering cycles:

.1 The equipment shall perform smoothly and safely.

.2 All tests shall be carried out with the systems loaded at 125 percent of capacity.

.3 Provide all necessary material, labour, tools and equipment required for all testing and commissioning.

.4 Supplier shall provide the test weight loads.

.1 Test weights shall be of minimal size and clearly labelled.

.5 Any defects shall be corrected by the Supplier without any expense to the Consultant.

3.3 TRAINING AND DEMONSTRATION

.1 Upon successful completion of testing and commissioning of lifts, after the delivery of all documentation (manuals, drawings, certificates, etc.) and prior to issuance of Certificate of Completion, carry out equipment and system demonstration and training.

.2 Demonstrate operations and maintenance of equipment and systems and provide training to Owner's operations and maintenance personnel.

.3 Provide certified personnel to demonstrate operation of crane.

.4 Provide Engineer a minimum of 7 days advance notice in writing of demonstration.

.5 Prior to demonstration, submit project record documents and operating and maintenance manuals to the Engineer.

.6 Instruct personnel (2 hours minimum allowance) in basic maintenance and use of the lifts

END OF SECTION

1 General

1.1 REFERENCES

.1 Conform to Division 1, General Requirements

1.2 CODES, STANDARDS AND LAWS

.1 All work shall be carried out in accordance with the applicable regulations of the following authoritative bodies, codes in effect at the time of Tender, and any other Authority having jurisdiction:

.1 Ontario Building Code

.2 Ontario Plumbing Code

.3 Fire Marshall

.4 Worker's Compensation Board

.5 Local Building By-Laws

.6 Canadian Standards Association

.7 CSA Gas Code B149.1

.8 CSA Mechanical Refrigeration Code B52

.9 Canadian Safety Standard (CSA):

.1 CAN/CSA C22.2.CAN/CSA C747, Energy Efficiency Test Methods for Small Motors.

.2 CAN/CSA C390, Test methods, marking requirements and energy efficiency levels for three-phase induction motors.

.10 Electrical Equipment Manufacturers' Association Council (EEMAC).

.11 Institute of Electrical and Electronic Engineers (IEEE).

.1 IEEE 112, Standard Test Procedure for Polyphase Induction Motors and Generators.

.12 National Electrical Manufacturers Association (NEMA).

1.3 WORK STANDARDS

.1 All Codes and Standards referred to in this Section are the latest edition of the Codes and Standards in effect at the time of tendering this Contract.

.2 All mechanical piping system Work, including equipment, must comply in all respects with requirements of the Ontario Technical Standards and Safety Authority, and CSA Standards B51, Boiler, Pressure Vessels and Pressure Piping Code. Where required, fittings, valves, equipment, etc., must bear a CRN number.

.3 All electrical items associated with mechanical equipment shall be CSA (or equivalent agency certified electrically), or bear a stamp to indicate special Electrical Safety Authority approval.

1.4 DEFINITIONS

.1 The following are definitions of words found in Sections of Divisions 20, 22, and 23 and on associated Drawings:

.1 "Concealed" – means Work hidden from normal sight in furred spaces, shafts, ceiling spaces, walls and partitions.

.2 "Exposed" – means Work normally visible, including Work in equipment rooms and similar spaces.

.3 "Provide" (and tenses of "provide") – means supply and install complete.

.4 "Install" (and tenses of "install") – means install and connect complete.

.5 "Supply" – means supply only.

.6 "Finished area" - means any area or part of an area which receives a finish such as paint, or is factory finished.

.2 Wherever the words "indicated", "shown", "noted", "listed", or similar words or phrases are used in the Specification Sections they are understood, unless otherwise defined in the Contract Documents, to mean that the product referred to is "indicated", "shown", "listed", or "noted" on the Drawings.

.3 Wherever the words "approved", "satisfactory", "as directed", "submit", "permitted", "inspected" or similar words or phrases are used in the Specification Sections they are understood, unless otherwise defined in the Contract Documents, to mean that Work or product referred to is "approved by", "inspected by", etc., the Consultant.

1.5 WORKPLACE SAFETY

.1 Comply with the requirements of the Workplace Hazardous Materials Information System (WHMIS) regarding the use, handling, storage and disposal of hazardous materials.

.2 Comply with all requirements of O.Reg 213/91, Construction Projects, enacted under the Occupational Health and Safety Act.

1.6 APPLICATION

.1 This Section specifies requirements, products, common criteria and characteristics, and methods and execution that are common to one or more Sections of Divisions 20, 22, and 23, and it is intended as a supplement to each Section and shall be read accordingly

1.7 PLANNING AND LAYOUT OF WORK

.1 The exact locations and routing of mechanical and electrical services shall be properly planned, coordinated and established with all affected trades prior to installation such that the services will clear each other as well as any obstructions. Generally, give the right-of-way to piping requiring uniform pitch and locate and arrange other services to suit.

.2 All shut-off valves, balancing devices, air vents, equipment and similar products, particularly such products located above suspended ceilings, must be located for easy access for servicing and/or removal. Products which do not meet the location's requirements shall be relocated at no cost to the Owner.

1.8 DOCUMENTS

.1 The Contract Drawings are performance Drawings, diagrammatic, and show approximate locations for equipment and materials. The Drawings are intended to convey the scope of work and do not necessarily show architectural and structural details. The locations of materials and equipment shown may be altered (when revised layouts have been submitted and approved), to meet requirements of the material and/or equipment, other equipment and systems being installed, and of the building. Provide all fittings, offsets, transformations, and similar items required as a result of obstructions and other architectural or structural details but not shown on the Mechanical Drawings.

1.9 ACCEPTABLE PRODUCT MANUFACTURERS

.1 Products scheduled and/or specified on the Drawings and in the Sections of Divisions 22 and 23 have been selected to establish a performance and quality standard, and, in some instances, a dimensional standard. In most cases, acceptable manufacturers are stated for any product specified by manufacturer's name and model number. The Contract price may be based on products supplied by any of the manufacturers named as acceptable for the particular product. If

acceptable manufacturers are not stated for a particular product, base the Contract price on the products supplied by the specified manufacturers.

.2 If products supplied by a manufacturer named as acceptable in any Section of Divisions 22 and 23 are used in lieu of the manufacturer specified, be responsible for ensuring that the substituted product is equivalent in performance and operating characteristics (including energy consumption if applicable) to the specified product, and, it is to be understood that any additional costs, and changes to associated or adjacent Work resulting from provision of products supplied by a manufacturer other than the specified manufacturer is included in the Contract price. In addition, in equipment spaces where products named as acceptable are used in lieu of specified products and the dimensions of such products differ from the specified products, prepare and submit for review, accurately dimensioned layouts of rooms affected.

1.10 SUBMITTALS

.1 Submit the following for review:

.1 Shop drawings for all products specified in this Section.

.2 Location drawings for all required sleeves and formed openings in new masonry walls.

.3 Samples of materials and any other items as specified in other Sections of this Division.

.4 WHMIS MSDS – Material Safety Data Sheets for all products where required, and maintain one copy at the site in a visible and accessible location and available to all personnel.

.5 A list of equipment identification nameplates indicating proposed wording and sizes.

.6 A list of pipe and duct identification colour coding and wording.

.7 A proposed valve tag chart and a list of proposed valve tag numbering and identification wording.

.8 A clean “reviewed” copy of each shop drawing for insertion into the O&M instruction manual.

1.11 SHOP DRAWINGS

.1 The following shall be read in conjunction with the wording on the Consultant's shop drawing review stamp applied to each and every mechanical work shop drawing submitted:

.1 “This review is for the sole purpose of ascertaining conformance with the general design concept. This review does not approve the detail design inherent in the shop drawings, responsibility for which remains with the Contractor, and such review does not relieve the Contractor of its responsibility for errors or omissions in the shop drawings or of its responsibility for meeting all requirements of the Contract Documents. Be responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation, and for coordination of the work of all sub-trades/subcontractors.”

1.12 OPERATING AND MAINTENANCE INSTRUCTION MANUALS

.1 The Contractor will prepare and submit for review to the Consultant one (1) copy of:

.1 Permits, inspection certificates, and the like,

.2 Shop drawings for all mechanical equipment,

.3 Pipe leakage test sheets, manufacturer’s startup check sheets, and similar data,

.4 All required operating and maintenance instruction data,

.5 Valve tag charts,

.6 All other data specified in applicable Sections of Divisions 20, 22, and 23 of the Specification.

.2 Each manual is to be organized into the following categories:

.1 A - Project Directory

.2 B - Warranty Letter

.3 C - All applicable certifications letters

.4 D - Plumbing and Drainage

.5 F - Heating

.6 G - Ventilation and Noise Attenuation

.7 H – Process Equipment and Systems

.8 I - Building Management System

.3 The project directory is to contain the names, addresses, telephone and fax numbers of the Project Team, including:

.1 Owner,

.2 Architect,

.3 Mechanical Consultant,

.4 General Contractor,

.5 Mechanical Sub-contractors,

.6 Manufacturers and manufacturer's representatives.

.4 Sections D to H are to be divided into the following subsections:

.1 Shop Drawings

.2 Operation Procedures

.3 Maintenance Procedures

.4 Spare Parts List

.5 Trouble Shooting Guide

.6 Valve Chart (where applicable)

.7 Equipment Lists

.8 Testing and Verification Forms

.9 Certification Forms

.5 Section I is to be divided into subsections as follows:

.1 Shop Drawings

.2 As-Built Control Sequences

.3 As-Built Panel Layout and Points List

.4 All Point Log Per System

.5 Operating Procedures for all Equipment and Systems

.6 Maintenance Procedures for all Equipment

.7 Spare Parts List

.8 Software Licensing Agreements

.9 Software Manuals

.10 Software Disks

.11 Point Data and Program Disks

.12 Testing and Verification Forms

.6 The operating procedures are to be the manufacturer's recommended operating procedures for the equipment.

.7 The maintenance procedures are to include Scope of Work, frequency of activity, parts required, and necessary documentation.

.8 The spare parts list is to be the manufacturer's recommended list for maintenance purposes.

.9 The trouble shooting guide is to be the manufacturer's recommendations for the equipment.

.10 The equipment list is to include make, model, serial number, electrical characteristics, RPM, pump impeller sizes, fan belt and sheave sizes, as applicable.

1.13 RECORD DRAWINGS

.1 Submit record model and drawings identifying location of fire dampers, access doors and actual room names or numbers.

.2 Piping Elevations:

.1 Water Lines: All water lines. Invert elevations to be given at each junction, changes of direction horizontally and vertically and at every 30m run as well as type of material used.

.2 Sanitary sewers and Storm sewers.

.3 Heating, and Plumbing Lines: All piping of any size. Invert elevations to be given at each junction, at change of direction, at high and low points.

.3 All valve stations, trap stations, coils, dampers and ductwork not easily accessible.

.4 All changes which affect the operation of the mechanical system.

.5 At end of construction, the final set of PDFs shall be made available to the Owner and Consultant for review.

.6 Location, tagging and numbering of all valves except individual plumbing fixtures or equipment isolation valves.

.7 The as-built daily marked-up prints shall conform to the standards of the contract drawings and shall include all details from revision drawings, supplementary drawings, change orders, addenda and site revisions, etc. Provide controls as built drawings from controls contractor. Each white print drawing sheet shall be marked: "We hereby certify that these drawings represent the building, as built." with signatures immediately below of authorized personnel of the Contractor

1.14 EQUIPMENT AND SYSTEM STARTUP AND COMMISSIONING

.1 An independent Commissioning Agent ("Commissioning Agent") shall be retained by the Contractor to supervise the system and equipment startup and performance testing, to test and balance air and water flows, to make final adjustments to equipment and systems, to prepare operating and maintenance instruction manuals, to update CADD discs for record drawings, and to provide other associated services.

.2 The work for the independent Commissioning Agent is specified in Section 23 08 00 – HVAC Commissioning. Carefully read Section 23 08 00 and provide for all labour to physically perform start-ups and performance testing, supply of equipment manufacturer's representatives and technicians on-site, services, etc., which are indicated as being supplied by the Contractor, including:

.1 Data and shop drawings for operation and maintenance manuals.

.2 Marked-up white print "record drawings" prepared on site during construction.

.3 All test data and certificates.

.3 The majority of the Commissioning Work specified in Section 23 08 00 must be complete prior to application for Substantial Performance of the Work.

2 Products

2.1 PIPE SLEEVES

.1 Minimum 1.6mm thick (16 ga) galvanized steel with an integral flange at one end to secure the sleeve to formwork construction.

.2 Factory fabricated, flanged, high density polyethylene sleeves with reinforced nail bosses.

.3 Schedule 40 mild galvanized steel pipe with a welded-on square steel anchor and water stop plate at the sleeve midpoint.

2.2 FIRESTOPPING AND SMOKE SEAL MATERIALS

.1 Asbestos-free elastomeric materials tested, listed and labelled by ULC in accordance with CAN4-S115 for installation in ULC designated firestopping and smoke seal systems to provide a positive fire, water and smoke seal, and a fire-resistance rating (flame, hose stream and temperature) not less than the fire resistance rating of surrounding construction.

.2 Pipe insulation forming part of a ULC fire and smoke seal assembly is specified in Section 20 07 00.

2.3 WATERPROOFING SEAL MATERIALS

.1 Modular, mechanical seal assemblies consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and the pipe sleeve or wall opening, assembled with stainless steel bolts and pressure plates and designed so that when the bolts are tightened the links expand to seal the opening watertight. The seal assemblies shall be selected to suit the pipe size and the sleeve size or wall opening size. Acceptable products are:

.1 Thunderline Corp. (Power Plant Supply Co.) “LINK SEAL” Model S.

.2 The Metraflex Co. “MetraSeal” type ES.

2.4 PIPE ESCUTCHEON PLATES

.1 One-piece chrome plated brass or #4 finish type 302 stainless steel plates with screws, each sized to cover the pipe sleeve or wall or slab opening, and to fit tightly around the pipe or pipe insulation.

2.5 EQUIPMENT DRIVE GUARDS AND ACCESSORIES

.1 For exposed fan blades, unless otherwise specified in the Contract Documents - removable 12 mm (0.5”) galvanized steel wire mesh with galvanized steel frames.

2.6 COMMON ELECTRICAL REQUIREMENTS

.1 Division 26 – Electrical, shall provide all line side power wiring for equipment provided by Division 21 – Fire Suppression, Division 22 – Plumbing, Division 23 – HVAC and Division 25 – Integrated Automation, up to the respective motor control center and starters, also provided under Divisions 26.

.2 Load side power wiring shall be under Divisions 21, 22 and 23. Divisions 21, 22 and 23 shall provide all local disconnect switches, control panels and VFD’s for mechanical equipment as required.

.3 Control wiring of local safeties and interlocks for packaged equipment shall be provided under the respective Sections unless otherwise specified in the Contract Documents.

.4 Conduit and wiring materials and methods shall be in strict accordance with the requirements of Division 26 - Electrical.

.5 Check all wiring diagrams and control diagrams submitted in shop drawing form. Before submitting these shop drawings to the Consultant, submit these drawings to Division 26 - Electrical Contractor for approval. Have these drawings stamped by Division 26 - Electrical Contractor as verification of their approval before forwarding to the Consultant. Co-operate in the commissioning of all electrically driven equipment with Division 26 - Electrical.

2.7 COMMON MOTORS REQUIREMENTS

.1 General:

.1 The efficiency of single phase motors to 0.746 kW (1 HP) is to be in accordance with CAN/CSA – C747. The efficiency of all three phase motors 0.746 kW (1 HP) and larger shall be equal to or exceed the NEMA Premium Efficiency designation as tested in accordance with CSA C390 or IEEE 112.

.2 Motors:

.1 Unless otherwise specified in the Contract Documents, motors shall conform to EEMAC Standard MG1, applicable IEEE Standards, and applicable CSA C22.2 Standards.

.2 Vertically mounted and submersible motors shall be purposely designed for mounting in this attitude.

.3 Single Phase Motors: Unless otherwise specified in the Contract Documents, motors smaller than 0.373 kW (0.5 HP) shall be 115 volt, continuous duty capacitor start type with an EEMAC 48 or 56 frame size, solid base, heavy-gauge steel shell with solid die-cast end shields, dynamically balanced die-cast rotor, integral automatic reset thermal overload protection, Class “B” insulation, and a 1.15 service factor at 40°C (104°F) ambient temperature.

.4 Thermistor Protection: Motors 22.37 kW (30 HP) and larger, as scheduled in the Contract Drawings, shall be complete with a heat sensing Siemens PTC thermistor (or an approved equivalent) in the end turn of the stator winding for each phase and connected in series inside the motor with two marked leads brought out to the main motor conduit box.

.3 Drive Guards and Accessories:

.1 For V-belt drives - removable, four sided, fully enclosed, galvanized sheet steel guards in accordance with OSHA standards, complete with 115 mm (4.5”) diameter tachometer openings covered with removable perforated galvanized plates at each shaft location.

.2 For flexible couplings - removable "U" shaped galvanized steel guards with a 2.3 mm (0.093") thick frame and expanded mesh face.

.3 For exposed fan blades, unless otherwise specified in the Contract Documents, removable 12 mm (0.5") galvanized steel wire mesh with galvanized steel frames.

3 Execution

3.1 INSTALLATION OF PIPE SLEEVES

.1 Where pipes pass through concrete and/or masonry surfaces provide pipe sleeves as follows:

.2 In poured concrete slabs, unless otherwise specified in the Contract Documents: minimum 1.6 mm thick (16 ga) flanged galvanized steel or, where permitted by governing authorities, factory fabricated, plastic sleeves

.3 In concrete or masonry walls: Schedule 40 galvanized steel pipe.

.4 Sleeves in waterproofed slabs shall be lengths of Schedule 40 mild galvanized steel pipe in accordance with the Drawing detail. Provide waterproof sleeves in the following locations:

.5 In mechanical room floor slabs, except where on grade.

.6 In slabs over mechanical, fan, electrical and telephone equipment rooms or closets.

.7 In all floors equipped with waterproof membranes.

.8 In the roof.

.9 Size sleeves, unless otherwise specified in the Contract Documents, to leave 12 mm (½") clearance around the pipes, or where pipe is insulated, a 12 mm (½") clearance around the pipe insulation.

.10 Pack and seal the void between the pipe sleeves and the pipe or pipe insulation for the length of the sleeves as follows:

.11 Pack sleeves in fire rated construction as specified in the article entitled "INSTALLATION OF FIRESTOPPING AND SMOKE SEAL MATERIALS".

.12 Pack sleeves in non-fire rated interior construction with mineral wool and seal both ends of the sleeves with non-hardening silicone base caulking compound.

.13 Pack sleeves in exterior walls above grade with mineral wool and seal both ends of the sleeves water-tight with approved non-hardening silicone base caulking compound unless mechanical type seals have been specified in the Contract Documents.

.14 Seal sleeves in exterior walls (and any other wall where water leakage may be a problem) with link type mechanical seals as specified below.

.15 Sleeves in fire rated construction will be packed and sealed as part of the work of Division 7.

.16 Where sleeves are required in masonry work, accurately locate and mark the sleeve position, and turn the sleeves over to the trade performing the masonry work for installation.

.17 Terminate sleeves for piping which will be exposed so that the sleeve is flush at both ends with the wall, partition or slab surface so that the sleeve may be completely covered by an escutcheon plate, except for sleeves in waterproof floors which are to extend 100 mm (4") above the finished surface.

.18 "Gang" type sleeving will not be permitted.

.19 Where sleeves are provided for future piping, or where piping has been removed from existing sleeves, cap and seal both ends of the sleeved opening.

3.2 INSTALLATION OF WATERPROOFING SEAL MATERIALS

.1 Provide watertight link type mechanical seals in exterior wall openings where shown and/or specified on the Drawings.

.2 Assemble and install each mechanical seal in accordance with the manufacturer's instructions.

.3 Periodically check each mechanical seal installation for leakage and, if necessary, tighten link seal bolts until the seal is completely watertight.

3.3 DUCT OPENINGS

.1 Duct openings, air inlet and outlet openings, fire damper and similar openings will be provided in poured concrete work, masonry, drywall and other building surfaces by the trade responsible for the particular construction in which the opening is required.

.2 Ensure that openings for fire dampers to 600 mm (24") high are sized to suit the damper arrangement with the folding blade out of the air stream.

3.4 SLEEVE AND FORMED OPENING LOCATION DRAWINGS

.1 Prepare and submit for review and forwarding to the concrete reinforcement detailer, drawings indicating all required sleeves, recesses and formed openings in poured concrete work. Such drawings shall be completely and accurately dimensioned and relate sleeve, recesses, and formed openings to suitable grid lines and elevation datum.

.2 Begin to prepare such drawings immediately upon notification of acceptance of Tender and award of Contract.

3.5 INSTALLATION OF FIRESTOPPING AND SMOKE SEAL MATERIAL

.1 Where mechanical Work penetrates fire rated construction, provide ULC listed and labelled firestopping and smoke seal material installed in accordance with the ULC Firestop System requirements to seal holes and voids in the walls or slabs, as follows:

.1 Bare pipe or conduit through a floor with a circular sleeved or core drilled opening - ULC System SP115.

.2 Bare pipe or conduit through a floor with a rectangular cast or cut opening - ULC System SP116.

.3 Bare pipe or conduit through a wall with a circular sleeved or core drilled opening - ULC System SP114.

.4 Bare pipe or conduit through a wall with a rectangular cast or cut opening -ULC System SP107.

.5 Insulated pipe through a wall with a sleeved or core drilled circular opening - ULC System SP108.

.6 Insulated pipe through a wall with a rectangular cast or cut opening - ULC System SP107.

.7 Insulated pipe through a floor with a circular sleeved or core drilled opening - ULC System SP109.

.8 Insulated pipe through a floor with a rectangular cast or cut opening - ULC System SP116.

.2 Note that the insulation for insulated piping penetrating fire rated construction is specified in Section 20 07 00 and is fire rated insulation with a vapour barrier jacket, ULC listed as a firestop component for use with ULC Systems SP107, SP108, SP109, and SP116.

.3 At all fusible link damper locations in ductwork penetrating fire rated construction, seal the perimeter of the angle iron framing on both sides of the wall or slab with ULC listed and labelled sealant materials to provide a positive smoke seal.

3.6 INSTALLATION OF PIPE ESCUTCHEON PLATES

.1 Provide escutcheon plates suitable secured over all exposed piping passing through finished building surfaces. A finished building surface is any surface with a factory finish or that receives a site applied finish.

.2 Install the plates so that they are tight against the building surface concerned, and ensure that the plates completely cover pipe sleeves and/or openings, except where waterproof sleeves extend above floors.

3.7 INSTALLATION OF FASTENING AND SECURING HARDWARE

.1 Provide all fastening and securing hardware required for mechanical Work to maintain installations attached to the structure or to finished floors, walls and ceilings in a secure and rigid manner capable of withstanding the dead loads, live loads, superimposed dead loads, and any vibration of the installed products.

.2 Use fasteners compatible with the structural requirements, finishes and types of products to be connected. Do not use materials subject to electrolytic action or corrosion where conditions are liable to cause such action.

.3 Where the floor, wall or ceiling construction is not suitable to support the loads, provide additional framing or special fasteners to ensure proper securement to the structure that is to support the

products. Provide reinforcing or connecting supports where required to distribute the loading to the structural components.

.4 Obtain written consent before using explosive actuated fastening devices. If consent is obtained, comply with the requirements of CSA Standards CAN3-Z166.1 and 2-M85.

3.8 INSTALLATION OF EQUIPMENT DRIVE GUARDS AND ACCESSORIES

.1 Protect all exposed accessible rotating parts on all mechanical equipment with a guard.

.2 Secure guards to the equipment or equipment base but do not bridge sound or vibration isolation.

3.9 INTERRUPTIONS TO AND SHUT-DOWNS OF MECHANICAL SERVICES AND SYSTEMS

.1 Co-ordinate all shut-downs and interruptions to the existing mechanical systems. Generally, shut-downs may be performed only between the hours of 12:00 midnight Sunday until 6:00 a.m. Monday morning.

.2 Upon award of the contract, submit a list of anticipated shut-down times and their maximum duration.

.3 Prior to each shut-down or interruption, inform the Owner in writing 72 hours in advance of the proposed shut-down or interruption and obtain written approval from the Owner to proceed. Do not shut-down or interrupt any system or service without such written approval.

.4 Perform work associated with shut-downs and interruptions as continuous operations to minimize the shut-down time and to reinstate the systems as soon as possible. Prior to any shut-down, ensure that all materials and labour required to complete the work for which the shut-down is required are available at the site.

3.10 EQUIPMENT BASES AND SUPPORT

.1 Unless otherwise specified in the Contract Documents, set all floor mounted equipment on 100 mm (4") high concrete housekeeping pads 100 mm (4") wider and longer than the equipment base dimensions.

.2 Supply dimensioned drawings, equipment base templates and anchor bolts for proper setting and securing of equipment on pads, and be responsible for all required leveling, alignment, and grouting of the equipment.

.3 For equipment not designed for base mounting, where required, provide prime coat painted structural steel stands flange bolted to housekeeping pads.

.4 Provide prime coat painted structural black steel angle or channel frames and brackets for all surface wall mounted equipment not specifically designed for surface wall mounting, unless otherwise specified in the Contract Documents.

3.11 EXCAVATION AND BACKFILL WORK

.1 Excavation, backfill and related Work such as dewatering required for the mechanical Work will be performed as part of the Work of Division 2, except for final hand grading Work which is to be performed as part of the Work of Division 23.

.2 Inverts and locations of existing site services have been shown on the Drawings. The inverts and locations shown are approximate, and it is your responsibility to confirm and satisfy yourself that the inverts and locations as shown are correct, prior to commencing site service Work.

.3 Accurately mark-out the location and routing of excavation required for the work of this Section, as well as the required depth.

.4 Ensure that all underground piping subject to freezing and located outside the building has a minimum of 1.5 m of cover.

.5 Ensure that all underground piping subject to freezing and located inside the building in unheated areas has a minimum of 450 mm of cover.

.6 Ensure that pipe bedding is proper prior to laying pipes. Hand excavate under pipe hubs, couplings, flanges and similar items to ensure even bearing along the entire barrel of each length of pipe.

.7 Ensure that piping is inspected, leakage tested and approved prior to backfilling. Supervise the initial backfilling operation to ensure that the buried Work is not disturbed.

3.12 PACKING AND SEALING CORE DRILLED PIPE OPENINGS

.1 Pack and seal the void between the pipe opening and the pipe or pipe insulation for the length of the opening as follows:

.1 Pack openings in non-fire rated interior construction with mineral wool and seal both ends of the opening with non-hardening silicone base caulking compound to produce a water-tight seal.

.2 Pack and seal openings in fire rated walls and slabs as specified in this Section.

.3 Pack and seal openings in exterior walls with mechanical link type waterproofing seal materials specified in PART 2 of this Section.

3.13 HOISTS AND SCAFFOLDS

.1 Provide interior movable or roller scaffolds for the installation of the mechanical work.

3.14 ACCESS OF EQUIPMENT

.1 Make all arrangements to ensure that access into the building is available for all mechanical equipment. Do all hoisting and rigging into place of all specified equipment and be responsible for any damages incurred.

3.15 EQUIPMENT PROTECTION AND CLEAN-UP

.1 Protect equipment and material in storage on site and after installation until final acceptance. Leave factory covers in place. Take special precautions to prevent entry of foreign material into working parts of piping and duct systems.

.2 Protect equipment with polyethylene covers and crates.

.3 Operate, drain and flush out bearings and refill with new change of oil, before final acceptance.

.4 Thoroughly clean piping, ducts and equipment of dirt, cuttings, and other foreign material.

.5 Protect bearings and shafts during installation. Grease shafts and sheaves to prevent corrosion. Supply and install necessary extended nipples for lubrication purposes.

.6 Ensure that existing equipment is carefully dismantled and not damaged or lost. Do not reuse existing materials and equipment unless specifically indicated.

3.16 TEMPORARY OR TRIAL USAGE

.1 Temporary or trial usage by the Owner of mechanical equipment supplied under contract shall not represent acceptance.

.2 Repair or replace permanent equipment used temporarily.

.3 Repair or otherwise rectify damage caused by defective materials or workmanship during temporary or trial usage.

3.17 SEMI-FINAL AND FINAL INSPECTIONS

.1 Perform the following items prior to semi-final inspection:

.1 Make heating and air conditioning systems capable of operation with automatic controls in operation generally, but not necessarily finally calibrated.

.2 Make necessary tests on equipment including those required by authorities having jurisdiction. Obtain certificates of approval.

.3 Rough balance air systems.

.4 Completely identify equipment so as to be clearly visible.

.5 Lubricate equipment as per manufacturer's data.

.6 Mail warranty forms to manufacturer. Provide copy of original warranty for equipment which has warranty period longer than one year.

.7 Submit sample of Operating/Maintenance Manuals. Arrange Operating and Maintenance Instructions and submit schedule for approval.

.8 Review and ensure access doors are suitably located and of correct type and equipment is easily accessible including plumbing cleanouts.

.9 Clean fan plenums, remove temporary filters and install permanent filters.

.10 Check operations of plumbing systems and fixtures and ensure fixtures are solidly supported.

.2 Prior to semi-final inspection, provide complete list of items which are deficient at the time of the semi-final inspection.

.3 Provide declaration in writing that deficiencies noted at time of semi-final inspection have been corrected and the following items completed prior to the final inspection:

.1 Clean equipment both inside and out and lubricate.

.2 Clean plumbing fixtures and brass.

.3 Complete final balancing.

.4 Submit rough data of balance reports.

.5 Complete final calibration.

3.18 SUBSTANTIAL COMPLETION INSPECTION

.1 Prior to the Contractor requesting an inspection for substantial completion all the following items must be provided to permit beneficial use by the Owner.

.1 Maintenance and Operating Manuals to be submitted and approved.

.2 Record drawings.

.3 Air balancing reports.

.4 All motor name plate ratings and actual operating amps and voltages.

.5 All systems shall be certified in writing by the Contractor as complete and fully operational.

.6 Instructions to the Owner's operating personnel shall be provided in accordance with the specifications. A signed statement to this effect, countersigned by the Owner, shall be submitted to the Architect.

.7 A complete list of items which the Contractor has not finished, or are deficient shall be provided. If, in the opinion of the Engineer, this list indicates the project is excessively incomplete, a substantial completion inspection will not be performed.

.8 The Contractor shall be fully responsible to accumulate all necessary data from this Sub-trades and suppliers and present same in the specified format for the approval by the Engineer.

3.19 INSTRUCTIONS TO OWNER

.1 Instruct the Owner's designated representatives in all aspects of the operation and maintenance of systems and equipment specified in this Division.

.2 Arrange and pay for the services at the site of qualified technicians and other manufacturer's representatives to instruct on specialized portions of the installation.

.3 Submit, prior to issue of a Certificate of Substantial Performance, a complete list of systems for which instructions where given to the Owner, stating for each system:

.1 Date instructions were given to the Owner's staff;

.2 Duration of instruction;

.3 Names of persons instructed;

.4 Other parties present (manufacturer's representatives, etc.).

.4 Obtain the signatures of the Owner's staff to verify that they properly understood the system installation, operation and maintenance requirements and have received operating and maintenance manuals and record Drawings.

3.20 COMMON MOTOR REQUIREMENTS

.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.

.2 Installation of Equipment Drive Guards and Accessories:

.1 Protect all exposed accessible rotating parts on all mechanical equipment with a guard.

.2 Secure guards to the equipment or equipment base but do not bridge sound or vibration isolation.

END OF SECTION

1 General

1.1 SUMMARY

.1 This Section covers the work of designing, fabrication and installation of pipe support systems for process and building mechanical piping systems unless the pipe support has been detailed elsewhere in the Contract Documents.

1.2 RELATED REQUIREMENTS

.1 Section 20 05 00 – General Requirements.

.2 Section 20 05 48 – Vibration Isolation.

.3 Section 22 11 16 – Domestic Water Piping.

.4 Section 22 13 16 – Drainage, Waste and Venting Piping.

.5 Section 23 30 00 – HVAC Ducts, Plenums.

.6 Section 23 21 13 – Hydronic Piping.

1.3 REFERENCES

.1 American Society for Testing and Materials (ASTM):

.1 ASTM A123/A123M, Standard Specification for Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products.

.2 ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc Iron Alloy Coated (Galvannealed) by the Hot Dip Process.

.2 Manufacturers Standardization Society

.1 ANSI/MSS SP-58, Pipe Hangers and Supports – Materials, Design, Manufacture, Selection, Applications and Installation.

.3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

.1 ANSI/SMACNA 006, HVAC Duct Construction Standards - Metal and Flexible

.4 National Building Code of Canada (NBC)

.5 Ontario Building Code 2012 (OBC)

1.4 SUBMITTALS

.1 Submit shop drawings in accordance with Section 01 33 00 – Submittal Requirements.

.2 Shop Drawings:

.1 The Contractor shall submit shop drawings and design calculations showing all anchors and guides for all systems with the potential for thermal expansion/contraction and/or loads due to weight or thrust. The drawings shall be sealed and signed by a professional engineer licensed to practice in the Province of Ontario.

.2 The drawings shall include all details of construction, static and dynamic forces at points of attachment, etc. necessary for review and acceptance by the project Structural Engineer's Representative. Make adjustments as necessary to satisfy the requirements of the Structural Division.

.3 The drawings shall identify each support, hanger, guide, and anchor type by catalogue number and Shop Drawing detail number. No anchor points shall be permitted without reviewed shop drawings and, where installed prior to review, shall be removed and replaced to the satisfaction of the Engineer's Representative.

.4 Metal Framing Support Systems: Detailed installation drawings, catalogue information, and complete component specifications.

.3 Information Submittals: Maintenance information on the piping support system.

1.5 DESIGN REQUIREMENTS

.1 General:

.1 Piping and equipment provided under the Mechanical Division shall be complete with all necessary supports and hangers required for a safe and workmanlike installation.

.2 Hangers, supports, anchors, guides, and restraints shall be selected to withstand all static and dynamic loading conditions which act upon the piping system and associated equipment.

.3 The piping support design shall meet the requirements of ANSI/MSS SP-58, "Pipe Hangers and Supports Materials, Design, Manufacture, Selection, Applications and Installation" or as modified by this Section.

.4 Revisions to support systems resulting from changes in the related piping system layout or by the addition other piping accessories (eg. flexible joints) as may occur during the execution of the Work, and shall be included in the Contractor’s design.

.2 Pipe Support Systems:

.1 The Contractor shall select and design within the spans and component requirements specified in the Contract Documents.

.2 Generally, the piping supports specified to be designed, supplied and installed by the Contractor are not shown on the Contract Drawings. The absence of pipe supports and details on the Contract Drawings shall not relieve the Contractor of its responsibility for sizing and providing supports.

.3 Criteria for Structural Design and Selection of Pipe Support System Components:

.1 Dead loads imposed by the weight of the pipes filled with water, except air and gas pipes within the specified spans and component requirements, plus any insulation.

.2 Safety Factor for drilled-in Concrete Anchors (for example, Hilti type anchors): Minimum of 5.

.4 The Contractor shall design, size, and space support anchoring devices, including lateral supports, anchor bolts, inserts, and other devices used to anchor the support, to withstand the shear and pullout loads imposed by loading and spacing on each particular support.

.5 Any modification to the piping, including the addition of flexible joints where not shown on the Contract Drawings, shall require the review and approval of the support system by the Consultant.

.6 Steel Framing Support System:

.1 Bending Members: Size such that beam stress does not exceed allowable stresses in accordance with the requirements of the OBC and maximum deflection does not exceed 1/240 of span.

.2 Compression Members: Size in accordance with the manufacturer's recommended method.

.3 Support Loads: Calculate using weight of pipes filled with water.

.3 Pipe Support Spacing:

.1 Vertical Supports: Stainless steel, mild steel, ductile iron, cast iron and copper piping (Note that this spacing may require the use of higher load pipe clamps and more than a single point anchor point in concrete).

.1 Unless otherwise specified or shown maximum pipe support spacing shall be in accordance with Table 4 in MSS SP-58 or the table below:

Table 1: Maximum Horizontal Pipe Hanger Spacing

Pipe Diameter		Max. Spacing Stainless Steel, Mild Steel & Ductile Iron		Max. Spacing Cast Iron		Max. Spacing Copper	
mm	in.	meters	feet	meters	feet	meters	feet
to 25	to 1	2.1	7	2.1	7	1.5	5
32 to 40	1¼ to 1½	2.1	7	2.1	7	1.8	6
50 to 100	2 to 4	3.0	10	3.0	10	2.4	8
150 to 250	6 to 10	4.2	14	3.0	10	3.6	12
250 & up	10 & up	Spaced as required by the Contractor's design calculations					

.2 Support pipe at changes in direction or elevation and adjacent to flexible joints, couplings, fittings, and valves within 610mm (24 in.) on each side on pipes over 40mm (1½ in.) diameter.

.2 Lateral Supports: Tie-rods in two directions or combined tension/compression members.

.3 Plastic and Fibreglass Piping:

.1 Maximum support spacing: As recommended by the manufacturer for the flow temperature in pipe.

.2 Minimum Hanger Rod Sizing: Same as listed for copper pipe.

.4 Pipe Support Hanger Rods: Galvanized steel (unless otherwise specified in the Contract Documents), round, threaded, to ASTM A36, complete with captive machine nuts with washers at hangers, sized to suit the loading in accordance with Table 3 in MSS SP-58 or the table below. When supporting multiple pipe runs rod size to be in accordance with the Contractor's design:

Table 2: Minimum Rod Diameters for Single Rigid Rod Hangers

Pipe Diameter		Hanger Rod Diameter	
mm	in.	mm	in.
to 50	to 2	9mm	3/8
65 to 75	2½ to 3	12mm	1/2
100	4	16mm	5/8
150	6	19mm	3/4
200 to 300	8 to 12	22mm	7/8

.5 Thrust Restraint:

.1 Thrust Blocks and Ties: For specified piping systems, thrust blocks, and ties at pipe joints, which are unable to transmit thrust forces, may be shown on the Contract Drawings.

.2 Piping systems shall be analyzed and designed by a professional engineer licensed to practice in the Province of Ontario, engaged by and paid by the Contractor. Such piping systems shall be provided with thrust blocks, ties and/or other restraint systems as required to resist all internal and external forces on the piping system. The Contractor-provided design shall provide as part of the shop drawing submittal process information on lateral deflection, axial strain and any resulting unbalanced forces on equipment or connecting piping systems.

.6 Duct Support Spacing:

.1 Unless otherwise specified or shown maximum duct support spacing and hanger construction shall be in accordance with Chapter 5 of SMACNA or the table below:

Table 3: Maximum Horizontal Duct Hanger Spacing

Duct Dimension	Hanger Construction
Horizontal rectangular duct	
Up to 1500 mm (60 in.) for Low Pressure Ductwork Only	Two 25 mm (1 in.) x 16 US gauge straps with two screws on side of duct one screw on bottom. Hangers shall be at each joint but in no case more than a maximum 2400 mm (96 in.) on centres.
For all sizes of Medium and High Pressure Ductwork up to 3000 mm (120 in.) and Low Pressure Ductwork from 1525 mm to 3000 mm (61 in. to 120 in.)	50 mm x 50 mm x 6 mm (2 in. x 2 in. x 1/4 in.) trapeze hanger with two 9 mm (3/8 in.) dia. rods. Hangers shall be at each joint but in no case more than a maximum 2400 mm (96 in.) on centres.
3000 mm to 6000 mm (120 in. to 240 in.)	65 mm x 65 mm x 5 mm (2-1/2 in. x 2-1/2 in. x 3/16 in.) trapeze hanger with two 9 mm (3/8 in.) dia. rods. Hangers shall be at each joint but in no case more than a maximum 1200 mm (48 in.) on centres.
Horizontal round duct	
Up to 450 mm (18 in.)	One 25 mm (1 in.) x 16 US gauge hanger ring supported from one 25 mm (1 in.) x 16 US gauge hanger strap. Hanger shall be at each joint but in no case more than a maximum 2400 mm (96 in.) on centres.
475 mm to 900 mm (19 in. to 36 in.)	One 25 mm (1 in.) x 12 US gauge hanger ring supported from 25 mm (1 in.) x 12 US gauge hanger strap. Hanger shall be at each joint but in no case more than a maximum 2400 mm (96 in.) on centres.
925 mm to 1250 mm (37 in. to 50 in.)	One 25 mm (1 in.) x 12 US gauge hanger ring supported from 25 mm (1 in.) x 12 US gauge hanger strap. Hanger shall be at each joint but in no case more than a maximum 2400 mm (96 in.) on centres.
1275 mm to 2100 mm (51 in. to 84 in.)	Two 40 mm (1-1/2 in.) x 12 US gauge hanger connected to the 32 mm x 32 mm x 3 mm (1-1/4 in. x 1-1/4 in. x 1/8 in.) angle girth reinforcing of duct hanger. Hangers shall be at each joint but in no case more than a maximum 2400 mm (96 in.) on centres.

.2 Support all vertical ducts at each floor, on all sides, with angle riveted to the ducts.

.3 Support all horizontal ducts within 610mm (24 in.) of each elbow and within 1200mm (48in.) of each branch intersection.

.4 Flexible duct lengths greater than 2,400 mm (84 in.) shall be supported at the midpoint with strap hangers.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 10 00 - General Requirements.

.2 Deliver materials to site in original factory packaging, labelled with the Manufacturer's name and address.

.3 Store at temperatures and conditions recommended by the Manufacturer.

2 Products

2.1 GENERAL

.1 Pipe hanger and support materials, including accessories, shall be, unless otherwise specified in the Contract Documents, constructed in accordance with the MSS Standard Practice Manual SP-58, “Pipe Hangers and Supports – Materials, Design and Manufacture”, and, where possible, MSS designations are indicted with each product.

.2 Ductwork hanger and support materials, including accessories, shall be, unless otherwise specified in the Contract Documents, constructed in accordance with the SMACNA, “HVAC Duct Construction Standards”.

.3 All pipe hangers and exposed ductwork hangers shall be zinc plated unless otherwise noted in the Contract Documents.

.4 Hangers and supports for insulated piping and ductwork shall be sized to fit around the insulation and covering.

.5 All pipe hangers and supports shall be manufactured to the latest requirements of MSS-SP-58. Where applicable, design and manufacture of hangers and supports shall also conform to ANSI/ASME Code for Pressure Piping B31.1

.6 When specified proprietary pipe support items are not available, fabricate pipe supports of the specified material and to the general configuration indicated by the Contract Drawings.

.7 Special support and hanger details as designed by the Contractor may be used for cases where standard catalogue supports are inapplicable or unpractical.

2.2 HORIZONTAL SUSPENDED PIPING

.1 Adjustable Clevis Type: MSS SP 58, Type 1.

.1 Anvil International Inc.; Fig. 260

.2 Cooper B Line Inc.; Fig. B3102

.2 Adjustable Split Ring Pipe Clamp: MSS SP 58, Type 6 or 12.

.1 Anvil International Inc.; Fig. 104

.2 Cooper B Line Inc.; Fig. B3198H

.3 Adjustable Swivel Ring Band: MSS SP 58, Type 10

.1 Anvil International Inc.; Fig. 69

.2 Cooper B Line Inc.; Fig. B3170

.4 Adjustable Roller Hanger c/w Steel Protection Saddle: MSS SP 58, Type 41, 43 or 45 c/w Type 39

.1 Anvil International Inc.; Fig. 171, 177 or 181 c/w Figure 160 to 166A

.5 Hanger Rods, Clevises, Nuts, Sockets, and Turnbuckles: In accordance with MSS SP 58.

.6 See section 2.3 “Trapeze Support System”

2.3 TRAPEZE TYPE SUPPORT SYSTEMS

.1 Trapeze Hanger/Support: MSS SP 58, Type 59

.2 Channel Size: As designed by contractor. Minimum 12 gauge, 1 5/8 inch wide steel. Minimum 1 1/2 inch wide FRP.

.3 Members and Connections: Design for all loads with safety factor of 5.

.4 Pipe Anchors Type: Galvanized steel anchor chair with U bolt strap.

.5 Manufacturers:

.1 Anvil International Inc.; Power Strut.

.2 Cooper B Line Inc.; Strut System.

.3 Unistrut Corporation.

.4 TYCO Inc. - Aickenstrut (FRP).

.5 Gripple Inc.

2.4 HORIZONTAL PIPE ON VERTICAL SURFACES:

.1 Steel offset pipe clamp:

.1 Anvil International Inc.; Fig. 103

.2 E. Myatt & Co. Inc. Fig. 170

.2 J-Hanger, MSS SP 58, Type 5:

.1 Anvil International Inc.; Fig. 262

.2 Cooper B Line Inc.; Fig. B3690

.3 See section 2.5 “Wall Brackets”

2.5 WALL BRACKETS

.1 Welded Steel Bracket: MSS SP 58 and SP 69, Type 33 (heavy-duty).

.1 Anvil International Inc.; Fig. 199

.2 Cooper B Line Inc.; Fig. B3067

.2 Pipe Anchors Type: Galvanized steel anchor chair with U bolt strap.

.3 One Hole Clamp: Anvil International Inc.; Figure 126.

.4 Channel Type:

.1 Unistrut Corporation.

.2 Anvil International Inc.; Power Strut.

.3 Cooper B Line Inc.; Strut System.

.4 TYCO Inc. - Aickenstrut (FRP).

.5 Gripple Inc.

2.6 VERTICAL RISERS THROUGH FLOORS:

.1 Riser clamp, MSS SP 58, Type 8:

.1 Anvil International Inc.; Fig 121,

.2 E. Myatt & Co. Inc. Fig. 151

.2 Heavy-duty steel riser clamp MSS SP 58, Type 8:

.1 Anvil International Inc.; Fig. 261

.2 E. Myatt & Co. Inc.; Fig's. 182,183, 190 and 191

.3 Base of Vertical Risers: Support for vertical risers in excess of 6 m (20') high extending out from base mounted equipment shall consist of a base elbow support with flange Empire Tool & Mfg. Co. Fig. 830 or approved equivalent.

2.7 VERTICAL PIPING ON VERTICAL SURFACES:

.1 Adjustable Split Ring Pipe Clamp: MSS SP 58, Type 6 or 12.

.1 Anvil International Inc.; Fig. 104

.2 Cooper B Line Inc.; Fig. B3198H

.2 Steel offset pipe clamp:

.1 Anvil International Inc.; Fig. 103

.2 E. Myatt & Co. Inc. Fig. 170

.3 Heavy-duty steel pipe strap: MSS Type 26

.1 Anvil International Inc.; Fig. 262

.2 E. Myatt & Co.; Fig. 161

2.8 PIPE GUIDES

.1 Intermediate Guides:

.1 Piping 150 mm and Smaller: Specify the use of pipe clamp with oversize pipe sleeve to provide a minimum of 3 mm of clearance.

.1 Manufacturers:

.1 Kin Line, Inc., Figure 417.

.2 Grinnell (division of Tyco Fire Products LP): Power Strut, Figure P5932.

.2 Piping 200 mm and Larger: Specially formed U bolts with double nuts to provide a minimum clearance of 6 mm around pipe.

.1 U Bolt Stock Size:

.1 200 mm Pipe: 16 mm U bolt.

.2 250 mm Pipe: 400 mm U bolt.

.3 300 through 400 mm Pipe: 22 mm U bolt.

.4 450 through 760 mm Pipe: 25 mm U bolt.

.2 Alignment Guides:

.1 Piping 200 mm and Smaller: Galvanized steel spider or sleeve type.

.2 Piping 250 mm and Larger: Galvanized roller type guides.

.3 Manufacturers:

.1 Vibrant Power Inc.

.2 Senior Flexonics Canada Ltd.

.3 Kin-Line Inc.

2.9 THERMAL BREAKS

.1 All insulated piping shall be provided with a continuous thermal break between the outer pipe diameter and the pipe hanger/support.

.2 Calcium silicate (or approved equivalent high density insulation) pre-insulated support shield c/w galvanized steel jacket.

.3 Manufacturers:

.1 Cooper B Line Inc.; B3380 thru B3387

.2 National Pipe Hanger Corp.; Pro-Shield

2.10 ACCESSORIES

.1 I-Beam Clamp: Concentric loading type, MSS SP 58, Type 21, 28, 29, or 30, which engage both sides of flange.

.2 Concrete Insert: MSS SP 58, Type 18, continuous channel insert with load rating not less than that of the hanger rod it supports.

.3 Concrete Anchors: Hilti (Canada) Co. type HIT or HSL anchors of size and numbers to resist the design loads based on a Factor of Safety (FOS) of 5.

.4 All fasteners to be sized by the equipment manufacturer.

.5 Insulation Saddle:

.1 Type: Galvanized steel or stainless steel, MSS SP 58 and SP 69, Type 40.

.2 Manufacturers and Products:

.1 Anvil International Inc.; Figure 167.

.2 Cooper B Line Inc.; Figure B3151.

2.11 SPECIAL HANGERS AND SUPPORTS:

.1 **Vibration isolated supports** – Black steel riser clamps as specified above, complete with vibration isolation pads Vibro-Acoustics Ltd. type “NSN” between the clamp and the floor or approved equivalent.

.2 **For groups of pipes having the same slope** – Welded steel brackets Anvil Fig. 195 or approved equivalent, universal trapeze assemblies Anvil Fig. 46, or Unistrut Corporation or approved equivalent assemblies, all with U-bolts, clamps, etc., to secure pipes in place. For pipes 150 mm ("6) and greater Anvil Fig. AS 911 pipe roller with Anvil Fig. 160 to 166A – MSS SP 58, Type 39 steel protection saddle or approved equivalent.

.3 **For sections of piping connected to vibration isolated equipment** – hangers and supports as specified above but complete with MSS SP 58, Type 48 spring cushions.

.4 **For plastic piping** – generally as specified above but in accordance with the pipe manufacturer’s printed recommendations.

.5 **For bare copper piping** – generally as specified above but factory vinyl coated to prevent contact between the pipe and hanger.

3 Execution

3.1 INSTALLATION OF PIPING SUPPORTS

.1 General:

.1 Install pipe support systems in accordance with MSS SP 58, unless shown otherwise on the Contract Drawings.

.2 Support piping connections to equipment by pipe support and not by the equipment.

.3 Support large or heavy valves, fittings, and appurtenances independently of connected piping.

.4 No pipe shall be supported by any other pipe located above, below or beside it.

.5 Do not install pipe supports and hangers in equipment access areas or bridge crane runs.

.6 Brace hanging pipes against horizontal movement by both longitudinal and lateral sway bracing and to reduce movement after startup.

.7 Install sway prevention bracing for all suspended piping in accordance with the requirements of OBC.

.8 All drilling for hangers, rod inserts and work of similar nature shall be done by Mechanical Division.

.9 Install pipe anchors where required to withstand expansion thrust loads and to direct and control thermal expansion.

.10 Repair mounting surfaces to their original condition after attachments are made.

.11 Install concrete anchors in accordance with the Manufacturer's printed instructions.

.12 Install resilient hangers in accordance with Section 20 05 48 – Vibration & Noise Control.

.2 Standard Pipe Supports:

.1 Horizontal Suspended Piping:

.1 Single Pipes: Adjustable swivel ring, split ring, or clevis hangers.

.2 Grouped Pipes: Trapeze hanger systems.

.3 Furnish galvanized steel protection shield and oversized hangers for insulated pipe.

.4 Furnish precut sections of rigid insulation with vapor barrier at hangers for insulated pipe.

.2 Horizontal Piping Supported From Vertical Surface:

.1 Single Pipes: Wall brackets or J-Hangers attached to wall with anchors. Clamps attached to wall mounted framing are also acceptable.

.2 Stacked Piping:

.1 Wall mounted framing system and clamps acceptable for piping smaller than 75 mm minimal diameter.

.2 Piping clamps that resist axial movement of pipe through support are not acceptable.

.3 Wall mounted piping clamps are not acceptable for insulated piping.

.4 Vertical Pipe: Support with wall brackets and base elbow or riser clamps on floor penetrations.

.5 Standard Attachments:

.1 To Concrete Ceilings: Concrete anchors.

.2 To Steel Beams: I beam clamp or welded attachments.

.3 To Wooden Beams: Lag screws and angle clips to members a minimum of 62.5 mm thick.

.4 To Concrete Walls: Concrete inserts or brackets or clip angles with anchor bolts.

.3 Intermediate and Pipe Alignment Guides:

.1 Provide pipe alignment guides (or pipe supports that provide same function) at expansion joints and loops.

.2 Guide piping on each side of expansion joint or loop at 4 and 14 pipe diameters from each joint or loop.

.3 Install intermediate guides on metal framing support systems not carrying pipe anchor or alignment guide.

.4 Accessories:

.1 Insulation Shield: Install on insulated piping. Oversize rollers and supports.

.2 Welding Insulation Saddle: Install on insulated steel pipe. Oversize rollers and supports.

.3 Vibration Isolation Pad: Install under base flange of pedestal type pipe supports adjacent to equipment, and where required to isolate vibration.

.1 Dielectric Barrier: 6.4 mm by 75 mm neoprene rubber wrap, oversize clamps

.2 Where factory applied electrical isolation between carbon steel members and copper is not possible wrap pipe with neoprene strip at hanger

.3 Install neoprene between stainless steel supports and non-stainless steel ferrous metal piping.

3.2 INSTALLATION OF DUCT SUPPORTS

.1 All drilling for hangers, rod inserts and work of similar nature shall be done by Mechanical Division.

.2 Hang all ductwork securely and in a rigid manner. Provide hangers as described in Section 1.5 “Design Requirements”

.3 **Rectangular Duct Support Inside Building:** Support horizontal rectangular ducts inside the building in accordance with SMACNA HVAC Duct Construction Standards Metal and Flexible, but use trapeze hangers with galvanized steel channels and galvanized steel hanger rods for all ducts that are exposed, and all concealed ducts wider than 500 mm (20 in.).

.4 **Round and Flat Oval Duct Support Inside Building:** Support round and flat oval ducts inside the building in accordance with SMACNA HVAC Duct Construction Standards Metal and Flexible. Unless otherwise specified in the Contract Documents, for both uninsulated and insulated ducts exposed in finished areas use bands and secure at the top of the duct to a hanger rod, all similar to Ductmate Canada Ltd. type "BA". If the duct is insulated, size the strap to suit the diameter of the insulated duct.

.5 **Flexible Duct Support Inside Building:** Unless otherwise specified in the Contract Documents support in accordance with requirements of SMACNA HVAC Duct Construction Standards Metal and Flexible.

3.3 FIELD FINISHING

.1 Paint: As specified in Section 09 90 00 – Painting.

END OF SECTION

1 General

1.1 SCOPE

.1 Furnish and Install a complete cUL Listed, CSA Certified, or FM approved system of heating cables, components, and controls to provide freeze protection of piping, similar to Raychem.

1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS

.1 Refer to and comply with the following sections:

.1 Section 20 05 00 – General Mechanical Provisions

.2 Section 20 05 53 – Labeling and Identification

.3 Section 20 05 93 – Testing, Adjusting and Balancing

.4 Division 25 – Controls

.5 Division 26 – Electrical

1.3 QUALITY ASSURANCE

.1 The electric heat-tracing system shall conform to this specification. It shall be designed, manufactured and tested in accordance with the requirements stated in the applicable CSA, FM, IEEE and UL standards and Canadian Electrical Codes

2 Products

2.1 MATERIALS

.1 Accepted vendors: Raychem, Pyrotenax, Serge Baril, Thermon

.2 Freeze-Protection Systems (Domestic water, chiller water, condenser water, sanitary and storm drain lines, sprinkler system)

.1 The heating cable shall consist of two 16 AWG or larger nickel-plated copper bus wires, embedded in a self-regulating polymeric core that controls power output so that the cable can be used directly on plastic or metallic pipes. Cables shall have a temperature identification number (T-rating) of T6 (185°F or 85°C) without use of thermostats.

.2 A ground-fault protection device set at 30 mA, with a nominal 100-ms response time, shall be used to protect each circuit.

.3 The heating cable shall have a tinned copper braid wire with a cross-sectional area being equal to or greater than conductor cross-sectional area. The braid shall be protected from chemical attack and mechanical abuse by a modified polyolefin or fluoropolymer outer jacket. In order to conserve energy and to prevent overheating, the heating cable shall have a self-regulating factor of at least 90 %. The self-regulation factor is defined as the percentage reduction, without thermostatic control, of the heating cable output going from 4.4°C (40°F) pipe temperature operation to 65.6°C (150°F) pipe temperature operation.

.4 In order to ensure that the self-regulating heating cable does not increase power output when accidentally exposed to high temperatures, resulting in thermal runaway and self-ignition, the cable shall produce less than 0.5 watts per foot (1.64 watts per meter) when energized and heated to 350°F (177°C) for 30 minutes. After this test, if the cable is reenergized, it must not have an increasing power output leading to thermal runaway. F. The heating cable shall be self-regulating heater, with continuous exposure (maintain) capability up to 150°F (65°C) and intermittent exposure capability up to 185°F (85°C).

Pipe size mm (inches)	Minimum Ambient Temperature -17.8°C (0°F)	-28.9°C (-20°F)
100 (4") or less	16.4 (5) Watts	16.4 (5) Watts
150 (6")	16.4 (5) Watts	26.2 (8) Watts
200 (8")	16.4 (5) Watts	26.2 (8) Watts
250 (10") or more	16.4 (5) Watts	2 strips of 16.4 (5) Watts

.3 Freeze Protection and Process Temperature Maintenance (Heating water and steam lines)

.1 The heating cable shall consist of two 14 AWG nickel-plated copper bus wires, separated by a fluoropolymer spacer and helically wrapped with a selfregulating fluoropolymer fiber that controls power output so that the cable has an unconditional temperature identification number (T-rating) of T2C (446°F or 230°C) or lower without use of thermostats.

.2 A ground-fault protection device set at 30 mA, with a nominal 100-ms response time, shall be used to protect each circuit.

.3 The heating cable shall have a tinned copper braid wire with a cross-sectional area being equal to or greater than conductor cross-sectional area. The braid shall be protected from chemical attack and mechanical abuse by a fluoropolymer outer jacket.

.4 The heating cable shall be self-regulating heater, for continuous exposure (maintain) capability up to 300°F (150°C) and intermittent exposure capability up to 482°F (250°C or 250 psi steam).

2.2 COMPONENTS

.1 All heating-cable components shall be cUL Listed, CSA Certified, or FM Approved for use as part of the system to provide pipe freeze protection. Component enclosures shall be rated NEMA 4X to prevent water ingress and corrosion. Installation shall not require the Installing Contractor to cut into the heating-cable core to expose the bus wires. All components that make an electrical connection shall be re-enterable for servicing.

.2 No component shall use silicone to seal the electrical connections. An exception will be made in areas where a conduit transition is required.

2.3 SYSTEM CONTROL

.1 Thermostatic Control–Line Sensing

.1 The system shall be controlled by a line sensing thermostat (AMC-F5) set at 4.4°C (40°F) either directly or through an appropriate contactor.

.2 No heat tracing circuit shall extend more than 600mm (24") beyond a point where such junctions permit optional flow paths. In such cases, separately controlled tracers shall be used.

.3 Separately controlled heating circuits shall be provided on dead end legs and closed bypasses.

.4 Where the rating of the thermostat would be exceeded, it shall be used in conjunction with a relay or contactor.

2.4 OTHER

.1 Provide an electrical pipe tracing system as indicated on the drawings and specified herein.

.2 Connect heat trace power supply from disconnect switches provided by Division 26 - Electrical. Refer to Division 26 – Electrical drawings for exact locations. Co-ordinate power requirements with Division 26 – Electrical.

.3 Provide electric tracing for the following services:

.1 All domestic water piping (cold, hot, hot recirculation), including humidification make-up, cooling tower make-up, and irrigation supply in unheated areas or outside the building.

.2 All sanitary and storm drain lines in unheated areas except parking drain sanitary system.

.3 Humidifier drain lines, cooling tower overflow and bleed-off lines, spray water pumps and piping, exposed on roof.

.4 All heating water lines in unheated areas, except glycol heating system.

.5 All fire standpipe and wet sprinkler lines in parking garage.

.6 Drum drips on the dry sprinkler system.

2.5 SHOP DRAWINGS

.1 Provide shop drawings for:

.1 heat trace cables

.2 temperature controls and ancillaries

.3 accessories including banding.

2.6 ELECTRICAL EQUIPMENT AND WORK

.1 Read together with Division 26 – Electrical and adhere to its requirements. Supply and install all electrical apparatus, which is required and is not covered by Division 26 – Electrical.

.2 The entire design and installation shall comply with the Electrical Code and all applicable regulations.

3 Execution

3.1 GENERAL

.1 The cable shall be fastened to each end of the pipe with pipe straps. Fasten middle of cable to middle of pipe leaving equal slack on either side. Fasten at the middle of the remaining lengths, repeating depending on length of pipe. The loops shall be formed around pipe and fastened at intervals not exceeding 450mm (18").

.2 Extra cable shall be used at points such as valves and flanges to compensate for increased heat loss.

.3 Use Cupron tie wire, 16 AWG or larger on irregularly shaped objects such as valves. Tie wire and strapping shall be snug but not cut or indent the sheath.

.4 Provide thermostatic control. Locate bulb and capillary of thermostat as far from heating cable as possible, ensure that bulb does not contact heating cable.

.5 After installation, before and after installing the thermal insulation, subject heating cable to testing using a 2500-VDC Megger. Minimum insulation resistance shall be 20 megohms or greater.

.6 All terminations shall be protected from the weather and from physical damage.

.7 Any field alternations or deviations shall proceed only after authority via signed change order has been issued by Consultant. All changes shall be accurately recorded by the Contractor and shall be turned over to the Consultant upon completion of the work.

.8 Junction boxes, thermostats, and the like shall not be attached to the insulation, but shall be mounted on brackets fabricated of galvanized angle, channel or other material of sufficient strength to support equipment mounted on them.

.9 Hydrostatically test all piping prior to installation of tracing cables.

.10 Apply “Electric Traced” labels to the outside of the thermal insulation.

END OF SECTION

1 General

1.1 SUMMARY

.1 This section covers the supply and installation of the complete vibration isolation system for all equipment, ductwork, and piping covered by the Mechanical Contractor.

.2 This specification should be read in conjunction with Section 23 21 13 - Hydronic Piping Specialties and Section 22 11 16 - Domestic Water Piping Specialties for flexible pipe connections and Section 23 33 00 - Air Duct Accessories for the acoustical treatment of ductwork.

1.2 RELATED REQUIREMENTS

.1 Section 20 05 00 – General Requirements.

.2 Section 20 05 29 – Hangers and Supports.

1.3 REFERENCES

.1 American Society of Heating, Refrigerating, and Air Condition Engineers (ASHRAE)

.1 ASHRAE Handbook: HVAC Applications “Chapter 43 Sound and Vibration Control”

.2 Ontario Building Code 2012 (OBC)

1.4 SUBMITTALS

.1 Submit shop drawings in accordance with Section 01 33 00 – Submittal Requirements.

.2 Shop Drawings:

.1 Provide the manufacturer's product literature and datasheets for all components listed in this specification.

.2 Include full details of design criteria, schematics, specifications, installation procedures and instructions.

.3 Closeout Submittals:

.1 Provide maintenance data for incorporation into O&M manual.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver materials to site in original factory packaging, labelled with the Manufacturer's name and address.

.3 Store at temperatures and conditions recommended by the Manufacturer.

2 Products

2.1 GENERAL

.1 All equipment provided for vibration isolation shall be new and manufactured specifically for the purpose intended.

.2 All vibration isolation devices shall be Vibro-Acoustics, Kinetics Noise Control or Mason Industries and shall be one manufacturer throughout the project.

.3 Provide vibration isolation with integral seismic restraint for equipment intended to provide restraint from seismic and wind forces. Housings shall be capable of withstanding the applicable design forces for the specific installation. Installation shall be in accordance with Section 20 05 50 - Seismic Restraint Systems.

2.2 VIBRATION ISOLATION

.1 **Type DDNH (Double Deflection Neoprene Hangers)**

.1 Type DDNH shall consist of a molded neoprene isolating element in a steel hanger box. A neoprene sleeve shall be provided where the lower hanger rod passes through the steel hanger box, such that the hanger rod cannot contact the steel. The diameter of the clear hole in the hanger box shall be at least 19mm larger than the diameter of the hanger rod and permit the hanger rod to swing through a 30 degree arc. When installed the hanger box shall be allowed to rotate through a full 360 degrees without encountering an obstructions.

.2 Unless otherwise specified the static deflection of DDNH hangers shall be 8mm.

.3 Acceptable Manufacturers:

.1 Vibro-Acoustics; Model RHD.

.2 Kinetics; Model RH.

.3 Mason Industries; Model HD.

.2 **Type SPH (Spring Hangers)**

.1 Type SPH shall consist of a steel spring and welded steel housing. Spring diameter and hanger box hole shall be large enough to permit the hanger rod to swing through a 30 degree arc. A neoprene sleeve shall be provided where the lower hanger rod passes through the steel hanger box, such that the hanger rod cannot contact the steel hanger. The diameter of the clear hole in the hanger box shall be at least 19 mm (3/4 in.) larger than the diameter of the hanger rod. When installed, the spring element shall not be cocked, and the hanger box shall be allowed to rotate through a full 360 degree arc without encountering any obstructions.

.2 Unless otherwise specified, the static deflection of SPH hangers under actual load conditions shall be 50 mm (2 in.).

.3 Acceptable Manufacturers:

.1 Vibro-Acoustics; Model SH.

.2 Kinetics; Model SH.

.3 Mason Industries; Model 30.

.3 **Type SPNH (Spring and Neoprene Hangers)**

.1 Type SPNH shall be as above with the addition of a neoprene element in series with the spring. The neoprene element shall have a deflection of not less than 9mm with a strain not exceeding 15%. Unless otherwise specified, the static deflection of SPNH hangers under actual load conditions shall be 50 mm (2 in.).

.2 Acceptable Manufacturers:

.1 Vibro-Acoustics; Model SHR.

.2 Kinetics; Model SRH.

.3 Mason Industries; Model 30N.

.4 All spring mounts shall be complete with levelling devices 6 mm (1/4 in.) thick ribbed neoprene sound pads and completely colour coded stable springs.

.5 Where steel spring isolation systems are described in the specifications, the mounting assemblies shall utilize bare springs with the spring diameter not less than 80% of the loaded operating height of the spring. Each spring isolator shall be designed and installed so that the ends of the spring remain parallel during and after spring installation.

.6 All isolators shall operate in the linear portion of their load versus deflection curve. Load versus deflection curves shall be furnished by the manufacturer, and must be linear over a deflection range of not less than 50% above the design deflection.

.7 All vibration isolators shall have either known undeflected heights of calibration markings to that, after adjustment, verified, thus determining that the load is within the proper range of the device and that the correct degree of vibration isolation is being provided according to design.

3 Execution

3.1 GENERAL

.1 Obtain one copy of all Shop Drawings of equipment to be isolated showing weights, shaft centres and all dimensions.

.2 On system start-up, inspect the complete installation and provide a report in writing.

.3 Furnish concrete bases, including concrete fill, on springs or other vibration isolation materials for mechanical isolation.

.4 All floor mounted equipment shall be erected on concrete housekeeping pads, with thickness as identified, over the complete floor area of the equipment, unless shown or specified otherwise. Wherever vibration eliminating devices and/or concrete inertia pads are specified, these items shall be mounted on concrete housekeeping pads.

.5 Furnish and install neoprene mounting sleeves for hold-down bolts to prevent any metal to metal contact.

.6 All equipment shall be provided with lateral restraining isolators as required to limit horizontal motion to 6mm maximum, under all operating conditions. Lateral restraining isolators shall have the same static deflection as equipment being isolated.

.7 Piping, ductwork, conduit or mechanical equipment shall be supported from building structure, not hung from or supported on other equipment, pipes, or ductwork.

.8 Equipment connected to water or other fluid piping shall be erected on isolators or isolated foundations at correct operating heights prior to connection of piping, and blocked-up with temporary shims to final operating height. When the system is assembled and fluid is added, the isolators shall be adjusted to allow removal of the shims.

.9 All mechanical equipment not specifically identified in this Section that contains rotating or vibrating elements, and any associated electrical apparatus installed by this Division that contains transformers or inductors shall be installed on Type DDNM, MEP, or EP isolators as appropriate.

.10 All wiring connections to mechanical equipment on isolators shall be made with a minimum long flexible conduit installed in a slack “U” shape.

.11 Springs shall be designed and installed so that ends of springs remain parallel and all springs installed with adjustment bolts.

.12 Springs shall be sized to be non-resonant with equipment forcing frequencies or support structure natural frequencies.

3.2 INSTALLATION OF VIBRATION ISOLATION

.1 Unit Heaters suspended from overhead structure shall be hung on Type SPNH spring isolators. The static deflection of the isolators shall be 50 mm (2 in.).

.2 Suspend all piping in Mechanical Rooms on Type SPH or SPNH isolators as required. Where piping is supported from the floor, weld brackets to the piping and support on Type SPNM isolators. Isolators do not replace constant support hangers or mounts.

.3 The first isolator both upstream and downstream of equipment on springs shall have a static deflection of 1.5 times the deflection of the vibration isolated equipment to a maximum of 50 mm (2 in.). All other piping supports shall have a static deflection of 25 mm (1 in.) minimum.

.4 Locate isolation hangers with the housing a minimum of 50 mm (2 in.) below but as close as possible to the structure. Where isolator hangers would be concealed by a non-accessible acoustical sub-ceiling, install the hangers immediately below the sub-ceiling for access.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 20 05 00 – General Requirements.

1.2 REFERENCES

.1 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.60-M, Interior Alkyd Gloss Enamel.

.2 CAN/CGSB-24.3, Identification of Piping Systems.

.2 Ontario Building Code 2012 (OBC)

1.3 DEFINITIONS

.1 For purposes of this Section:

.1 "CONCEALED" means mechanical services and equipment in suspended ceilings, non-accessible chases, and furred-in spaces.

.2 "EXPOSED" means "not concealed" as defined in this Section.

1.4 SUBMITTALS

.1 Submit shop drawings in accordance with Section 01 33 00 – Submittal Requirements.

.2 Shop Drawings:

.1 Provide manufacturer product literature identifying size, type, material and colour of labels.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver materials to site in original factory packaging, labelled with the Manufacturer's name and address.

.3 Store at temperatures and conditions recommended by the Manufacturer.

2 Products

2.1 PIPE IDENTIFICATION

.1 Mechanical Contractor shall identify piping and equipment throughout with labels and direction of flow arrows regardless of whether or not specified elsewhere. Labelling shall be as per Painting Schedule or as requested by Consultant if not covered in Schedule.

.2 **Pipe Markers and Direction Arrows:** This piping identification system lends itself to commercially available pipe markers having standard sizes of lettering and colours. Standard Colours designate classes of materials as follows, and are consistent with those specified by CAN/CGSB-24.

Colour	**Material**
Yellow	Dangerous Materials
Green	Safe Materials
Red	Fire Protection Equipment
Blue	Protective Materials

.3 Standard Pipe Identification:

.1 For pipe up to and including 150 mm (6") diameter markers shall consist of coloured, coiled, semi-rigid vinyl plastic of a length to wrap completely around the pipe, and indoor/outdoor type vinyl ink lettering and directional arrows.

.2 Stencilled lettering (black Franklin Gothic) identification and directional arrows for normal flow shall be applied by each colour band.

.3 The lettering and arrow size shall be as indicated below:

Pipe Size (mm)	**Letter Height (mm)**	**Arrow Height x Arrow Length (mm x mm)**
Greater than 65	50	50 x 150
30 to 65	25	25 x 100
Smaller than 30	12	12 x 50

.4 Pipe markers and direction arrows shall be suitable for continuous operating temperatures between -40°and 122°C.

.4 **Standard Pipe Identification Wording and Colours:** Identification wording and colours for pipe identification materials shall be as follows:

Legend	**Colour**	**Symbol**
Potable Cold Water	White/Green	DCW
Potable Hot Water	White/Green	DHW
Potable Hot Water Return	White/Green	DHWR
Tempered Potable Water	White/Green	TW
Storm Drainage	White/Green	ST
Sanitary Drainage	White/Green	SAN
Plumbing Vent	White/Green	VENT
Glycol Heating Water Supply	Black/Yellow	GHWS
Glycol Heating Water Return	Black/Yellow	GHWR

.5 **Identification Material Manufacturers:** Acceptable manufacturers of identification materials shall be equivalent SMS “Coil-Mark” pipe markers:

.1 Smillie McAdams Summerlin Ltd.

.2 W.M. Brady of Canada Ltd.

.3 Revere-Seton Inc.

.4 Embree Industries Ltd.Execution

2.2 EQUIPMENT IDENTIFICATION

.1 **Equipment Nameplates:** Minimum 1.6 mm (1/16") thick 2-ply laminated coloured plastic plates, white background – black lettering, minimum 12 mm x 50 mm (½" x 2") for smaller items such as damper motors and control valves, minimum 25 mm x 65 mm (1" x 2 ½") for equipment, and minimum 50 mm x 100 mm (2" x 4") for control panels and similar items. Each nameplate shall be complete with bevelled edges and engraved wording to completely identify the equipment with no abbreviations. Wording shall generally be in accordance with the Drawings but must be reviewed by the Consultant prior to engraving. Supply stainless steel screws for securing nameplates in place.

.2 **Valve Tags:** Coloured, 40 mm (1½") square, 2-ply laminated plastic with bevelled edges, red-white, green-white, yellow-black, etc., to match the piping classification colour, each complete with a 3.2 mm (1/8") diameter by 100 mm (4") long brass plated steel bead chain, and four lines of engraved maximum size identification wording. For example:

VALVE V12
200 mm
DCW
NORMALLY OPEN

2.3 DUCT IDENTIFICATION:

.1 Custom made Mylar stencils with 50 mm (2") high lettering to accurately describe the duct service, i.e. “AHU-1 SUPPLY”, complete with a directional arrow, and coloured inks with ink pads and roller applicators. Ink colours shall contrast with the lettering background.

.2 Paint: CAN/CGSB-1.60-M in colours specified in the Contract Documents. Non-specified colours to conform to CAN/CGSB-24.3.

.3 Letters shall be 50 mm high and directional flow arrows shall be 150 mm long stenciled with specified paint with the following wording:

.1 SUPPLY AIR

.2 RETURN AIR

.3 EXHAUST AIR

.4 TRANSFER AIR

3 Execution

3.1 INSTALLATION OF MECHANICAL IDENTIFICATION

.1 **Exposed Piping and Ductwork:** Identify exposed piping and ductwork in accordance with Part 2 of this Section in the following locations:

.1 At every end of every piping or duct run.

.2 Adjacent to each valve, strainer, damper and similar accessory.

.3 At each piece of connecting equipment.

.4 At every change of direction.

.5 On both sides of every pipe and duct passing through a floor, wall or partition, unless otherwise specified in the Contract Documents.

.6 At 6 m (20') intervals on pipe and duct runs exceeding 6 m (20') in length.

.7 On each side of special valves, special fittings and branch connections.

.8 At least once in each room and at least once on pipe and duct runs less than 6 m (20') in length.

.2 **Concealed Piping and Ductwork:** Identify concealed piping and ductwork in accordance with Part 2 of this Section in the following locations:

.1 At points where pipes or ducts enter and leave rooms, shafts, pipe chases, furred spaces, and similar areas.

.2 At maximum 6 m (20') intervals on piping and ductwork above suspended accessible ceilings, and at least once in each room.

.3 At each access door location.

.4 At each piece of connected equipment, automatic valve, etc.

.3 **Equipment:** Provide an identification nameplate for each piece of equipment, including items such as control valves, motorized dampers, instruments, and similar products. Secure nameplates in place with stainless steel screws unless such a practice is prohibitive, in which

case use epoxy cement applied to cleaned surfaces. Locate all nameplates in the most conspicuous and readable location.

.4 **Electrical Tracing:** For all electrically traced mechanical Work, identification wording shall include the phrase “ELECTRICALLY TRACED”.

.5 **Valve Tagging and Chart:** Tag valves and prepare a valve tag chart in accordance with the following requirements:

.1 Attach a valve tag to each new valve, except for valves located immediately at the equipment they control.

.2 Prepare a typed or computer printed valve tag chart to list all tagged valves, with, for each valve, the tag number, location, valve size, piping service, and valve attitude (normally open or normally closed).

.3 Frame and glaze one copy of the chart and affix the same to a wall where later directed at the site.

.4 Include a copy of the valve tag chart in each copy of the O&M instructions.

.6 **Ceiling Tacks or Stickers:** Where shut-off valves, control dampers, and similar items which will or may need maintenance and/or repair are located above accessible suspended ceilings, provide round coloured ceiling tacks in the ceiling panel material, or stickers on the ceiling grid material to indicate locations of the items. Confirm colours prior to installation.

END OF SECTION

1 General

1.1 SUMMARY

.1 TAB means testing, adjusting and balancing equipment to ensure performance in accordance with requirements of Contract Documents and to perform all other work as specified in this section.

.2 Standard: TAB shall be performed in accordance with the most stringent of TAB standards of AABC, NEBB, SMACNA and ASHRAE.

.3 Perform TAB of all systems, equipment, components, controls specified in the Mechanical Division.

.4 TAB is to be split into two sections of work, the Mechanical Contractors testing and balancing, and the and the TAB Contractor's (see Article 1.3) testing and balancing:.

.1 Mechanical Contractor's Obligations: Leakage testing of piping, and ductwork.

.2 TAB Contractor's Obligations: Testing, adjusting and balancing of all equipment and system components (pumps, valves, fans, dampers, etc).

1.2 THE TAB CONTRACTOR

.1 The Mechanical Contractor in consultation with the Consultant shall appoint a TAB Contractor to measure and report TAB results to the Consultant. The Mechanical Contractor shall submit a proposal to the Consultant for assessment before any selection of the TAB Contractor is made. The proposal shall include:

.1 Experience in projects of this size.

.2 Labour 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 Names of all personnel proposed to perform TAB shall be submitted to and approved by the Owner within 90 days of the award of the contract.

.3 Qualifications: Personnel performing TAB shall be current member in good standing of AABC, NEBB, or NBCTA.

.4 Suggested Testing and Balancing Agents: Design Test & Balancing Co. (905-886-6513), John Price Enterprises (416-755-4676), Airwaso (519-652-4040), Technical Aire Balancing Inc (416-492-9408), Air Adjustments & Balancing Inc. (416-254-3004) and Flowset Balancing Ltd. (416-410-9793).

1.3 SUBMITTALS

.1 Pre-mobilization

.1 Submit to the Consultant, prior to the commencement of TAB, the following:

.1 Proposed methodology and procedures for performing TAB if different from referenced standard.

.2 Proposed check lists and report forms.

.2 Preliminary TAB Report

.1 Submit for checking and approval of the Consultant, prior to submission of formal TAB report, sample of rough TAB sheets. Include the following:

.1 Details of instruments used.

.2 Details of TAB procedures employed.

.3 Calculations procedures.

.4 Summaries.

.3 Tab Report

.1 TAB report shall show all results in SI units and shall include:

.1 Tabulated data from air and piping system measurements; see Article 3.5 and 3.6.

.2 Project record drawings used to show testing locations.

.3 System schematics.

.2 Submit electronic copy of the initial TAB Report to the Consultant for verification and approval, if requested submit one paper copy complete with index tabs.

.3 Provide three copies of the final TAB report. Reports shall be complete with index pages and index tabs, and certified by the TAB Contractor. Any diagram 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 the consultant.

1.4 QUALITY ASSURANCE

.1 The work specified in this section shall be performed by an Independent Agency specializing in this type of work.

.2 Balancing (of both air and piping systems) and sound level readings shall be performed by the same agency.

.3 Balancing procedures shall be in accordance with the latest, current requirements of “National Environmental Balancing Bureau” (NEBB) or “Associated Air Balance Council” (AABC), including the following:

.1 NEBB Procedural Standards For Whole Building Systems Commissioning Of New Construction;

.2 NEBB Procedural Standards For Testing Adjusting And Balancing Of Environmental Systems;

.3 NEBB Procedural Standards For Retro- Commissioning Of Existing Buildings;

.4 AABC National Standards for Total System Balance;

.5 AABC Test and Balance Procedures;

.4 TAB of systems and equipment regulated by codes, standards shall be to the satisfaction of the Ontario Building Code.

1.5 SCOPE OF TAB

.1 The following systems shall be tested, adjusted, and balanced:

.1 Air conditioning, ventilation and heating systems

.2 Air distribution (supply, return and exhaust)

.3 Miscellaneous ventilation or exhaust systems including Process dust collection.

.4 Boilers and hydronic distribution

.5 Plumbing systems

.6 All process piping including natural gas, oil, compressed air, etc.

2 Products [NOT USED]

3 Execution

3.1 PURPOSE OF TAB

.1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads.

.2 Adjust and regulate equipment and systems so as to meet specified performance requirements and to achieve specified interaction with all other related systems under all normal and emergency loads and operating conditions.

.3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.

.4 Report all values back to Consultant.

3.2 COORDINATION

.1 Schedule time required for TAB (including repairs, re-testing) into the Work construction and completion schedule so as to ensure completion prior to the acceptance of project.

.2 Perform TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.

.3 The TAB Contractor shall co-ordinate with the Mechanical Contractor to ensure that all necessary control and balancing valves (water-side) as well as manual and splitter dampers (air-side) for 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, dampers, locations, installation, etc. If this TAB Contractor 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 TAB Contractor at no cost to the Owners.

.4 The TAB Contractor shall not disconnect any control device. If the TAB Contractor 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 TAB Contractor at no cost to the Owner.

.5 The Mechanical Contractor will provide new filters, etc. required for the measurements taken by the TAB Contractor.

.6 The Mechanical Contractor shall provide copies of all Shop Drawings requested by the TAB Contractor.

.7 The Mechanical Contractor shall make staff available, as required by the TAB Contractor, to operate the equipment to take measurements and to correct any deficiencies in the mechanical systems which prevent the TAB Contractor from balancing the system.

3.3 THE MECHANICAL CONTRACTOR'S TESTING

.1 Pipework and ductwork leakage tests shall be carried out on sections of the work during construction and these sections shall be identified by reference number of the test sheet and by description of the piping or duct system. The reference identification number shall be indicated on the As-Built Drawings.

.2 All tests for systems shall be performed in the presence of, and test reports signed by the TAB Contractor. Notify the TAB Contractor in writing a minimum of one week in advance of testing.

.3 Repair any leaks or defects and repeat the tests to the satisfaction of the Consultant.

.4 Ensure access is provided to all valves, dampers, fire dampers, and other equipment that requires servicing.

.5 Start-Up and Operation of Equipment:

.1 Follow start-up procedures as recommended by the equipment manufacturer unless specified otherwise in the Contract Documents.

.2 Follow special start-up procedures specified in the Mechanical Division

.3 Operate systems for length of time required for TAB and as required by the Consultant for verification of TAB reports.

.4 Coordinate with Commissioning Agent as required.

.6 Piping System Tests:

.1 Test all piping systems for leakage in accordance with all applicable plumbing codes.

.2 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.

.3 Test pressure for domestic water, and hydronic systems shall be:

.1 1-1/2 times the system working pressure but not less than 1035 kPa (150 psig), or

.2 The maximum working pressure of expansion joints and vibration isolators.

.4 Test pressure for drainage and venting systems:

.1 Securely close all openings and pipe ends and fill piping with water up to the highest level, and ensure that the water stands at the same level for a minimum of two hours.

.2 After the fixtures and fittings are set and the pipes connected to the building drain or drains, turn on water into all pipe, fixtures, fittings and traps in order to detect any imperfect material or workmanship.

.3 Make a smoke test, ball test, or video inspection if required by the local Municipality.

.7 Air System Tests:

.1 Test all ductwork for leakage in accordance with all SMACNA Manuals and Standards.

.2 Seal ducts at all equipment connections and pressurize with a small blower.

.3 Refer to Section 23 30 00 – HVAC Ducts and Plenums, Article 3.2.9 for leakage testing requirements and pressure ratings of ductwork.

.4 The entire system shall be tested for noise, tightness of joints and proper functioning of the system. Noise tests shall be made under minimum system pressure drop conditions (highest air velocities and clean filter conditions). This Section shall make all necessary alterations and repeat the tests until satisfactory operation is achieved.

3.4 THE TAB CONTRACTOR'S TESTING AND BALANCING

.1 The TAB Contractor is responsible for balancing the systems to obtain the design conditions and shall repeat the balancing until the required conditions have been met.

.2 The TAB Contractor shall balance all air systems to ensure all fans, VAVs, FCUs, and AHUs are operating to design conditions. Adjust air volumes and control settings under maximum system pressure drop conditions by means of balancing dampers and record balance position.

.3 The TAB Contractor shall balance all piping systems to ensure all boilers, chillers, pumps, heat exchangers, AHUs, FCUs, cabinet/unit/other heaters, domestic hot water balancing valves, etc,

are operating to design conditions. Adjust the circuits by means of the balancing valves and record balance position.

.4 Pre-Tab Review:

.1 Review contract documents prior to the commencement of the Work and confirm in writing to the Consultant adequacy of provisions for TAB and all other aspects of design and installation pertinent to success of TAB.

.2 If testing procedures are to deviate from the specified standards provide the Consultant with all proposed procedures for acceptance.

.3 During construction, co-ordinate location and installation of all TAB devices, equipment, accessories, measurement ports and fittings.

.5 Instruments:

.1 Prior to TAB work, submit to the Consultant a list of instruments to be used for TAB together with serial numbers.

.2 Calibrate the instruments in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.

.3 Calibrate the instruments within 3 months of the performance of TAB work. Provide certification of calibration to the Consultant.

.6 Tolerances:

.1 Perform TAB in accordance with the following application tolerances of design information:

.1 Piping systems: Plus or minus 10%.

.2 Air systems: Plus or minus 5%.

.2 Accuracy of measured values shall be accurate to within plus or minus 2% of actual values.

.7 Start-up of TAB:

.1 Notify the Commissioning Agent and the Consultant seven (7) days prior to start of TAB.

.2 Start TAB only when the building is essentially completed, including the following components:

.1 Installation of ceilings, doors, windows, other construction affecting TAB.

.2 Application of weather stripping, sealing, caulking.

.3 All pressure, leakage, other tests specified elsewhere; Division 22, 23, 25.

.4 All provisions and components for TAB installed and operational.

.5 Start-up and verification of proper, normal and safe operation of all mechanical systems and associated electrical/control systems affecting TAB including but not limited to:

.1 Proper thermal overload protection in place for electrical equipment.

.2 Air systems:

.1 Filters.

.2 Duct systems clean.

.3 Ducts, air shafts, ceiling plenums are airtight to within specified tolerances.

.4 Correct fan rotation.

.5 Fire, smoke, volume control dampers installed and open.

.6 Coil fins combed, clean.

.7 Duct access doors installed, closed.

.8 All outlets installed, volume control dampers open.

.3 Piping systems:

.1 Flushed, filled and vented.

.2 Correct pump rotation.

.3 Strainers in place, baskets clean.

.4 Isolation, check, and control valves installed, open.

.5 Calibrated balancing valves installed, at factory settings.

.6 Chemical treatment systems complete, operational.

.3 The TAB Contractor shall balance the air and piping systems as described in Articles 3.5 and 3.6 of this Section. TAB Contractor shall submit an initial TAB Report for Verification.

.8 Verification:

.1 After initial balancing all reported results are subject to verification by the Consultant.

.2 In all cases where measurements by the TAB Contractor show failure to comply with the Drawings and Specifications, the Contractor shall change fan sheaves, etc., as required, and new balancing measurements shall be made by the TAB Contractor.

.3 At the time of final review, recheck in the presence of the Consultant random selections of air quantities and fan 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.

.4 At the time of verification measure space temperature and humidity in a representative number of rooms to verify performance. Tabulate these results and bind into certified report as an appendix.

.5 Number and location of verified results shall be at the discretion of the Consultant. A measured flow deviation of more than 10% between the verification reading and the reported data shall be considered as failing the verification procedure.

.6 Bear costs to repeat TAB and submit new certified reports as required to the satisfaction of the Consultant.

.9 Completion of TAB:

.1 TAB shall be considered complete when the final TAB Report is received and approved by the Consultant.

.2 After TAB is competed to satisfaction of the Consultant, replace drive guards, close all access doors, lock all devices in set positions, ensure sensors are at required settings.

.3 Following final acceptance of the certified reports by the Consultant, permanently mark the settings of all valves, dampers, splitters and other adjustable devices so that balance set position can be restored if disturbed at any time. Do not mark such devices until after final acceptance.

.4 Ensure all thermostats and controls are set to give specified conditions and include settings is report.

3.5 AIR SYSTEMS TESTING BY TAB CONTRACTOR

.1 Measurements: shall include, but not be limited to the following as appropriate for systems, equipment, components, controls:

.1 Air velocity, static pressure, flow rate, pressure drop (or loss), temperatures (dry bulb, wet bulb, dew point), duct cross-sectional area, RPM, electrical power, voltage, noise, vibration.

.2 Locations of equipment measurements shall include, but not be limited to the following as appropriate:

.1 Inlet and outlet of each damper, filter, coil, fan, other equipment causing changes in conditions, at each controller, controlled devices.

.3 Locations of systems measurements shall include, but not be limited to following as appropriate:

.1 Each main duct, main branch, sub-branch, or run-out (or grille, register or diffuser).

.4 Duct traverse readings shall be taken through the access ports provided. Where no access ports have been provided new holes shall be made as required. These holes shall be resealed after final readings with sheet metal cover plates and sealant. Duct tape is not acceptable. Where insulation is damaged it shall be repaired including the vapour barrier in an approved manner. Duct tape is not acceptable.

.5 Fans on all systems shall be set up to give the minimum discharge pressure required to overcome the resistance of the box, discharge ductwork and diffusers.

3.6 PIPING SYSTEMS TESTING BY TAB CONTRACTOR

.1 Measurements: shall include, but not be limited to the following as appropriate for systems, equipment, components, controls:

.1 Liquid velocity, pressure, flow rate, pressure drop (or loss), temperatures, RPM, electrical power, voltage, noise, vibration.

.2 Locations of equipment measurements shall include, but not be limited to following as appropriate:

.1 Inlet and outlet of each heater, tank, pump, circulator, at each controller, controlled device, or fixture. (Includes both hydronic and plumbing systems)

.3 Locations of systems measurements shall include, but not be limited to following as appropriate:

.1 Each main, main branch, branch, or sub-branch.

.4 Flow through all coils, heat exchangers, 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.

.5 If the design conditions cannot be met by adjusting the balancing valves throughout the system, or by the adjusted the VFD settings, then pump impellers shall be either changed or trimmed as required.

END OF SECTION

1 General

1.1 SUMMARY

.1 This Section covers the selection and installation of plumbing, process, and building mechanical piping insulation as well as the selection and installation of ductwork insulation unless additional requirements have been detailed elsewhere in the Contract Documents.

1.2 RELATED REQUIREMENTS

.1 Section 20 05 00 – General Requirements.

.2 Section 20 05 29 – Hangers and Supports.

.3 Section 22 11 19 – Domestic Water Piping.

.4 Section 22 11 20 – Drainage, Waste and Venting Piping.

.5 Section 23 31 00 – HVAC Ducts and Plenums.

.6 Section 23 57 19 – Hydronic Piping.

1.3 REFERENCES

.1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

.1 ANSI/ASHRAE/IESNA 90.1, SI; Energy Standard for Buildings Except Low-Rise Residential Buildings.

.2 American Society for Testing and Materials International, (ASTM)

.1 ASTM B 209M, Specification for Aluminum and Aluminum Alloy Sheet and Plate (Metric).

.2 C165: Standard Test Method for Measuring Compressive Properties of Thermal Insulations

.3 ASTM C 177, Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.

.4 ASTM C 240, Standard Test Methods of Testing Cellular Glass Insulation Block.

.5 ASTM C 335, Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.

.6 ASTM C 411, Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.

.7 ASTM C 449, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.

.8 ASTM C 547, Specification for Mineral Fiber Pipe Insulation.

.9 ASTM C 553, Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

.10 ASTM C 612, Specification for Mineral Fiber Block and Board Thermal Insulation.

.11 ASTM C 795, Specification for Thermal Insulation for Use with Austenitic Stainless Steel.

.12 ASTM C 921, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.

.13 ASTM E 96 / E 96M, Standard Test Methods for Water Vapor Transmission of Materials.

.3 Canadian General Standards Board (CGSB)

.1 CGSB 51-GP-52Ma, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.

.4 International Organization for Standardization (ISO)

.1 ISO-6944, Duct 'A' Standard with 1 or 2-Hour External Duct Fire Rating.

.5 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 Ontario Building Code 2012 (OBC)

1.4 DEFINITIONS

.1 For purposes of this Section:

.1 "CONCEALED" means insulated mechanical services and equipment in suspended ceilings and non-accessible chases and furred-in spaces.

.2 "EXPOSED" means "not concealed" as defined in this Section.

.3 Insulation systems shall mean insulation material, fasteners, jackets, and other accessories.

1.5 SUBMITTALS

.1 Submit shop drawings in accordance with Section 01 33 00 – Submittal Requirements.

.2 Shop Drawings:

.1 Submit a set of shop drawings identifying each product with the manufacturer's name and insulation type, and the proposed use of the insulation. Include a product data sheet for each insulation type.

.2 Include shop drawings of all insulation jacket materials, each identified as to its intended use, and product data sheets for the protective coatings.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver materials to site in original factory packaging, labelled with the Manufacturer's name and address.

.3 Store at temperatures and conditions recommended by the Manufacturer.

2 Products

2.1 FIRE HAZARD RATINGS

.1 All insulation materials shall meet the requirements of CAN/ULC-S700 Series Standards.

.2 Unless otherwise specified in the Contract Documents, all insulation system materials inside the building must have a fire hazard rating of not more than 25 for flame spread and 50 for smoke developed when tested in accordance with CAN/ULC-S102.

2.2 PIPE INSULATION MATERIALS

.1 **Flexible Elastomeric Foam:** Closed cell, tubular foamed plastic pipe insulation with a "k" factor of 0.039 W/m°C (0.27 BTU/hr*ft*°F) when tested in accordance with ASTM C177 or ASTM C518 at mean temperature 24°C (75°F), 25/50 flame spread/smoke developed rated, with a water vapour transmission rating of 0.08 in accordance with ASTM E 96, Procedure A, and all required installation accessories. Acceptable products are:

.1 Armacell LLC "AP Armaflex 25/50" with "Armafix" insulation pipe hangers (IPH)

.2 **Closed Cell Foamed Glass:** Pittsburgh-Corning "FOAMGLASS", expanded, sectional, rigid sleeve type insulation with a liquid or vapour permeability rating (in accordance with ASTM C240)

of 0.00, and a factory applied "PITTWRAP SSII" self-sealing jacket secured with, when required. "PITTWRAP SS" primer and PC88 adhesive.

.3 **Fire Rated Preformed Fibreglass:** Non-Combustible, fire rated, hollow cylindrical heavy density (min 7 pcf or 112 kg/m3) fibreglass units with an all service jacket. Longitudinal joints sealed with metal fasteners or factory-applied self-sealing lap tape. Transverse joints secured with metal fasteners or with butt tape supplied with the product. Pipe covering material as listed as a firestop component in cUL/ULC listed firestop systems, C-AJ-1366, C-AJ-1066, W-J-1127, C-AJ-5125, and C-AJ-8075.

.4 **Preformed Fibreglass:** Rigid, sectional, sleeve type insulation with a "k" factor of 0.033W/m°C (0.23 @ 75°F) when tested in accordance with ASTM C335 (Standard Test Method for Steady State Heat Transfer Properties of Pipe Insulation), and a factory applied vapour retarding jacket (.02 perm). Acceptable products are:

.1 Johns Manville Inc. "Micro-Lok H" with "ASJ-SSL jacket

.2 Knauf Insulation Ltd. Earthwool 1000° with ASJ/SSL Pipe Insulation

.3 Manson Insulation Products Ltd. "ALLEY K" with "ASJ-SSL" jacket

.5 **Blanket Fibreglass:** Blanket type roll insulation, 24 kg/m^3 (1.5 lb/ft^3) density, with installed "R" value of 0.83 m2 °C/W (4.7 BTU/hr*ft*°F, and a factory applied vapour barrier facing. Acceptable products are:

.1 Johns Manville Inc. Type 150 "Microlite"

.2 Knauf Insulation Ltd. Fiber Glass Blanket Insulation with multi-purpose "FSK" facing

.3 Manson Insulation Products Ltd. "ALLEY WRAP FSK"

.6 **Pipe Insulation at Hangers and Supports:** Coordinate with discipline responsible for Section 20 05 29 Hangers and Supports to provide thermal breaks as listed here and in section 2.9 of that specification. Insulation shall be a 300 mm (12 in.) long piece of sectional pipe insulation with a thickness equal to the adjacent insulation, a foil and glass reinforced kraft paper vapour barrier jacket, and a minimum 0.80 mm thick (22 ga) G60 galvanized steel shield the same length as the insulation. The insulation shall be:

.1 Johns Manville Inc. "Thermo-12 Gold" or Calsilite Group Ruston "GOLD" rigid calcium silicate

.2 Belform Insulation Ltd. 60 kg/m^3 (3.75 lb./ft^3) density "Insulphen" closed cell phenolic foam

2.3 EQUIPMENT INSULATION MATERIALS

.1 **Blanket Fibreglass:** Blanket type roll form insulation, 24 kg/m^3 (1.5 lb/ft^3) density, with a "k" factor (compressed thickness) of 0.035 W/m°C (0.24 BTU/hr*ft*°F), with a factory applied vapour barrier facing. Acceptable products are:

.1 Johns Manville Inc. Type 150 "Microlite"

.2 Knauf Insulation Ltd. Friendly Feel Duct Wrap with KwikStretch Markings with multi-purpose "FSK" facing

.3 Manson Insulation Products Ltd. "ALLEY WRAP FSK"

.2 **Semi-Rigid Fibreglass Board:** Roll form, moulded insulation, 48.1 kg/m^3 (3.0 lb/ft^3) density, with a "k" factor of 0.033 W/m°C (0.23 BTU/hr*ft*°F), with a factory applied vapour barrier facing consisting of laminated aluminum foil and kraft paper. Acceptable products are:

.1 Johns Manville Inc. "Pipe and Equipment Insulation"

.2 Knauf Insulation Ltd. Fiber Glass Pipe and Tank Insulation or KwikFlex Pipe & Tank Insulation

.3 Manson Insulation Inc. "AK FLEX"

.3 **Closed Cell Foamed Glass:** Pittsburgh Corning "FOAMGLAS" expanded, rigid board and bock type insulation with a liquid or vapour permeability rating (in accordance with ASTM C240) of 0.00.

2.4 DUCTWORK SYSTEM INSULATION MATERIALS

.1 **Rigid Fibreglass Board:** Preformed board type insulation, 48.1 kg/m^3 (3.0 lb/ft^3) density, with a "k" factor of 0.033 W/m°C (0.23 BTU/hr*ft*°F @ 75°F mean), with a factory applied reinforced aluminum foil and kraft paper facing. Acceptable products are:

.1 Johns Manville Inc. Type 814 "Spin-Glas"

.2 Knauf Insulation Ltd. Fiber Glass Insulation Board with FSK facing

.3 Manson Insulation Products Ltd. "AK BOARD FSK"

.2 **Blanket Fibreglass:** Blanket type roll form insulation, 24 kg/m^3 (1.5 lb/ft^3) density, 40mm (1.5 in.) thick, with a factory applied vapour barrier facing. Acceptable products are:

.1 Johns Manville Inc. Duct Wrap Type 150 "Microlite"

.2 Knauf Insulation Ltd. Friendly Feel Duct Wrap with KwikStretch Markings with multi-purpose "FSK" facing

.3 Manson Insulation Products Ltd. "ALLEY WRAP FSK"

.3 **Flexible Elastomeric Foam Sheet:** Sheet form, closed cell foamed plastic insulation with a "k" factor of 0.039 W/m°C (0.27 BTU/hr*ft*°F) at mean temp 24°C (75°F) per ASTM C177, 25/50 flame spread/smoke developed rated, with a water vapour transmission rating of 0.08 in accordance with ASTM E 96, Procedure A, and all required installation accessories. Acceptable products are:

.1 Armacell LLC "AP Armaflex 25/50" Sheet & Roll

2.5 INSULATION FASTENINGS

.1 **Wire:** Minimum 1.8 mm diameter (15 ga) galvanized annealed wire.

.2 Stainless Steel Banding: Childers Products Co. "FABSTAPS" 0.6 mm (24 ga) Type 304 minimum 12 mm (0.5 in.) wide stainless steel strapping or approved equivalent.

.3 **Duct Insulation Fasteners:** Weld-on 2 mm (12 ga) zinc coated steel spindles of suitable length, complete with minimum 40 mm (1.5 in.) square plastic or zinc plated steel self-locking washers.

.4 **Tape Sealant:** Venture Tape Corp. 1525CW, 3M FSK Silver (foil) Facing Tape UL 723 classified (5/10 flame/smoke rating), 3M™ FSK Facing Tape or approved equivalent self-adhesive insulation tapes, types PAF, FSK, ASJ, or SWV as required to match the surface being sealed.

.5 **Adhesive - Fibreglass Insulation:** Clear, pressure sensitive, quick setting brush consistency adhesive, non-flammable when wet, fire resistive when dry, suitable for a temperature range of -20□C (-4°F) to 82□C (180□F) and compatible with the type of material to be secured, and WHMIS classified as non-hazardous.

.6 **Adhesive – Flexible Elastomeric Insulation:** Armstrong World Industries Inc. # 520 air-drying contact adhesive.

.7 **Adhesive – Closed Cell Foamed Glass Insulation:** Pittsburgh-Corning PC88 multi-purpose two-component adhesive.

.8 **Sheet Metal Screws:** No. 10 stainless steel sheet metal screws.

2.6 INSULATION JACKETS AND FINISHES

.1 **White PVC Fitting Covers:** Factory preformed, one-piece, minimum 15 mil thick white PVC covers, 25/50 rated with a semi-luster finish. Acceptable products are:

.1 Proto Corp. "LoSMOKE"

.2 Foster Products (H.B. Fuller Construction Products Inc.) "SMOKE-SAFE 25/50 SEALFAS"

.3 Speedline Corporation The Sure-Fit System "SMOKE-LESS 25/50"

.4 Johns Manville Inc. "Zeston"

.5 Belform Insulation Ltd.

.2 **White Sheet PVC:** Roll form (and fitting covers), minimum 15 mil thick white PVC, 25/50 rated, complete with installation and sealing accessories. Acceptable products are:

.1 Proto Corp. "LoSMOKE"

.2 Foster Products (H.B. Fuller Construction Products Inc.) "SMOKE-SAFE 25/50 SEALFAS"

.3 Speedline Corporation The Sure-Fit System "SMOKE-LESS 25/50"

.4 Johns Manville Inc. "Zeston"

.5 Belform Insulation Ltd.

.3 **Aluminum:** Smooth aluminum jacket material with a 13 mm (0.5 in.) safety edge in accordance with ASTM B209, 0.6 mm (0.025 in.) thick, factory cut to size and complete with moisture barrier and 50 mm overlap and with stainless steel bands on 300 mm (12 in.) centres. Fittings shall be two piece epoxy coated with silicone joints as required.

.4 **Stainless Steel:** Smooth type 304 stainless steel jacket material to ASTM A240, 0.4mm (0.016 in.) thick, factory cut to size, complete with moisture barrier and 50 mm overlap and with stainless steel bands on 300 mm (12 in.) centers. Fittings are to be two piece pressed stainless steel with with silicone joints as required.

.5 **Factory Applied Insulation Weather Barrier:** Knauf Insulation Ltd. Redi-Klad™ 1,000° pipe insulation, factory applied, five-ply, weather and abuse resistant, 0.0 permeability, embossed aluminum, self-sealing lap pipe insulation jacket. Insulation and jacketing system shall be designed for piping systems operating from -18°C to 538°C (0°F to 1,000°F).

.6 **Insulation Cement:** Heat resistant, trowel consistency thermal insulating and finishing cement to ASTM C-449/C-449M, and suitable in all respects for the application.

.7 **Protective Coating - Foamed Glass Insulation:** Pittsburgh Corning Co. "PITTCOTE 404" flexible acrylic latex weather barrier coating, white unless otherwise specified in the Contract.

.8 **Protective Coating - Flexible Elastomeric Foam Insulation:** Armacell LLC "WB Armaflex" white, water based latex enamel, semi-gloss or approved equivalent.

3 Execution

3.1 GENERAL INSULATION APPLICATION REQUIREMENTS

.1 Unless otherwise specified in the Contract Documents, do not insulate the following:

.1 Factory insulated equipment and piping;

.2 Heating piping within radiation unit enclosures, including blank filler sections of enclosures;

.3 Heating piping in soffits and/or overhang spaces and connected to bare element radiation in the spaces;

.4 Heated liquid system pump casings, valves, strainers and similar accessories;

.5 Manufactured expansion joints and flexible connections;

.6 Acoustically lined ductwork and/or equipment; and

.7 Flexible ductwork.

.2 Unless otherwise specified or shown in the Contract Documents the installation of piping and ductwork insulation shall be in accordance with the TIAC Mechanical Insulation Best Practices Guide.

.3 Install insulation directly over pipes and ducts and not over hangers and supports. Insulation and covering shall pass unbroken through the hangers and supports.

.4 Do not apply insulation unless leakage tests have been satisfactorily completed.

.5 Ensure that all surfaces to be insulated are clean and dry.

.6 Ensure that the ambient temperature is minimum 13ºC (55ºF) for a minimum of one day prior to the application of insulation, and for the duration of insulation work, and that relative humidity is and will be at a level such that mildew will not form on insulation materials.

.7 Install piping insulation and covering continuous through pipe openings and sleeves.

.8 Install duct insulation continuous through walls, partitions, and similar surfaces except at fire dampers.

.9 Pipe insulation at hangers and supports shall consist of a minimum of 300 mm (12 in.) long sections of calcium silicate or phenolic foam sectional insulation with vapour barrier jacket. Coordinate with discipline responsible for Section 20 05 29 Hangers and Supports to provide thermal breaks as listed here and in section 2.9 of that specification. Galvanized steel shields shall be provided between the insulation and the hanger or support for all pipe 50 mm (2 in.) diameter and above and not requiring a roller hanger or support. Provide "Armafix" insulation pipe hangers (IPH) for flexible elastomeric foam insulation.

.10 When insulating "cold" piping and equipment, extend insulation up valve bodies and other such projections as far as possible, and protect the insulation jacketing from the action of condensation at its junction with the metal. Insulation on cold piping must not be broken. Saddles that touch the cold piping directly are not acceptable on cold piping.

.11 Irregular shaped objects such as strainers, pipe system filters, cyclone separators, blowdown valves and other accessories requiring servicing, on insulated piping, shall be insulated with removable caps or sections. All edges shall be sealed between pipe and vapour barrier and held in place with stainless steel straps. Finish all insulation smooth, making the outline of pipe insulation a true circular and concentric shape. Shape the outline of fitted insulation to blend with adjacent covering.

.12 The final appearance and finish of exposed mechanical Work depends to a large degree on the quality of the insulation application, therefore, a neat and properly finished insulation job will be insisted upon.

.13 When insulating vertical piping risers 75 mm (3 in.) diameter and larger, use insulation support rings welded directly above the lowest pipe fitting, and thereafter at 4.5 m (15 ft.) centres and at each valve and flange. Insulate in accordance with Thermal Insulation Association of Canada National Insulation Standards, Figure No. 9.

.14 Where piping and/or equipment is traced with electric heating cable, ensure that the cable has been tested and accepted prior to the application of insulation, and ensure that the cable is not damaged or displaced during the application of insulation.

.15 Where existing insulation work is damaged as a result of a new mechanical work, repair the damaged insulation work to new work standards.

.16 Where fibreglass rigid sleeve type insulation is terminated at valves, equipment, unions, etc., neatly cover the exposed end of the insulation with a purpose made PVC cover on "cold" piping.

.17 Carefully and neatly gouge out insulation for proper fit where there is interference between weld bead, mechanical joints, etc., and insulation. Bevel away from studs and nuts to permit their removal without damage to insulation, and closely and neatly trim around extending parts of pipe saddles.

.18 Where thermometers, gauges, etc., occur in insulated piping, and where access to heat transfer piping balancing valve ports and similar items are required, create a neat, properly sized hole in the insulation and provide a suitable grommet in the opening.

3.2 PIPE INSULATION REQUIREMENTS – FIBREGLASS

.1 **Domestic Water:** Insulate the following pipe with fibreglass insulation of the thickness noted below:

.1 Potable cold water piping inside building and above ground – 25 mm (1 in.) thick.

.2 Potable hot water piping within. operating water temperatures up to and including 60°C (140°F), size of up to and including 32 mm (1.25 in.) – 25 mm (1 in.) thick.

.3 Tempered potable water piping, up to and including 32 mm (1.5 in.) - 25 mm (1 in.) thick.

.4 Tempered potable water piping, 40 mm (1.5 in.) and larger - 40 mm (1.5 in.) thick.

.5 Potable hot water recirculation piping with operating water temperatures up to and including 60°C (140°F), size of up to and including 32 mm (1.25 in.) - 25 mm (1 in.) thick.

.6 Non-potable cold water inside building and above ground – 25 mm (1 in.) thick.

.2 **Drainage, Waste, and Venting:** Insulate the following pipe with fibreglass insulation of the thickness noted below:

.1 Storm drainage piping from roof drains to the point where main vertical risers extend straight down, without offsets, and connect to horizontal mains. Where the roof drain is less than 3000 mm (10 ft.) from the vertical leader, insulate the first 3000 mm (10 ft.) of pipe closest to the roof drain including the vertical riser - 25 mm (1 in.) thick.

.2 Drainage piping from refrigerated drinking fountains to nearest 75 mm (3 in.) dia. or larger drain pipe – 25 mm (1 in.) thick.

.3 Drainage piping carrying chilled condensate to closest branch or main – 25

.3 **Heating Water Piping:** Insulate the following pipe with fibreglass insulation of the thickness noted below:

.4 Glycol solution heating or heat reclaim piping, supply and return, up to and including 32 mm (1.25 in.) dia. - 40 mm (1.5 in.) thick.

.5 Glycol solution heating or heat reclaim piping, supply and return, 40 mm (1.5 in.) dia. and larger - 50 mm (2 in.) thick.

.6 Piping: Ensure that the overlap flap of the sectional insulation jacket is secured tightly in place. Cover section to section butt joints with tape sealant.

.7 Fittings: Insulate fittings with sectional pipe insulation mitred to fit tightly, and cover butt joints with tape sealant, or, alternatively, wrap fittings with blanket fibreglass insulation to a thickness and insulating value equal to the sectional insulation and secured in place with adhesive and/or wire and covered with PVC fitting covers. Provide sufficient material to prevent the PVC cover from being pushed in or crushed.

.8 "Cold" Piping Valves, Strainers, Etc.: Insulate valves, strainers, and similar piping system accessories in "cold" piping such as potable water piping with cut and tightly fitted segments of sectional pipe insulation with all joints covered with tape sealant, or, alternatively, wrap the piping valve, strainer, etc., with blanket fibreglass and cover with PVC covers as for "Fittings" above.

.9 Flanges and Mechanical Couplings: Terminate sectional insulation approximately 50 mm from the flange or coupling on each side of the flange or coupling. Cover the flange or coupling with a minimum 50 mm (2 in.) thickness of blanket fibreglass insulation wide enough to butt tightly to the ends of the adjacent sectional insulation. Secure the blanket insulation in place and cover with a PVC cover. Provide sufficient material to prevent the PVC cover from being pushed in or crushed.

3.3 DUCTWORK INSULATION REQUIREMENTS – FIBREGLASS

.1 Insulate the following ductwork systems with fibreglass insulation of the thickness noted below:

.1 All fresh air intake ductwork, casings and plenums from fresh air intakes to and including mixing plenums or sections, or, if mixing plenums or sections are not provided, to the first heating coil, or if both mixing plenums or sections and heating coil sections are not provided, and the fresh air is not tempered, then the fresh air ductwork system complete – 50 mm (2 in.) thick

.2 Mixed supply air or preheated supply air casings, plenums and sections to and including the fan section where not factory insulated – 50 mm (2 in.) thick rigid board or 40 mm (1.5 in.) thick flexible blanket

.3 Supply air ductwork outward from fans, except for supply ductwork exposed in the area it serves – 50 mm (2 in.) thick rigid board or 40 mm (1.5 in.) thick flexible blanket

.4 Exhaust discharge ductwork for a distance of 3 m (10 ft.) downstream (back) from exhaust openings to atmosphere, including any exhaust plenums within the 3 m (10 ft.) distance or up until the motor operated damper – 50 mm (2 in.) thick rigid board or 40 mm (1.5 in.) thick flexible blanket

.5 Any other ductwork, casings, plenums or sections specified or detailed on the Drawings to be insulated – thickness shall be as specified on the Drawings.

.2 Insulation for casings, plenums, exposed rectangular ductwork shall be rigid board type. Insulation for round ductwork and concealed rectangular ductwork shall be blanket type.

.3 Liberally apply adhesive to all surfaces of the ductwork and/or casing. Provide weld-on pins at 450 mm (18 in.) centres on the bottom duct surface only where blanket insulation is to be applied, and at 450 mm (18 in.) centres on bottom and side surfaces of ducts and/or casings where board insulation is to be applied. Secure the insulation in place with tight circumferential and longitudinal joints. Secure and seal all joints with 75 mm (3 in.) wide tape sealant. Install self-locking washers over pins and cut-off any excess pin length. Ensure that the insulation does not sag or bulge.

.4 Provide drywall type metal corner beads on edges of exposed rectangular ductwork, casings and plenums in equipment rooms, service corridors, and any other area where the insulation is subject to accidental damage. Secure in place with tape sealant.

.5 At each trapeze type duct hanger under rectangular or oval ductwork to be insulated with blanket type insulation, provide a 100 mm (4 in.) wide full length piece of rigid fibreglass board insulation between the duct and the hanger and cover joints with strips of tape sealant.

.6 At each band type duct hanger around round ductwork to be insulated, provided a 100 mm (4 in.) wide section of sleeve or scored board type fibreglass insulation and cover joints with tape sealant.

3.4 INSULATION FINISH REQUIREMENTS

.1 White Sheet PVC: Unless otherwise shown and/or specified in the Contract Documents, jacket all exposed fibreglass insulation work inside the building with white sheet PVC and fitting covers tightly in place with overlapped circumferential and longitudinal joints arranged to shed water. Seal all joints to produce a neat water-tight installation. Provide slip-type expansion joints where required by the manufacturer's instructions.

.2 Protective Coating – Flexible Elastomeric Insulation: Apply two heavy coats of the coating specified in the Contract Documents to all flexible elastomeric insulation exposed above grade.

END OF SECTION

1 General

1.1 REFERENCE STANDARDS

.1 National Fire Prevention Association (NFPA)

.1 NFPA 13, Standard for the Installation of Sprinkler Systems.

.2 NFPA 25, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.

.2 Underwriter's Laboratories of Canada (ULC)

.1 CAN4 S543, Standard for Internal Lug Quick Connect Couplings for Fire Hose.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Provide manufacturer's printed product literature and data sheets, and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Ontario, Canada.

.2 Indicate:

.1 Materials.

.2 Finishes.

.3 Method of anchorage

.4 Number of anchors.

.5 Supports.

.6 Reinforcement.

.7 Assembly details.

.8 Accessories.

.4 Samples:

.1 Submit samples of following:

.1 Each type of sprinkler head.

.2 Signs.

.5 Test reports:

.1 Submit certified test reports for wet pipe fire protection sprinkler systems from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.

.6 Certificates:

.1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.7 Manufacturers' Instructions:

.1 Provide manufacturer's installation instructions.

1.3 CLOSEOUT SUBMITTALS

.1 Provide operation, maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals in accordance with ANSI/NFPA 20.

.2 Manufacturer's catalogue Data, including specific model, type, and size for:

.1 Pipe and fittings.

.2 Alarm valves.

.3 Valves, including gate, check, and globe.

.4 Sprinkler heads.

.5 Pipe hangers and supports.

.6 Pressure or flow switch.

.7 Mechanical couplings.

.3 Drawings:

.1 Sprinkler heads and piping system layout.

.1 Prepare 707 mm by 1000 mm detail working drawings of system layout in accordance with NFPA 13, "Working Drawings (Plans)".

.2 Show data essential for proper installation of each system.

.3 Show details, plan view, elevations, and sections of systems supply and piping.

.4 Show piping schematic of systems supply, devices, valves, pipe, and fittings. Show point to point electrical wiring diagrams.

.2 Electrical wiring diagrams.

.4 Design Data:

.1 Calculations of sprinkler system design.

.2 Indicate type and design of each system and certify that each system has performed satisfactorily in the manner intended for not less than 18 months.

.5 Field Test Reports:

.1 Preliminary tests on piping system.

.6 Records:

.1 As-built drawings of each system.

.1 After completion, but before final acceptance, submit complete set of as-built drawings of each system for record purposes.

.2 Submit 707 mm by 1000 mm drawings with title block similar to full size contract drawings.

.7 Operation and Maintenance Manuals:

.1 Provide detailed hydraulic calculations including summary sheet, and Contractors Material and Test Certificate for underground and aboveground piping and other documentation for incorporation into manual in accordance with NFPA 13.

1.4 QUALITY ASSURANCE

.1 Qualifications:

.1 Installer: company or person specializing in wet sprinkler systems with documented experience and approved by manufacturer.

.2 Supply grooved joint couplings, fittings, valves, grooving tools and specialties from a single manufacturer. Use date stamped castings for coupling housings, fittings, valve bodies, for quality assurance and traceability.

1.5 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Materials:

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Provide spare sprinklers and tools in accordance with NFPA 13.

1.6 DELIVERY, STORAGE AND HANDLING

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

.2 Delivery and Acceptance Requirements:

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Storage and Protection:

.1 Store and protect materials from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.

2 Products

2.1 DESIGN REQUIREMENTS

.1 Design automatic wet pipe fire suppression sprinkler systems in accordance with required and advisory provisions of NFPA 13, by hydraulic calculations for uniform distribution of water over design area.

.2 Include with each system materials, accessories, and equipment inside and outside building to provide each system complete and ready for use.

.3 Design and provide each system to give full consideration to blind spaces, piping, electrical equipment, ducts, and other construction and equipment in accordance with detailed shop drawings.

.4 Locate sprinkler heads in consistent pattern with ceiling grid, lights, and air supply diffusers.

.5 Devices and equipment for fire protection service: ULC approved for use in wet pipe sprinkler systems.

.6 Design systems for earthquake protection.

.7 Location of Sprinkler Heads:

.1 Locate heads in relation to ceiling and spacing of sprinkler heads not to exceed that permitted by NFPA 13 for ordinary hazard occupancy or as indicated.

.2 Uniformly space sprinklers on branch.

.8 Water Distribution:

.1 Make distribution uniform throughout the area in which sprinkler heads will open.

.2 Discharge from individual heads in hydraulically most remote area to be 100 % of specified density.

.9 Density of Application of Water:

.1 Size pipe to provide specified density when system is discharging specified total maximum required flow.

.10 Sprinkler Discharge Area:

.1 Area: hydraulically most remote areas as defined in NFPA 13.

.11 Outside Hose Allowances:

.1 Include allowance in hydraulic calculations of 1892 lpm for outside hose streams.

.12 Friction Losses:

.1 Calculate losses in piping in accordance with Hazen-Williams formula with 'C' value of 120 for steel piping, 150 for copper tubing, and 140 for cement-lined ductile-iron piping.

.13 Water Supply:

.1 Perform water supply test to form the basis of hydraulic calculations. Coordinate with Owner.

2.2 ABOVE GROUND PIPING SYSTEMS

.1 Provide fittings for changes in direction of piping and for connections.

.1 Make changes in piping sizes through tapered reducing pipe fittings, bushings will not be permitted.

.2 Perform welding in shop; field welding will only be permitted following written approval from Owner.

.3 Conceal piping in areas with suspended ceiling.

2.3 PIPE, FITTINGS AND VALVES

.1 Pipe:

.1 Ferrous: to NFPA 13.

.2 Fittings and joints to NFPA 13:

.1 Ferrous: screwed, welded, flanged or roll grooved.

.1 Grooved joints designed with two ductile iron housing segments, pressure responsive gasket, and zinc-electroplated steel bolts and nuts. Cast with offsetting angle-pattern bolt pads for rigidity and visual pad-to-pad offset contact.

.2 Provide threaded fittings into which sprinkler heads, sprinkler head riser nipples, or drop nipples are threaded.

.3 Plain-end fittings with mechanical couplings and fittings which use steel gripping devices to bite into pipe when pressure is applied will not be permitted.

.4 Rubber gasketted grooved-end pipe and fittings with mechanical couplings are permitted in pipe sizes 32 mm and larger.

.5 Fittings: ULC approved for use in wet pipe sprinkler systems.

.6 Ensure fittings, mechanical couplings, and rubber gaskets are supplied by same manufacturer.

.7 Side outlet tees using rubber gasketted fittings are not permitted.

.8 Sprinkler pipe and fittings: metal.

.3 Valves:

.1 ULC listed for fire protection service.

.2 Gate valves: open by counterclockwise rotation.

.3 Provide wall indicator valve beneath each alarm valve in each riser when more than one alarm valve is supplied from same water supply pipe.

.4 Check valves: flanged clear opening swing or spring actuated check type with flanged inspection and access cover plate for sizes 10 cm and larger.

.5 Provide gate valve in piping protecting machine rooms, machinery spaces, and elevator hoistways.

.4 Pipe hangers:

.1 ULC listed for fire protection services in accordance with NFPA.

2.4 SPRINKLER HEADS

.1 General: to NFPA 13 and ULC listed for fire services.

.2 Sprinkler Head Type:

.1 Type A: upright bronze.

.2 Type B: pendant chrome link and lever type.

.3 Type C: pendant chrome glass bulb type.

.4 Type D: recessed chrome glass bulb type with ring and cup.

.5 Type E: flush satin link and lever type.

.6 Type F: side wall chrome link and lever type.

.3 Provide nominal 1.2 cm orifice sprinkler heads.

.1 Release element of each head to be of intermediate temperature rating or higher as suitable for specific application.

.2 Provide polished chromium-plated pendent sprinklers below suspended ceilings.

.3 Provide corrosion-resistant sprinkler heads and sprinkler head guards in accordance with NFPA 13.

.4 Provide sprinkler heads as indicated.

.5 Deflector: not more than 75 mm below suspended ceilings.

.6 Ceiling plates: not more than 25 mm deep.

.7 Ceiling cups: not permitted.

2.5 SUPERVISORY SWITCHES

.1 General: to NFPA 13 and ULC listed for fire service.

.2 Valves:

.1 Mechanically attached to valve body, with normally open and normally closed contacts and supervisory capability.

.3 Pressure or flow switch type:

.1 With normally open and normally closed contacts and supervisory capability.

.2 Provide switch with circuit opener or closer for automatic transmittal of alarm over facility fire alarm system.

.3 Connect into building fire alarm system.

.4 Alarm actuating device: mechanical diaphragm controlled retard device adjustable from 10 to 60 seconds and instantly recycle.

.4 Pressure alarm switch:

.1 With normally open and normally closed contacts and supervisory capability.

2.6 PRESSURE GAUGES

.1 ULC listed. and to Section 23 05 19.01 - Thermometers and Pressure Gauges - Piping Systems

.2 Maximum limit of not less than twice normal working pressure at point where installed.

2.7 PIPE SLEEVES

.1 Provide pipe sleeves where piping passes through walls, floors, and roofs.

.2 Secure sleeves in position and location during construction.

.3 Provide sleeves of sufficient length to pass through entire thickness of walls, floors, and roofs.

.4 Provide 2.5 cm minimum clearance between exterior of piping and interior of sleeve or core-drilled hole.

.1 Firmly pack space with mineral wool insulation.

.2 Seal space at both ends of sleeve or core-drilled hole with mechanically adjustable segmented elastomeric seal.

.3 In fire walls and fire floors, seal both ends of pipe sleeves or core-drilled holes with ULC listed fill, void, or cavity material.

.5 Sleeves in Masonry and Concrete Walls, Floors, and Roofs:

.1 Provide hot-dip galvanized steel.

.2 Core drilling of masonry and concrete may be provided in lieu of pipe sleeves when cavities in core-drilled hole are completely grouted smooth.

.6 Sleeves in Other than Masonry and Concrete Walls, Floors, and Roofs:

.1 Provide 0.61 mm thick galvanized steel sheet.

2.8 ESCUTCHEON PLATES

.1 Provide one piece type metal plates for piping passing through walls, floors, and ceilings in exposed spaces.

.2 Provide polished chromium-plated finish on copper alloy plates in finished spaces.

.3 Provide paint finish on metal plates in unfinished spaces.

2.9 INSPECTOR'S TEST CONNECTION

.1 Locate inspector's test connection at hydraulically most remote part of each system, provide test connections approximately 3 m above floor for each sprinkler system or portion of each sprinkler system equipped with alarm device.

.2 Provide test connection piping to location where discharge will be readily visible and where water may be discharged without property damage.

.3 Provide discharge orifice of same size as corresponding sprinkler orifice.

2.10 SIGNS

.1 Attach properly lettered Bilingual and approved metal signs to each valve and alarm device to NFPA 13.

.2 Permanently fix hydraulic design data nameplates to riser of each system.

2.11 SPARE PARTS CABINET

.1 For storage of maintenance materials, spare sprinkler heads and special tools.

.2 Construct to sprinkler head manufacturers standard.

.3 Number and types of extra sprinkler heads as specified in NFPA 13.

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install, inspect and test to acceptance in accordance with NFPA 13 and NFPA 25.

.2 Testing to be witnessed by authority having jurisdiction.

3.3 PIPE INSTALLATION

.1 Install piping straight and true to bear evenly on hangers and supports. Do not hang piping from plaster ceilings.

.2 Keep interior and ends of new piping and existing piping thoroughly cleaned of water and foreign matter.

.3 Keep piping systems clean during installation by means of plugs or other approved methods. When work is not in progress, securely close open ends of piping to prevent entry of water and foreign matter.

.4 Inspect piping before placing into position.

3.4 ELECTRICAL CONNECTIONS

.1 Provide electrical work associated with this section under Section 26 05 00 – General Electrical Requirements.

.2 Provide control and fire alarm wiring, including connections to fire alarm systems, in accordance with National Electrical Code.

.3 Provide wiring in rigid metal conduit or intermediate metal conduit.

3.5 DISINFECTION

.1 Disinfect new piping.

.2 Fill piping systems with solution containing minimum of 50 parts per million of chlorine and allow solution to stand for minimum of 24 hours.

.3 Flush solution from systems with clean water until maximum residual chlorine content is not greater than 0.2 part per million or residual chlorine content of domestic water supply.

.4 Obtain at least two consecutive satisfactory bacteriological samples from piping, analyzed by certified laboratory, and submit results prior to piping being placed into service.

3.6 FIELD PAINTING

.1 Clean, pretreat, prime, and paint new systems including valves, piping, conduit, hangers, supports, miscellaneous metalwork, and accessories.

.2 Apply coatings to clean, dry surfaces, using clean brushes.

.3 Clean surfaces to remove dust, dirt, rust, and loose mill scale.

.4 Immediately after cleaning, provide metal surfaces with 1 coat of pretreatment primer applied to minimum dry film thickness of 0.3 ml, and one coat of zinc chromate primer applied to minimum dry film thickness of 1.0 ml.

.5 Shield sprinkler heads with protective covering while painting is in progress.

.6 Upon completion of painting, remove protective covering from sprinkler heads.

.7 Remove sprinkler heads which have been painted and replace with new sprinkler heads.

.8 Provide primed surfaces with following:

.1 Piping in Finished Areas:

.1 Provide primed surfaces with 2 coats of paint to match adjacent surfaces.

.2 Provide valves and operating accessories with 1 coat of red alkyd gloss enamel applied to minimum dry film thickness of 1.0 mil.

.3 Provide piping with 50 mm wide red enamel bands spaced at maximum of 6 m intervals throughout piping systems.

.2 Piping in Unfinished Areas:

.1 Provide primed surfaces with one coat of red alkyd gloss enamel applied to minimum dry film thickness of 1.0 mil in spaces where walls or ceiling are not painted or not constructed of a prefinished material, pipe chases, spaces above suspended ceilings, crawl spaces, mechanical equipment room.

.2 Provide piping with 50 mm wide red enamel bands spaced at maximum of 6 m intervals.

3.7 FIELD QUALITY CONTROL

.1 Site Test, Inspection:

.1 Perform test to determine compliance with specified requirements in presence of Owner.

.2 Test, inspect, and approve piping before covering or concealing.

.3 Preliminary Tests:

.1 Hydrostatically test each system at 200 psig for a 2 hour period with no leakage or reduction in pressure.

.2 Flush piping with potable water in accordance with NFPA 13.

.3 Piping above suspended ceilings: tested, inspected, and approved before installation of ceilings.

.4 Test alarms and other devices.

.5 Test water flow alarms by flowing water through inspector's test connection. When tests have been completed and corrections made, submit signed and dated certificate in accordance with NFPA 13.

.4 Formal Tests and Inspections:

.1 Do not submit request for formal test and inspection until preliminary test and corrections are completed and approved.

.2 Submit written request for formal inspection at least 15 days prior to inspection date.

.3 Repeat required tests as directed.

.4 Correct defects and make additional tests until systems comply with contract requirements.

.5 Furnish personnel, equipment, instruments, appliances, connecting devices, for tests.

.6 Authority of Jurisdiction, will witness formal tests and approve systems before they are accepted.

3.8 CLEANING

.1 Clean in accordance with Section 01 74 11 - Cleaning.

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 American Society of Mechanical Engineers International (ASME)

- .1 ANSI/ASME B16.15, Cast Cooper Alloy Threaded Fittings, Classes 125 and 250.
- .2 ANSI/ASME B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.
- .3 ANSI/ASME B16.22, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
- .4 ANSI/ASME B16.24, Cast Copper Alloy Pipe Flanges and Flanged Fittings: Class 150, 300, 400, 600, 900, 1500 and 2500.
- .5 ASME B16.26, Cast Copper Alloy Fittings for Flared Copper Tubes.
- .6 ASME B31.9, Building Services Piping.
- .7 ASME B36.19M, Stainless Steel Pipe.

.2 ASTM International

- .1 ASTM A182/A 182M, Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.
- .2 ASTM A269, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
- .3 ASTM A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
- .4 ASTM A312/A312M, Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
- .5 ASTM A351/A351M, Castings, Austenitic, for Pressure Containing Parts.
- .6 ASTM A403/A403M, Wrought Austenitic Stainless Steel Piping Fittings.
- .7 ASTM A536, Standard Specification for Ductile Iron Castings.
- .8 ASTM B32, Standard Specification for Solder Metal.
- .9 ASTM B42, Seamless Copper Tube, Standard Sizes.
- .10 ASTM B88M, Standard Specification for Seamless Copper Water Tube (Metric).

.3 American National Standards Institute/American Water Works Association (ANSI)/(AWWA)

- .1 ANSI/AWWA C111/A21.11, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
- .2 ANSI/AWWA C151/A21.51, Ductile Iron Pipe, Centrifugally Cast, for Water.

.4 CSA Group

- .1 CSA B242, Groove and Shoulder Type Mechanical Pipe Couplings.

.5 Underwriters Laboratories of Canada (ULC)

- .1 CAN/ULC S101, Fire Endurance Tests of Buildings Construction and Materials.
- .2 CAN/ULC S102.2, Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings and Miscellaneous Materials and Assemblies.
- .3 CAN/ULC S115, Standard Method of Fire Tests of Firestop.

.6 Department of Justice Canada (Jus)

.1 Canadian Environmental Protection Act, 1999, c. 33 (CEPA).

.7 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.8 Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS).

.1 MSS-SP-67, Butterfly Valves.

.2 MSS-SP-70, Grey Iron Gate Valves, Flanged and Threaded Ends.

.3 MSS-SP-71, Grey Iron Swing Check Valves, Flanged and Threaded Ends.

.4 MSS-SP-80, Bronze Gate, Globe, Angle and Check Valves.

.9 National Research Council (NRC)

.1 National Plumbing Code of Canada (NPC).

.10 Transport Canada (TC)

.1 Transportation of Dangerous Goods Act, 1992, c. 34 (TDGA).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 10 00.

.2 Product Data

.1 Provide manufacturer's printed product literature and datasheets for insulation and adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Closeout Submittals:

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

1.3 DELIVERY, STORAGE AND HANDLING

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

.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 in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect all new equipment, devices, and piping from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 PIPING

.1 Domestic hot, cold and recirculation systems, within building.

.1 Above ground:

.1 Copper tube, hard drawn, type L: to ASTM B88M.

.2 Buried or embedded:

.1 Copper tube, soft annealed, type K: to ASTM B88M, in long lengths and with no buried joints.

2.2 FITTINGS

.1 Bronze pipe flanges and flanged fittings, Class 150: to ANSI/ASME B16.24.

.2 Cast bronze threaded fittings, Class 125: to ANSI/ASME B16.15.

.3 Cast copper, solder type: to ANSI/ASME B16.18.

.4 Wrought copper and copper alloy, solder type: to ANSI/ASME B16.22.

2.3 JOINTS

.1 Rubber gaskets, latex-free 1.6 mm thick: to AWWA C111.

.2 Bolts, nuts, hex head and washers: to ASTM A307, heavy series.

.3 Solder: tin copper alloy 95/5.

.4 Teflon tape: for threaded joints.

.5 Dielectric connections between dissimilar metals: dielectric fitting, complete with thermoplastic liner.

2.4 GATE VALVES

.1 NPS 2 and under, soldered:

.1 Rising stem: to MSS-SP-80, Class 125, 860 kPa, bronze body, screw-in bonnet, solid wedge disc.

.2 NPS 2 1/2 and over, flanged:

.1 Rising stem: to MSS-SP-70, Class 125, 860 kPa, flat flange faces, cast-iron body, OS&Y bronze trim.

2.5 GLOBE VALVES

.1 NPS 2 and under, soldered:

.1 To MSS-SP-80, Class 125, 860 kPa, bronze body, renewable composition disc, screwed over bonnet.

.2 NPS 2 and under, screwed:

.1 To MSS-SP-80, Class 150, 1 MPa, bronze body, screwed over bonnet, renewable composition disc.

2.6 SWING CHECK VALVES

.1 NPS 2 and under, soldered:

.1 To MSS-SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat.

.2 NPS 2 1/2 and over, flanged:

.1 To MSS-SP-71, Class 125, 860 kPa, cast iron body, flat flange faces, renewable seat, bronze disc, bolted cap.

2.7 BALL VALVES

.1 NPS 2 and under, soldered:

.1 To ANSI/ASME B16.18, Class 150.

.2 Bronze body, stainless steel ball, PTFE adjustable packing, brass gland and seat, steel lever handle, with NPT to copper adaptors.

2.8 BUTTERFLY VALVES

.1 NPS 2-1/2 and over, lug :

.1 To MSS-SP-67, Class 200.

.2 Cast iron body, ductile iron chrome plated disc, stainless steel stem, EPT liner.

.3 Lever operated.

.2 NPS 2-1/2 and over, grooved ends:

.1 Class 300 psig CWP, bubble tight shut-off, bronze body EPDM coated ductile iron disc with integrally cast stem.

.2 Operator:

.1 NPS 4 and under: lever handle.

Part 3 Execution

3.1 APPLICATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

.1 Install in accordance with National Plumbing Code and local authority having jurisdiction.

.2 Install pipe work in accordance with Section 23 05 15 - Common Installation Requirements for Pipework, supplemented as specified herein.

.3 Assemble piping using fittings manufactured to ANSI and Standard Council of Canada (SCC) standards.

.4 Install CWS piping below and away from HWS and HWR and other hot piping so as to maintain temperature of cold water as low as possible.

.5 Connect to fixtures and equipment in accordance with manufacturer's written instructions unless otherwise indicated.

.6 Buried tubing:

.1 Lay in well compacted washed sand in accordance with AWWA Class B bedding.

.2 Bend tubing without crimping or constriction. Minimize use of fittings.

.7 Valves

.1 Isolate equipment, fixtures and branches with ball valves or butterfly valves.

.2 Balance recirculation system using circuit balancing valves. Mark settings and record on as-built drawings on completion.

3.3 PRESSURE TESTS

.1 Test pressure: greater of 1 times maximum system operating pressure or 860 kPa.

3.4 FLUSHING AND CLEANING

.1 Flush entire system for 8 h. Ensure outlets flushed for 2 hours. Let stand for 24 hours, then draw one sample off longest run. Submit to testing laboratory to verify that system is clean to Federal/Provincial potable water guidelines. Let system flush for additional 2 hours, then draw off another sample for testing.

3.5 PRE-START-UP INSPECTIONS

.1 Systems to be complete, prior to flushing, testing and start-up.

.2 Verify that system can be completely drained.

.3 Ensure that pressure booster systems are operating properly.

.4 Ensure that air chambers, expansion compensators are installed properly.

3.6 DISINFECTION

.1 Flush out, disinfect and rinse system to requirements of authority having jurisdiction and approval of DCC Representative.

.2 Upon completion, provide laboratory test reports on water quality for DCC Representative approval.

3.7 START-UP

.1 Timing: start up after:

.1 Pressure tests have been completed.

.2 Disinfection procedures have been completed.

.3 Certificate of static completion has been issued.

.4 Water treatment systems operational.

.2 Provide continuous supervision during start-up.

.3 Start-up procedures:

.1 Establish circulation and ensure that air is eliminated.

.2 Check pressurization to ensure proper operation and to prevent water hammer, flashing and/or cavitation.

.3 Bring HWS storage tank up to design temperature slowly.

.4 Monitor piping HWS and HWR piping systems for freedom of movement, pipe expansion as designed.

.5 Check control, limit, safety devices for normal and safe operation.

.4 Rectify start-up deficiencies.

3.8 PERFORMANCE VERIFICATION

.1 Scheduling:

.1 Verify system performance after pressure and leakage tests and disinfection are completed, and Certificate of Completion has been issued by authority having jurisdiction.

.2 Procedures:

.1 Verify that flow rate and pressure meet Design Criteria.

.2 Verify compliance with safety and health requirements.

.3 Check for proper operation of water hammer arrestors. Run one outlet for 10 seconds, then shut of water immediately. If water hammer occurs, replace water hammer arrestor or re-charge air chambers. Repeat for outlets and flush valves.

.4 Confirm water quality consistent with supply standards, and ensure no residuals remain as result of flushing or cleaning.

3.9 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 10 00.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 10 00.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 20 05 00 – General Requirements.

.2 Section 22 42 00 – Plumbing Fixtures and Fittings.

1.2 REFERENCES

.1 ASTM International Inc.

.1 ASTM B306, Standard Specification for Copper Drainage Tube (DWV).

.2 Canadian Standards Association (CSA International)

.1 CAN/CSA B70, Cast iron soil pipe, fittings, and means of joining.

.2 CAN/CSA B602, Mechanical couplings for drain, waste, and vent and sewer pipe.

.3 CAN/CSA B182.2, PSM Type Polyvinylchloride (PVC) Sewer Pipe and Fittings.

.3 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC S102.2, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.5 Ontario Building Code 2012 (OBC)

1.3 SUBMITTALS

.1 **Shop Drawings**: Submit shop drawings for all products specified in this Section except pipe and fittings. Shop drawings are to include all components including but not limited to panel layout drawings, wiring diagrams with wire numbers, individual components within panel, motor shop drawing, etc.

.2 **Test Data:** Submit the following test data prior to application for Substantial Performance of the Work.

.1 Pipe leakage test sheets in accordance with Section 20 05 93.

.2 A copy of the plumbing inspection certificate.

.3 Any other start-up or test data specified in this Section.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 10 00 - General Requirements.

.2 Deliver materials to site in original factory packaging, labelled with the Manufacturer's name and address.

.3 Store at temperatures and conditions recommended by the Manufacturer.

2 Products

2.1 PIPE, FITTINGS AND JOINTS

.1 Adhesives and Sealants: Use sealants as recommended by the Manufacturer.

2.2 PIPING AND FITTINGS

.1 **Solvent Weld PVC Sewer Pipe:** SDR 35, 150 mm (6") and below, rigid PVC hub and spigot pattern sewer pipe and fittings in accordance with CAN/CSA B182.2. Solvent weld cement and

primer (when required by manufacture) shall be same manufacturer as pipe. Provide green coloured pipe for sanitary lines and white coloured pipe for storm lines.

.1 Acceptable Manufacturers

.1 Ipex Solvent Weld Sewer Pipe

.2 Royal Building Products Solvent Weld Sewer Pipe

.2 **Gasketed PVC Sewer Pipe:** SDR 35, 200 mm (8") and above, rigid PVC hub and spigot pattern sewer pipe and fittings in accordance with CAN/CSA B182.2, with gasket joints assembled with pipe lubricant from same manufacture as pipe. Provide green coloured pipe for sanitary lines and white coloured pipe for storm lines.

.1 Acceptable Manufacturers

.1 Ipex “Ring-Tite” Sewer Pipe

.2 Royal Building Products “DSLI” Sewer Pipe

.3 Next Polymers “Duraloc” Sewer Pipe

.3 **PVC DWV Pipe:** Ipex Inc. System 15 rigid PVC drain, waste, and vent pipe and fittings manufactured to CAN/CSA B181.2, complete with solvent weld joints. Solvent weld cement and primer (when required by manufacture) shall be same manufacturer as pipe. When used in buildings of non-combustible construction all PVC pipes shall be certified to CAN/ULC S102.2 and achieve a Flame Spread Rating not exceeding 25. System 15 shall not be used in high buildings or air plenums. For dry fire barrier penetration, an approved donut type firestop conforming to the requirements of ULC/CAN4-S115 M95 shall be installed at all fire rated walls.

.1 Acceptable Manufacturers

.1 Ipex “System 15” DWV Pipe

.2 Royal Building Products “LRS-25” DWV Pipe

.4 **Plenum Rated PVC DWV Pipe:** Ipex Inc. System XFR rigid PVC drain, waste, and vent pipe and fittings to CAN/CSA B181.2, complete with solvent weld joints. Solvent weld cement and primer (when required by manufacture) shall be same manufacturer as pipe. When used in buildings of non-combustible construction, high buildings, and air plenums all PVC pipes shall be certified to CAN/ULC S102.2, achieve a Flame Spread Rating not exceeding 25 and achieve Smoke Developed Classification not exceeding 50. For dry fire barrier penetration, an approved donut type firestop conforming to the requirements of ULC/CAN4-S115 M95 shall be installed at all fire rated walls.

.1 Acceptable Manufacturers

.1 Ipex “XFR” DWV Pipe

.2 Royal Building Products “HRS-2550” DWV Pipe

.5 **DWV Copper- Solder Joint:** Type DWV hard temper in accordance with ASTM B306, with forged copper solder type drainage fittings and 50% lead - 50% tin solder joints.

.6 **Cast Iron:** Cast iron pipe, fittings and joints in accordance with CAN/CSA B70, couplings to CAN/CSA B602 (Class 4000).

.7 **DWV Copper-Grooved Coupling Joint:** Type DWV hard temper in accordance with ASTM B306, with factory or site rolled grooved ends (with grooving rolls designed for copper) and Victaulic Co. "Copper Connection" wrought copper or cast bronze fittings and Style 606 gasket type couplings or Grinnell (Tyco Mechanical Products) Style 672.

3 Execution

3.1 PIPING INSTALLATION REQUIREMENTS

.1 Provide all required drainage, waste, and vent piping. Pipe, unless otherwise specified in the Contract Documents, shall be as follows:

.1 For underground sanitary and storm pipe inside the building footprint use rigid **PVC Sewer Pipe**, minimum 100 mm (4") diameter. For pipe sizes 150 mm (6") diameter and smaller use **Solvent Weld PVC Sewer Pipe**, for all larger pipe diameters use **Gasketed PVC Sewer Pipe.**

.2 For sanitary and storm pipe inside the building and above ground in sizes up to and including 65 mm (2½") diameter type **DWV Copper** shall be used. Where permitted by the OBC, **PVC DWV Pipe** may be used in lieu of **DWV Copper**.

.3 For sanitary and storm pipe inside the building and above ground in sizes 75 mm (3") diameter and larger - **Cast Iron** shall be used except for drainage pump discharge pipe. Where permitted by the OBC, **PVC DWV Pipe** may be used in lieu of **Cast Iron**.

.4 In air plenums **Plenum Rated PVC DWV Pipe** shall be used in lieu of **PVC DWV Pipe**.

.2 Lay pipes true to line and grade with bells upgrade. Fit sections together so that, when complete, the pipe has a smooth and uniform invert. Keep pipe thoroughly clean so that jointed compound will adhere. Inspect the pipe for defects before lowering the pipe into the trench. Do not use defective pipe.

.3 Unless otherwise specified in the Contract Documents, slope horizontal drainage piping above ground in sizes to and including 75 mm (3") diameter 25 mm (1") in 1.2 m (4'), and pipe 100 mm (4") diameter and larger 25 mm (1") in 2.4 m (8').

.4 Install and slope underground drainage piping to inverts or slopes indicated on the Drawings to facilitate straight and true gradients between the points shown. Verify available slopes before installing the pipes.

.5 Unless otherwise specified in the Contract Documents, slope horizontal branches of vent piping down to the fixture or pipe to which they connect with a minimum pitch of 25 mm (1") in 1.2 (4').

.6 Extend vent stacks up through the roof generally where shown but with exact locations to suit site conditions. Terminate vent stacks 457 mm (18") above the roof in vent stack covers.

.7 Provide proper dielectric unions at connections between copper pipe and ferrous pipe or equipment.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 20 05 00 – General Requirements.

.2 Section 22 13 16 – Drainage, Waste, and Vent Piping.

.3 Section 22 13 20 – Floor Drains.

1.2 REFERENCES

.1 ASTM International Inc.

.1 ASTM A743, Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application.

.2 ASTM A48, Standard Specification for Gray Iron Castings.

.3 ASTM A563, Standard Specification for Ductile Iron Castings.

.4 ASTM B584, ASTM Specification for Copper Alloy Sand Castings.

.2 American Society of Mechanical Engineers (ASME)

.1 ASME B1.20.1, Pipe Threads, General Purpose, Inch

.3 Canadian Standards Association (CSA International)

.1 CAN/CSA B602, Mechanical couplings for drain, waste, and vent and sewer pipe.

.2 CAN/CSA B182.2, PSM Type Polyvinylchloride (PVC) Sewer Pipe and Fittings.

.3 CSA B272-93, Prefabricated Self-Sealing Roof Vent Flashings.

1.3 SUBMITTALS

.1 **Shop Drawings**: Submit shop drawings for all products specified in this Section except pipe and fittings. Shop drawings are to include all components including but not limited to panel layout drawings, wiring diagrams with wire numbers, individual components within panel, motor shop drawing, etc.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 10 00 - General Requirements.

.2 Deliver materials to site in original factory packaging, labelled with the Manufacturer's name and address.

.3 Store at temperatures and conditions recommended by the Manufacturer.

2 Products

2.1 CLEANOUTS

.1 Horizontal Piping: TY pipe fitting with an extra heavy brass plug screwed into the fitting.

.2 Vertical Piping:

.1 Bronze or copper cleanout tees in copper piping, each complete with a bronze ferrule, and, for cast iron piping, epoxy coated cast iron cleanout tees, each gas and water-tight, complete with an ABS tapered thread plug. Acceptable cast iron cleanout tees are:

.1 Zurn #Z-1445

.2 Jay R. Smith #4510

.3 Mifab #C1460

.4 Watts Water Technologies (Canada) Inc. #CO-460

.3 Urinal(s): Wall access cleanout assemblies, each complete with a tapered plug, threaded brass insert, urethane rubber seal, and polished stainless steel access cover with vandalproof stainless steel securing screw. Acceptable products are:

.1 Zurn #Z-1666-1-VP

.2 Jay R. Smith #SQ4-1819

.3 Mifab #C1440-RD-6

.4 Watts Water Technologies (Canada) Inc. #CO-440-RD-6

2.2 FLOOR CLEANOUT TERMINATIONS

.1 Baked epoxy coated cast iron terminations, each complete with a solid stainless steel gasketed access cover to suit the floor finish, a cleanout plug, and captive stainless steel securing hardware. Acceptable products are:

.1 Zurn #ZS-1602-SP Series

.2 Jay R. Smith #4020-SS-F-C Series

.3 Mifab #C1000-R-3-34

.4 Watts Water Technologies (Canada) Inc. #CO-1200-R-3-34

.2 All cleanout terminations in areas with a tile or sheet vinyl finish are to be as above but with a square top in lieu of a round top. Refer to the Room Finish Schedule.

3 Execution

3.1 INSTALLATION OF CLEANOUTS:

.1 Provide cleanouts in drainage piping in locations as follows:

.1 In the building drain or drains as close as possible to the inner face of the outside wall, and, if a building trap is installed, locate the cleanout on the downstream side of the building trap.

.2 At or as close as practicable to the foot of each drainage stack.

.3 At maximum 15 m (50 foot) intervals in horizontal pipe 100 mm (4 inch) diameter and smaller.

.4 At maximum 30 m (100 foot) intervals in horizontal pipe larger than 100 mm (4 inch) diameter.

.5 In the wall at each new urinal or bank of urinals in a washroom.

.6 Wherever else shown on the Drawings.

.2 Cleanouts are to be the same diameter as the pipe in piping to 100 mm (4 inch) diameter, and not less than 100 mm (4 inch) diameter in piping larger than 100 mm (4 inch) diameter.

.3 Cleanouts in vertical piping are to be cleanout tees, cast iron in piping 75 mm (3 inch) diameter and larger, copper or bronze in piping smaller than 75 mm (3 inch) dia.

.4 Cleanouts in horizontal piping are to be TY fittings with removable plugs.

.5 Where cleanouts are concealed behind walls or partitions, install the cleanouts near the floor and so that the cover is within 25 mm (1 inch) of the finished face of the wall or partition.

3.2 INSTALLATION OF FLOOR CLEANOUT TERMINATIONS:

.1 Where cleanouts occur in horizontal inaccessible underground piping, extend the cleanout TY fitting up to the floor and provide a cleanout termination set flush with the finished floor.

.2 In waterproof floors, ensure that each cleanout termination is equipped with a flashing clamp device. Cleanout terminations are to suit the floor finish. Refer to Room Finish Schedules.

.3 Where cleanout terminations occur in finished areas, confirm locations prior to rough-in and arrange piping to suit.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 20 05 00 – General Requirements.

.2 Section 22 13 16 – Drainage, Waste, and Vent Piping.

.3 Section 22 13 19 – Drainage, Waste, and Vent Piping Specialties.

1.2 REFERENCES

.1 ASTM International Inc.

.1 ASTM A743, Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application.

.2 ASTM A48, Standard Specification for Gray Iron Castings.

.3 ASTM A563, Standard Specification for Ductile Iron Castings.

.4 ASTM B584, ASTM Specification for Copper Alloy Sand Castings.

.2 American Society of Mechanical Engineers (ASME)

.1 ASME B1.20.1, Pipe Threads, General Purpose, Inch

.3 Canadian Standards Association (CSA International)

.1 CAN/CSA B70, Cast iron soil pipe, fittings, and means of joining.

.2 CAN/CSA B602, Mechanical couplings for drain, waste, and vent and sewer pipe.

.3 CAN/CSA B182.2, PSM Type Polyvinylchloride (PVC) Sewer Pipe and Fittings.

1.3 SUBMITTALS

.1 **Shop Drawings**: Submit shop drawings for all products specified in this Section except pipe and fittings. Shop drawings are to include all components including but not limited to panel layout drawings, wiring diagrams with wire numbers, individual components within panel, motor shop drawing, etc.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver materials to site in original factory packaging, labelled with the Manufacturer's name and address.

.3 Store at temperatures and conditions recommended by the Manufacturer.

2 Products

2.1 FLOOR DRAINS

.1 Compliance: ASME A112.6.3.

.2 Body: 8-inch (200-mm) diameter body.

.3 Lacquered, ASTM A 48, Class 25 cast iron body with anchor flange and weepholes.

.4 4-inch (100-mm) throat. 4-inch (100-mm) NPS machined integral body threads.

.5 Ductile iron grate.

.6 Strainer Diameter: 5 inches (125 mm).

.7 Pipe Size: minimum 3 inches (75 mm)

.8 Sediment bucket.

.9 Socket Connection Body: [PVC] [ABS].

3 Execution

3.1 INSTALLATION OF FLOOR DRAINS

.1 Provide floor drains where shown on the Drawings.

.2 Equip each drain with a trap and trap primer line.

.3 In equipment rooms and similar areas, exactly locate floor drains to suit the location of mechanical equipment and equipment indirect drainage piping.

.4 Confirm the exact location of drains prior to roughing in.

.5 Temporarily plug floor drains during construction procedures. Remove plugs during final cleanup work and demonstrate free and clear operation of each drain. Replace any damaged grates.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:

.1 Supply and installation of all piping, fittings, receiver, and related equipment used to supply compressed air to:

.1 Festooning system for two traveling person lifts.

.2 Compressed air festooning hose supplied by lift supplier.

.3 Existing distribution piping system for abrasive blasting units.

.4 Purified Breathing Air filtration system

.5 Including festooning hose to two person lifts.

.6 Receiver/storage tank.

.7 Dust collector system.

.8 As also indicated on the drawings.

.2 Quick disconnect connectors for room outlets and two outlets for person-lifts

.3 Related Requirements

.1 Not used

1.2 REFERENCE STANDARDS

.1 American Society of Mechanical Engineers (ASME)

.1 ASME Boiler and Pressure Vessel Code Section VIII Pressure Vessels.

.1 BPVC-VIII B, BPVC Section VIII - Rules for Construction of Pressure Vessels Division 1.

.2 BPVC-VIII-2 B, BPVC Section VIII - Rules for Construction of Pressure Vessels Division 2 - Alternative Rules.

.3 BPVC-VIII-3 B, BPVC Section VIII - Rules for Construction of Pressure Vessels Division 3 - Alternative Rules High Press Vessels.

.2 ASME B16.5, Pipe Flanges and Flanged Fittings.

.3 ASME B16.11, Forged Fittings, Socket-Welding and Threaded.

.2 American Society for Testing and Materials International (ASTM)

.1 ASTM A53/A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.

.2 ASTM A181/A181, Standard Specification for Carbon Steel Forgings for General Purpose Piping.

.3 Canadian Standards Association (CSA International)

.1 CSA B51, Boiler, Pressure Vessel, and Pressure Piping Code.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submittals in accordance with Section 01 10 00- General Requirements.

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet for piping, fittings and equipment.

.2 Submit WHMIS MSDS in accordance with Section 01 10 00. Indicate VOC's for adhesive and solvents during application and curing.

.3 Shop Drawings:

.1 Submit shop drawings:

.2 Shop Drawings shall include all the major systems including and not limited to the following information:

.3 Filters

.4 Receiver

.5 Automatic drain and condensate pumping

.6 Piping Systems.

.1 Piping, fittings, valves.

.2 System purging and cleaning procedures and products.

.3 Quick connectors

.7 Electrical.

.1 Single line wiring diagram showing all devices and electrical components.

.8 Controls.

.1 Control Panel features and alarms.

1.4 QUALITY ASSURANCE

.1 Pre-Installation Meeting:

.1 Convene pre-installation meeting 1 week prior to beginning work of this Section.

.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.

1.5 TSSA PACKAGE:

.1 Submit all required forms to CSA B51 and TSSA requirements.

.2 Submit copies to both ONTC and the TSSA.

.3 Items to include:

.1 List of all welders working upon piping systems.

.2 Each welder’s certification and welding procedure registration number(s).

.3 Welders’ credentials prior to beginning installation of any system governed by the Boilers and Pressure Vessels Act.

.4 TSSA form, “Piping Systems Installation and Test Data Report.”

.4 Submit Pre-Start Health and Safety Review Report in accordance with this Section.

1.6 APPROVALS

.1 ONTC will register Contract Drawings and Specifications, where required under Boilers and Pressure Vessels Act, with Technical Standards and Safety Authority (TSSA).

1.7 DELIVERY, STORAGE AND HANDLING

.1 Waste Management and Disposal:

.1 Separate waste materials for recycling.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal and for recycling in accordance with Waste Management Plan (WMP).

.4 Separate for recycling and reuse and place in designated containers in accordance with Waste Management Plan (WMP).

.5 Handle and dispose of hazardous materials in accordance with CEPA and Regional and Municipal regulations.

.6 Divert unused metal materials from landfill to metal recycling facility as approved by Consultant.

1.8 PRE-START HEALTH AND SAFETY:

.1 Submit Pre-Start Health and Safety Review Report in accordance with this Section.

1.9 APPROVALS

.1 ONTC will register Contract Drawings and Specifications, where required under Boilers and Pressure Vessels Act, with Technical Standards and Safety Authority (TSSA).

1.10 CLOSEOUT SUBMITTAL(S):

.1 Submit the following for incorporation into Operation and Maintenance Manuals in accordance with Section 01 10 00:

.1 Identification: Manufacturing name, type, year, serial number, number of units, capacity and identification of related systems.

.2 Functional description detailing operation and control of components.

.3 Performance criteria and maintenance data.

.4 Operating instructions and precautions.

.5 Safety precautions.

.6 Spare parts list in accordance with Section 20 05 00.

.7 All TSSA test and inspection reports.

.8 Maximum allowable operating pressure of each system.

.9 Pressure rating of every device in each system, including pipes, fittings, hoses, flexible connectors, and valves.

.10 Actual working operating pressure of each system.

.11 Setting of each pressure regulator, PRV, etc.

.12 Maintain records and include documentation provided to TSSA of all certified fittings and assemblies (CRN).

.13 Copy of test certificate TSSA form “Piping Systems Installation and Test Data Report” completed and signed by the Contractor and TSSA inspector.

.14 Copy of piping system registration documents (Supplied by ONTC).

.15 Manufacturer's instructions for piping delivery and storage.

.16 Copy of full set of reviewed Shop Drawings and, if applicable, Marked-up Shop Drawings.

.17 Warranty information.

2 Products

2.1 MATERIALS

2.2 AIR RECEIVER

.1 Steel tank: to CSA B51, ASME Section VIII and provincial regulations, for working gauge pressure of 1035 kPa.

.2 Inlet and outlet connections: NPS 3.

.3 Accessories: adjustable pressure regulator, safety valve, 125 mm diameter gauge with pressure range of 0 to 1500 kPa, drain cock, and automatic condensate trap.

.4 CRN.

.5 Provincial inspector's certificate and label.

.6 Finish: shop primed, ready for field painting.

2.3 STEEL PIPING

.1 Piping: to ASTM A53/A53M, schedule 40 seamless black steel.

.2 Fittings:

.1 NPS1 and smaller: to ASME B16.11, schedule 40 steel, threaded.

.2 NPS1 to 2: to ASME B16.11, schedule 40 steel, threaded.

.3 NPS2 1/2 and larger: to ASME B16.11, schedule 40 steel, butt or socket welded.

.3 Couplings: to ASME B16.11, socket welded or threaded half coupling type.

.4 Unions: 1035 kPa malleable iron with brass-to-iron ground seat.

.5 Dissimilar metal junctions: use dielectric unions.

.6 Flanges:

.1 NPS2 and smaller: to ASME B16.5, forged steel, raised face and socket welded.

.2 NPS2 1/2 and larger: to ASME B16.5, forged steel, raised face and slip-on or weld neck.

.7 Joints:

.1 NPS2 and smaller: NPT.

.2 NPS2 1/2 and larger: butt welded.

2.4 BALL VALVES

.1 Three piece design or top entry for ease of in-line maintenance.

.1 To ASTM A181/A181M, Class 70, carbon steel body screwed ends, carbon steel ball and associated trim suitable for compressed air application.

.2 To withstand 1035 kPa maximum pressure.

.2 Proprietary for approved proprietary piping systems.

2.5 COUPLERS/CONNECTORS

.1 Industrial interchange series, full-bore, to match existing.

.2 Maximum inlet pressure: 1700 kPa.

.3 Valve seat: moulded nylon.

.4 Body: zinc plated steel.

.5 Threads: NPT.

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 COMPRESSED AIR PIPING CONNECTIONS AND INSTALLATION

.1 Install flexible connection in accordance with Section 23 05 16 – Piping Expansion Compensation.

.2 Install shut-off valves at outlets, major branch lines and in locations as indicated.

.3 Install quick-coupler chucks and pressure gauges on drop pipes.

.4 Install unions to permit removal or replacement of equipment.

.5 Install tees in lieu of elbows at changes in direction of piping. Install plug in open ends of tees.

.6 Grade piping at 1% slope minimum.

.7 Install compressed air trap and pressure equalizing pipe at moisture collecting points. Drain pipe to nearest floor drain.

.8 Make branch connections from top of main.

.9 Install compressed air trap at bottom of risers and at low points in mains, piped to nearest drain. Distance between drain points to be 30 m maximum.

.10 Weld steel piping in accordance with Section 23 05 17- Pipe Welding and;

.1 To ASME code and requirements of authority having jurisdiction.

.2 Weld concealed and inaccessible piping regardless of size.

3.3 FIELD QUALITY CONTROL

.1 Site Tests/Inspection:

.1 Testing: pressure test in accordance with requirements of Section 21 05 01 - Common Work Results for Mechanical, for 4 hours minimum, to 1100 kPa, with outlets closed and with compressor isolated from system. Pressure drop not to exceed 10 kPa.

3.4 CLEANING

.1 Refer to Section 20 05 00 - and Section 20 05 93.

.2 Cleaning: blow out piping to clean interior thoroughly of oil and foreign matter.

.3 Check entire installation is approved by authority having jurisdiction.

.4 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 REQUIREMENTS

.1 Section 20 01 00 – General Requirements

.2 Section 22 11 16 – Domestic Water Piping

1.2 REFERENCE STANDARDS

.1 Canadian Standards Association (CSA International):

.1 CAN/CSA-B45 Series, Plumbing Fixtures.

.2 CAN/CSA-B125.3, Plumbing Fittings.

.3 CAN/CSA-B651, Accessible Design for the Built Environment.

1.3 ACTIONS AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.3 Provide manufacturer's printed product literature and datasheets for fixtures and include product characteristics, performance criteria, physical size, finish and limitations.

.4 Closeout Submittals:

.5 Provide maintenance data in accordance with Section 01 78 00.

.6 Include:

.1 Description of fixture and trim, giving manufacturer's name, type, model, year, capacity.

.2 Details of operation, servicing, maintenance.

.3 List of recommended spare parts.

.7 Include diagrams for power, signal, and control wiring of automatic faucets.

1.4 DELIVERY STORAGE AND DISPOSAL

.1 Waste Management and Disposal:

.2 Separate waste materials for reuse and recycling.

.3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material, in appropriate on-site bins.

.4 Fold up metal and plastic banding, flatten and place in designated area for recycling.

2 Products

2.1 PLUMBING FIXTURE AND FITTING SCHEDULE

.1 For plumbing fixture and fitting manufacturers, catalogue numbers, and specific requirements, refer to the Drawing schedule of plumbing fixtures and fittings.

.2 Unless otherwise specified in the Contract Documents, requirements specified below apply to the plumbing fixtures and fittings scheduled on the Drawings.

2.2 GENERAL: PLUMBING FIXTURES AND FITTINGS

.1 Fixtures and fittings, where applicable, shall be in accordance with the requirements of CSA B45 Series, Plumbing Fixtures.

.2 All fixtures and fittings for use by the handicapped are to be in accordance with Ontario Building Code requirements.

.3 Unless otherwise specified in the Contract Documents, all vitreous china and porcelain enamelled fixtures shall be white.

.4 Unless otherwise specified in the Contract Documents, all fittings exposed to view shall be chrome plated and polished.

.5 All fittings located in areas other than private washrooms shall be vandal-proof.

.6 All fixtures carriers shall be suitable in all respects for the fixture they support and the construction in which they are located.

2.3 WATER CLOSETS

.1 WC-1 - Barrier Free, Wall Hung, Solar Flush Valve Water Closet

.1 Fixture: American Standard Afwall Millennium FloWise Elongated bowl no. 3351101.020 High Efficiency Toilet, vitreous china with EverClean antimicrobial surface which inhibits the growth of stain and odor causing bacteria mold and mildew, white finish, siphon jet flush action, toilet operates in the range of 4.2L to 6.0L (1.1USG to 1.6USG) per flush, condensate channel, 305mm x 254mm (12" x 10") water surface, 54mm (2-1/8") fully glazed internal trapway, 38mm (1-1/2") diameter top spud.

.2 Seat: Centoco no. AMFR1500STSCCSS-001 toilet seat, extra heavy duty, for elongated bowl, open front, solid plastic, less cover, stainless steel self-sustaining check hinges, metal flat washers stainless steel posts and nuts, white, antimicrobial and fire retardant surface.

.3 Valve: Delta Commercial model 81T201SP-48-MMO, electronic exposed solar flush valve for top spud toilet, polished chrome finish, 4.8L (1.28USG) factory set flow non-adjustable, vandal proof metal cover with top mounted electronic sensor and solar module, true mechanical manual override button (MMO), sensor designed for indoor lighting and operates in high or low brightness levels and compatible with occupancy lighting, scratch resistant lens window, four 'AA' batteries (factory installed) with battery strength indicator and low battery warning light, infrared sensor with multiple detection distances along with a bowl length setting to react appropriately to usage patterns, 24 hour automatic flush option, quiet action 'TECK' exposed chloramine resistant diaphragm flush valve, angle check stop with protecting cap, cover tube, wall flange, spud flange, concealed spud nut, outlet tube for 292mm (11-1/2") rough-in, vacuum breaker. Valve handing (Left or Right) shall be selected to suit each barrier free toilet stall location with **valve override button located farthest away from side wall**.

.4 Carrier: Watts no. ISCA-101-M11 single horizontal adjustable toilet carrier, mounted on concrete floor, all epoxy coated cast iron fitting, adjustable ABS slide nipple with integral test cap and neoprene bowl gasket, wasted plated hardware, chrome cap nuts, tiling frame, 102mm (4") no hub waste, 51mm (2") no hub vent, 158.8kg (350 lbs) static load. Minimum space: 305mm (12") finished metal stud wall to back of pipe space.

.5 Coupling: Champion model MI-XHUB, no hub, 304 type stainless steel band and eyelet, elastomeric compound gasket comply to ASTM C-564, 304 type SS shield painted red to ease identification

2.4 LAVATORIES

.1 LAV-1 - Barrier free Wall Hung Lavatory with Solar Faucet

.1 Fixture: American Standard Decorum #9024.001EC.020 Basin, Center hole only, 508 mm x 464 mm x 127 mm (20" x 18-1/4" x 5") high, Vitreous china, White Finish, for carrier with concealed arms, for carrier with concealed arms, Rear overflow, self-draining faucet ledge.

.2 Faucet: Delta model DEMD-320LF solar powered Electronic Faucet, Chrome plated finish, Center hole only, solid brass, above deck serviceable components, sensor designed for indoor lighting and operates in high or low brightness levels and compatible with occupancy lighting, four 'AA' batteries (factory installed) with low battery warning light, auto shut-off after 30 seconds, vandal resistant concealed aerator at 0.5 GPM (1.9 LPM), single temperature, built-in check valve and inline filte.

.3 McGuire #155A Open Grid Drain, cast brass one piece top, 17 GA. (1.5 mm) tubular 32 mm (1-1/4") tailpiece.

.4 McGuire #LFH170BV Faucet Supplies, Chrome plated finish polished brass, commercial duty 1/4 turn ball valve angle stops, 13 mm (1/2") I.D. Inlet x 127 mm (5") horizontal extension tubes, convertible 1/4 turn/loose key handles, Escutcheon and flexible copper risers.

.5 McGuire #8872C P-Trap, heavy cast brass adjustable body, with slip nut, 32 mm (1-1/4") size, Shallow wall flange and Seamless tubular wall bend.

.6 McGuire PROWRAP #PW2000 Sanitary Covering vandal-resistant, flexible seamless moulded closed-cell PVC resin, formulated with anti-microbial additive to limit the growth of fungus and bacteria, to exposed piping (to protect against heat/contusions) as per local codes.

.7 Watts #WCA-411 Basin Carrier, concealed arms, wall flanges to attach to backing plate secured in wall with locking device and levelling screws, heavy gauge steel uprights with integral welded feet. For one unit: 102 mm (4") for two to six units in a row: 152 mm (6") finished metal stud wall to back of pipe space

2.5 SINKS

.1 S-1 – Barrier Free Two Compartment Stainless Steel Sink

.1 Fixture: Franke Commercial no. ALBD6406P-1/1 double bowl countertop mount sink, 1 hole, 794mm (31-1/4") wide x 521mm (20-1/2") long x 152mm (6") deep, spillway, counter mounted, back ledge, grade 18-10 18ga. (1.2mm) type 304 stainless steel, self-rimming, satin finish rim and bowls, mounting kit provided, fully undercoated to reduce condensation and resonance, factory applied rim seal, 3-1/2" (89mm) crumb cup waste assembly with 1-1/2" (38mm) tailpiece.

.2 Faucet: Delta Signature model 470-DST single handle faucet, polished chrome finish, center hole only, Diamond coated ceramic cartridge, 6.8LPM (1.8GPM) regulator, swing spout rotates 120 degrees, 229mm (9") reach, lever handle with red/blue indicator markings, pull-out spray wand with aerated stream or spray, retractable hose 1346mm (53”) long which extends to 864mm (34”) usable length, standard 10mm (3/8”) compression gasket fittings, integral double check valves in spout, 3/8” OD straight staggered PEX supply lines.

.3 Supplies: McGuire no. LFBV170 faucet supplies, chrome plated finish polished brass, commercial duty 1/4 turn ball valve angle stops, 13mm (1/2") I.D., inlet x 127mm (5") horizontal extension tubes, convertible 1/4 turn/loose key handles, escutcheon and flexible copper risers.

.4 Trap: McGuire no. 8912CB P-Trap, heavy cast brass adjustable body, with slip nut, 38mm (1-1/2") size, box flange and seamless tubular wall bend.

.5 McGuire PROWRAP #PW2000 Sanitary Covering vandal-resistant, flexible seamless moulded closed-cell PVC resin, formulated with anti-microbial additive to limit the growth of fungus and bacteria, to exposed piping (to protect against heat/contusions) as per local codes

.2 MS - Floor Mounted Service Sink

.1 Fixture: Stern Williams no. CRS-2200 Crescent quarter round service / mop sink, 711mm (28") wide x 711mm (28") long x 305mm (12") deep with 152mm (6") front lip with one piece 20 go. 302 stainless steel cap cast integral on from drop, floor mounted, Terrazzo receptor composed of pearl grey marble chips and white Portland cement ground smooth, grouted and sealed to resist stains, integral cast brass drain with stainless steel strainer, 3" (76mm) outlet.

.2 Faucet: Delta no. 28C8173 wall mounted two handles faucet, chrome plated finish, wall mount 8" (203mm) center set, cast brass body, 3.8LPM (1.0GPM) unrestricted hose end outlet, 203mm (8") projection spout with vacuum breaker and bucket hook, vandal resistant hooded lever handle, top brace, integral check stops, CER-TECK cartridges.

.3 Splash Panel: Stern Williams BP 610mm (24") 20 ga. 304 stainless steel.

.4 Hose & Wall Hook: Stern Williams T-34 hose and wall hook 36" (915mm) long flexible heavy duty 5/8" rubber hose, cloth reinforced with 3/4" chrome coupling. Wall bracket is 5"(127mm) long by 3" (76.2mm) stainless steel rubber grip.

.5 Hanger: Stern Williams T-40 mop hanger, stainless steel with #4 finish, 24 inch long with 3 rubber spring loaded grips.

2.6 SHOWERS

.1 SH-1 – Barrier Free Shower

.1 Fixture: Delta #T13H152-25 Universal Pressure balancing Shower kit, Chrome plated finish, R10000-UNWS MultiChoice valve heavy duty forged brass body, integral screwdriver stops, wall trim faceplate with on/off and temperature control single lever handle, integral service stops and adjustable hot limit safety stop. Hand shower with two check valves, 5.7 LPM (1.5 GPM) flow rate, 1753mm (69") long chrome plated stainless steel hose, wall supply, 914mm (36") stainless steel slide bar with adjustable slide.

.2 Drain: Watts #FD-100-C-A Floor Drain, epoxy coated cast iron, 5" (127 mm) adjustable round nickel bronze strainer, reversible clamping collar with primary & secondary weepholes. Provide P-Trap, Same material as the connecting pipe drain.

2.7 EMERGENCY FIXTURES

.1 ES – Eye Wash and Emergency Shower

.1 Fixture: Guardian #G1902 -FC20-SSH, pedestal mounted, combination shower and eye wash, 11 1/2" (292 mm) diameter, stainless steel bowl, two (2) GS-Plus spray heads with fliptop dust cover and filter, powder coated cast aluminum flag handle activation, 10" (254 mm) diameter stainless steel shower head, 1/2" (13 mm) IPS chrome plated brass stay-open ball valve with Teflon seal, 1" (25 mm) IPS chrome plated brass stay-open ball valve with Teflon seals, stainless steel actuating arm and 29" (737 mm) stainless steel pull rod, schedule 40 galvanized steel furnished with orange polyethylene covers on vertical piping, shower flow rate at 20 GPM (76 LPM), 1-1/4" (32 mm) NPT female outlet - Unit is third party certified by IAPMO to meet ANSI Z358.1-2014, the Uniform Plumbing Code cUPC and the National Plumbing Code of Canada. Eyewash/Facewash fixture should be installed 4 to 10 feet from the mixing valve.

.2 Thermostatic Mixing Valve: Lawler no. 911E/F, emergency thermostatic mixing valve for Eyewash or Eye/Face Wash, lead-free brass and stainless steel design, vandal resistant temperature adjustment, stainless steel sliding piston control device allow cold flow through both the fixed and variable bypass, 13mm (1/2") N.P.T., outlet, positive hot water shut-off, liquid-filled thermostatic motor control mechanism, 29°C (84.2°F) factory set temperature, standard 69.8°F (21°C) - 89.6°F (32°C) temperature range, 26LPM (6.9GPM) flow capacity at 30psi (207kPa) pressure drop across the valve, 7.57LPM (2.0GPM) min. Flow rate, 18LPM (4.8GPM) bypass flowrate at 30psig. Provide shut-offs at emergency mixing valve

2.8 ACCEPTABLE MANUFACTURERS

.1 Vitreous china and enameled cast iron or steel fixtures: Basis of Design = American Standard, Alternate: Zurn, Sloan, Toto, and Kohler.

.2 Stainless steel sinks: Franke, AERO, Novanni Stainless Inc., Kindred Industries "Aristaline".

.3 Precast terrazzo fixtures: Acorn, Fiat Products Ltd. and Stern-Williams.

.4 Water closet seats: Basis of Design = Centoco, Alternate: Zurn, Bemis, Olsonite and Beneke.

.5 Flush valves: Basis of Design = Delta Commercial, Alternates: Zurn, Sloan, American Standard, Toto.

.6 Fixture carriers: Zurn, Mifab, Jay R. Smith and Watts Industries .

.7 Faucets: unless otherwise specified, Delta Commercial, Zurn, American Standard, Kohler and Chicago Faucet.

.8 Fixture trim: unless otherwise specified, McGuire, Zurn, American Standard, Kohler.

3 Execution

3.1 INSTALLATION OF PLUMBING FIXTURES AND FITTINGS

.1 Provide all required plumbing fixtures and fittings.

.2 Provide isolation valves (ball valves) for all fixtures.

.3 Connect plumbing fixtures and fittings with piping sized in accordance with the Drawing schedule.

.4 Confirm the exact location of all plumbing fixtures and trim prior to roughing-in.

.5 When installation is complete, check and test the operation of each fixture and fitting. Adjust or repair as required.

.6 Counter Mounted Fixtures and Trim: Supply templates for all counter mounted fixtures and trim and hand to the trade who will but the counter. Ensure openings in the counter are properly located.

.7 Electronic Lavatory Faucets: Locate control panels for electronic faucets under the lavatories and recessed into the wall. It is the intent to locate the transformer(s) (power converter(s)) in the wall cavity or concealed under counters. Provide access doors accordingly for servicing of transformer(s). Coordinate locations with the work of Division 26 that will provide 120 vac line supply to the transformers(s). Provide low voltage wiring from the transformer(s) to each terminal point in control panel(s) under lavatories. All water and electronic supply from control panel to faucet shall be through the flexible conduit supplied with the control panel. Connect hot and cold water piping to the mixing valve in each box, and tempered water piping from each mixing valve to the faucet. Set mixing valve maximum temperature limit stops to 43ºC. (109ºF) after potable water systems (hot and cold) are complete. Ensure that each programmable controller is properly programmed, and that water off after deactivation is set for three seconds. **Note:** All electrical line supply and low voltage wiring, including any wall receptacles as well as low voltage wiring to boxes shall be concealed.

.8 Electronic Flush Valves: Locate the transformer(s) (power converter(s)) in the wall cavity next to fixtures to be served. Provide access doors accordingly for servicing of transformer(s). Coordinate locations with Division 26 who will provide 120 vac line supply to the transformers(s). Provide low voltage wiring from the transformers(s) to each electronic flush valve terminal point. Note: All electrical line supply and low voltage wiring, including any wall receptacles as well as low voltage wiring to boxes shall be concealed.

.9 Thermostatic Mixing Valves: The device shall be designed to be installed at a single outlet. It may be used to supply individual outlets when there is sufficient supply pressure. Ball valves shall be installed on the hot and cold inlet supplies. Temperature shall be field set. Maximum pressure

differential shall be 103 kPa (15 psi) between hot and cold inlets. Integral check valves and strainer screen shall be installed on hot and cold supply.

3.2 ADJUSTING

.1 Adjust the water flow rate to design flow rates.

.2 Adjust the pressure to fixtures to ensure no splashing at maximum pressures.

.3 Checks:

.1 Aerators: Verify operation, cleanliness.

.2 Vacuum breakers, backflow preventers: Verify operation under all conditions.

.3 Thermostatic controls:

.4 Verify temperature settings, operation of control, limit and safety controls.

3.3 CLEANING AND PROTECTION

.1 After completing the installation of fixtures, inspect and repair damaged finishes.

.2 Clean fixtures, faucets, valves and other fittings with the manufacturers' recommended cleaning methods and materials.

.3 Provide protective covering for installed fixtures and fittings.

.4 Do not allow the use of fixtures for temporary facilities unless approved in writing by the Owner.

END OF SECTION

END OF SECTION

1 General

1.1 REFERENCE STANDARDS

.1 ASTM International

.1 ASTM A126, Standard Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.

.2 ASTM B62, Standard Specification for Composition Bronze or Ounce Metal Castings.

.2 American Water Works Association (AWWA)

.1 ANSI/AWWA C700, Standard for Cold Water Meters-Displacement Type, Bronze Main Case.

.2 ANSI/AWWA C701, Standard for Cold Water Meters-Turbine Type for Customer Service.

.3 ANSI/AWWA C702, Standard for Cold Water Meters-Compound Type.

.3 CSA International

.1 CSA-B64 Series, Backflow Preventers and Vacuum Breakers.

.2 CSA B79, Commercial and Residential Drains and Cleanouts.

.3 CAN/CSA-B356, Water Pressure Reducing Valves for Domestic Water Supply Systems.

.4 National Research Council Canada (NRC)

.1 National Plumbing Code of Canada (NPC).

.5 Plumbing and Drainage Institute (PDI)

.1 PDI-WH201, Water Hammer Arresters Standard.

1.2 ADMINISTRATIVE REQUIREMENTS

.1 Pre-installation Meetings:

.1 Convene pre-installation meeting 1 week prior to beginning on-site installation, with DCC Representative to:

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Co-ordination with other building construction subtrades.

.4 Review manufacturer's written installation instructions and warranty requirements.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Provide manufacturer's printed product literature and datasheets for plumbing products and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Drawings to indicate accessories, dimensions, construction and assembly details, number of anchors, finishes, materials, method of anchorage.

.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.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 – Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for plumbing specialties and accessories for incorporation into manual.

.1 Description of plumbing specialties and accessories, giving manufacturers name, type, model, year and capacity.

.2 Details of operation, servicing and maintenance.

.3 Recommended spare parts list.

1.5 DELIVERY, STORAGE AND HANDLING

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

.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 in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect plumbing materials from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

2 Products

2.1 FLOOR DRAINS

.1 Floor Drains: to CSA B79.

.2 Type 2: heavy duty ; cast iron body, heavy duty non-tilting or hinged lacquered cast iron grate, integral seepage pan and clamping collar.

.3 Type 3: combination funnel floor drain ; cast iron body with integral seepage pan, clamping collar, nickel-bronze adjustable head strainer with integral funnel, and trap seal primer connection.

2.2 TRENCH DRAINS

.1 Trench Drains: to CSA B79.

.2 Description: 14” (352mm) wide x 3.28’ (1000mm) long drain system with integral ductile iron edge rail, precast polyester concrete channel of interlocking design with a built-in slope of 0.5%. Channel has an integral ductile iron edge rail, radiused bottom and 12" (305mm) internal width. Supplied with secured ductile iron slotted grate, Catch basin or integral 8" (203mm) No Hub bottom outlets. System shall be frame-anchored, with ductile iron, ADA compliant grating to suit DIN Class F load rating. System to include frame connectors, grate lockdowns, and construction covers.

.3 Provide accessories to install and service the trench drains including minimum of four (4) grate removal tools. Turn accessories over to DCC Representative.

2.3 ROOF DRAINS

.1 Type 2: standard roof drain with cast iron body with aluminum dome, under-deck clamp to suit roof construction, flashing clamp ring with integral gravel stop.

2.4 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, 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 and:

.1 Plugs: bolted bronze with neoprene gasket.

.2 Cover for Unfinished Concrete Floors: round nickel bronze gasket, vandal-proof screws.

2.5 NON-FREEZE WALL HYDRANTS

.1 Recessed type with integral vacuum breaker, NPS 3/4 hose outlet, removable operating key. Chrome plated finish.

2.6 WATER HAMMER ARRESTORS

.1 Copper construction, piston type: to PDI-WH201.

2.7 BACK FLOW PREVENTERS

.1 Preventers: to CSA-B64 Series, application as indicated, including reduced pressure principle type and double check valve assembly.

2.8 VACUUM BREAKERS

.1 Breakers: to CSA-B64 Series, vacuum breaker, hose connection.

2.9 PRESSURE REGULATORS

.1 Capacity: as indicated.

.1 Inlet pressure: 1034 kPa.

.2 Outlet pressure: 413 kPa.

.2 Up to NPS 1-1/2 bronze bodies, screwed: to ASTM B62.

.3 NPS 2 and over, semi-steel bodies, Class 125, flanged: to ASTM A126, Class B.

.4 Semi-steel spring chambers with bronze trim.

2.10 BACKWATER VALVES

.1 Coated extra heavy cast iron body with bronze seat, revolving bronze flapper and threaded cover.

.2 Access:

.1 Surface access.

.2 Access pipe with cover: maximum 300 mm depth.

.3 Steel housing with gasketted steel cover.

.4 Concrete access pit with cover, as indicated.

2.11 HOSE BIBBS AND SEDIMENT FAUCETS

.1 Bronze construction complete with integral back flow preventer, hose thread spout, replaceable composition disc, and chrome plated in finished areas.

2.12 WATER MAKE-UP ASSEMBLY

.1 Complete with backflow preventer, pressure gauge on inlet and outlet, pressure reducing valve to CAN/CSA-B356, pressure relief valve on low pressure side and ball valves on inlet and outlet.

2.13 TRAP SEAL PRIMERS

.1 Pre-fabricated distribution manifold for trap seal priming. Quantity of connections to be determined by contractor on site.

.2 Backflow Prevention: anti-siphon atmospheric vacuum breaker. NPS 3/4 inlet and outlet. Type “L” copper tubing.

.3 Electrical Components: circuit breaker, manual override switch/test button, timer, solenoid valve marked as ULC listed, 120V.

.4 Cabinet: 305 x 305 x 102 mm NEMA 1 surface mount, galvanized finish.

2.14 STRAINERS

.1 860 kPa, Y type with 20 mesh, monel, bronze or stainless steel removable screen.

.2 NPS 2 and under, bronze body, screwed ends, with brass cap.

.3 NPS 2 1/2 and over, cast iron body, flanged ends, with bolted cap.

2.15 EMERGENCY FIXTURES

.1 Designation: EW – Eye Wash and Emergency Shower

.1 Fixture: Pedestal mounted, combination shower and eye wash, 11 1/2" (292 mm) diameter, stainless steel bowl, two (2) spray heads with fliptop dust cover and filter, powder coated cast aluminum flag handle activation, 10" (254 mm) diameter stainless steel shower head, 1/2" (13 mm) IPS chrome plated brass stay-open ball valve with Teflon seal, 1" (25 mm) IPS chrome plated brass stay-open ball valve with Teflon seals, stainless steel actuating arm and 29" (737 mm) stainless steel pull rod, schedule 40 galvanized steel furnished with orange polyethylene covers on vertical piping, shower flow rate at 20 GPM (76 LPM), 1-1/4" (32 mm) NPT female outlet. Unit shall be third party certified by IAPMO to meet ANSI Z358.1-2014, the Uniform Plumbing Code cUPC and the National Plumbing Code of Canada. Eyewash/Facewash fixture shall not be installed further than 3000mm from the mixing valve.

.2 Thermostatic Mixing Valve: Emergency mixing valve, Thermostatic High-low master water mixing valve, Rough bronze finish, 7" X 6-1/2" X 3" (178 mm X165 mm X75 mm) , Temperature adjustment shall be vandal-resistant, 34 LPM (9 GPM) tempered flowrate @ 5 PSI pressure drop, 49 LPM (13 GPM) tempered flowrate @10 PSI pressure drop, 64 LPM (17 GPM) tempered flowrate @ 20 PSI pressure drop, 94 LPM (25 GPM) tempered flowrate @ 20 PSI pressure drop, In the event that the liquid motor fails, the control mechanism closes off the hot water port with the reverse seat and fully opens the internal variable bypass to allow cold water flow, The control mechanism shall employ a liquid-filled thermostatic motor to drive the valve without additional power requirements. The

control mechanism shall employ a stainless steel sliding piston control device with reverse seat closure and both fixed and variable cold water bypass, Listed to ASSE 1071, 32 mm (1-1/4") NPT inlet, 32 mm (1-1/4") NPT outlet, In the event of interruption of the hot water supply, the control mechanism shall allow cold flow through both the fixed and variable bypass., In-built thermometer to measute the temperature of the stream, In the event of interruption of the cold water supply, the control mechanism closes off the hot water port, stopping all flow. Positive hot water shut-off, For a single shower or for a single or multiple Eye wash station, 85 F, 125 PSI max inlet pressure, 70-90 F, 35 PSI Minimum supply pressure, 120 F Recommended inlet temperature, 65 PSI recommended operating pressure, 102 LPM (27 GPM) tempered flowrate @ 40 PSI pressure drop, The mixing valve must be installed with inlet check valves and the shower or the Eyewash/Facewash fixture should be installed 4 to 10 feet from the mixing valve. Hot and cold water inlet pressures must be equal. Provisions shall be made to thermally isolate the valve. Provide shut-offs at emergency mixing valve.

2.16 MASTER THERMOSTATIC MIXING VALVE

.1 Master water mixing valve shall be of the thermostatic type with liquid-filled thermal motor. It shall have lead free brass body construction with replaceable corrosion-resistant components. Valve construction shall employ a sliding piston control mechanism. Sliding piston and liner shall be of stainless steel material. Valve shall come equipped with union end stop and check inlets with removable stainless steel strainers. Valve shall control temperature from a low flow of 19 LPM (5 GPM) up to a maximum flow rate for a given pressure differential. For a flow rate of 624 LPM (200 GPM) the nominal pressure drop shall be 310 kPa (45 PSI). For a flow rate of 363 LPM (96 GPM) the nominal pressure drop shall be 70 kPa (10 PSI). Valve shall provide protection against hot or cold supply line failure and thermostat failure. Valve shall have safety limit feature set at 45 degrees C maximum and be adjustable on site.

.2 Unit shall include a dial thermometer and shut-off valve on tempered water outlet. Unit shall be assembled and tested with necessary fittings and nipples.

3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: Examine all existing site conditions prior to commencing any work. Inform DCC Representative of any and all unacceptable conditions or deviations from the contract documents immediately upon discovery. Proceed with installation only after unacceptable conditions have been remedied or deviations have been addressed following receipt of written approval to proceed from DCC Representative.

3.2 MANUFACTURER'S INSTRUCTIONS

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

3.3 INSTALLATION

.1 Install in accordance with National Plumbing Code and local authority having jurisdiction.

.2 Install in accordance with manufacturer's instructions and as specified.

3.4 CLEANOUTS

.1 Install cleanouts at base of soil and waste stacks, and at locations required code, and as indicated.

.2 Bring cleanouts to wall or finished floor unless serviceable from below floor.

.3 Building drain cleanout and stack base cleanouts: line size to maximum NPS 4.

3.5 NON-FREEZE WALL HYDRANTS

.1 Install 600 mm above finished grade and as indicated.

3.6 WATER HAMMER ARRESTORS

.1 Install on branch supplies to fixtures or group of fixtures.

3.7 BACK FLOW PREVENTERS

.1 Install in accordance with CSA-B64 Series, where indicated and elsewhere as required by code.

.1 Drains.

.2 Backwater Valves.

.3 Water Make-up Assembly.

.2 Pipe discharge to terminate over nearest drain or service sink.

3.8 BACKWATER VALVES

.1 Install in main sewer lines and where indicated.

.2 Install in access pit as indicated.

3.9 HOSE BIBBS AND SEDIMENT FAUCETS

.1 Install at bottom of risers, at low points to drain systems, and as indicated.

3.10 TRAP SEAL PRIMERS

.1 Install for floor drains and elsewhere, as indicated.

.2 Install on cold water supply, in concealed space, to approval of DCC Representative.

.3 Install soft copper tubing to floor drain.

3.11 STRAINERS

.1 Install with sufficient room to remove basket for maintenance.

3.12 WATER METERS

.1 Install water metre provided by local water authority.

.2 Install water metre as indicated.

3.13 WATER MAKE-UP ASSEMBLY

.1 Install on valved bypass.

.2 Pipe discharge from relief valve to nearest floor drain.

3.14 EMERGENCY FIXTURES

.1 Wall mount eye/face/shower water tempering valve assembly where indicated. Set maximum temperature limit stop to deliver 30°C water. Set mixing valve to deliver 25°C and confirm proper operation.

.2 Secure eye/face/shower assembly to floor in accordance with manufacturer's installation instructions.

3.15 START-UP

.1 General:

.1 In accordance with General Requirements, supplemented as specified herein.

.2 Timing: start-up only after:

.1 Pressure tests have been completed.

.2 Disinfection procedures have been completed.

.3 Certificate of static completion has been issued.

.4 Water treatment systems operational.

.3 Provide continuous supervision during start-up.

3.16 TESTING AND ADJUSTING

.1 General:

.1 Test and adjust plumbing specialties and accessories in accordance with General Requirements, supplemented as specified.

.2 Timing:

.1 After start-up deficiencies rectified.

.2 After certificate of completion has been issued by authority having jurisdiction.

.3 Application tolerances:

.1 Pressure at fixtures: +/- 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 Floor drains:

.1 Verify operation of trap seal primer.

.2 Prime, using trap primer. Adjust flow rate to suit site conditions.

.3 Check operations of flushing features.

.4 Check security, accessibility, removability of strainer.

.5 Clean out baskets.

.6 Trench Drains

.1 Verify operation of trap seal primer and/or trench fume extraction fan.

.2 Prime, using trap primer. Adjust flow rate to suit site conditions.

.3 Check for proper slope and drainage throughout.

.4 Check security, accessibility, removability of grating.

.7 Vacuum breakers, backflow preventers, backwater valves:

.1 Test tightness, accessibility for O&M of cover and of valve.

.2 Simulate reverse flow and back-pressure conditions to test operation of vacuum breakers, backflow preventers.

.3 Verify visibility of discharge from open ports.

.8 Roof drains:

.1 Check location at low points in roof.

.2 Check security, removability of dome.

.3 Adjust weirs to suit actual roof slopes, meet requirements of design.

.4 Clean out sumps.

.5 Verify provisions for movement of roof systems.

.9 Access doors:

.1 Verify size and location relative to items to be accessed.

.10 Cleanouts:

.1 Verify covers are gas-tight, secure, yet readily removable.

.11 Water hammer arrestors:

.1 Verify proper installation of correct type of water hammer arrester.

.12 Wall hydrants:

.1 Verify complete drainage, freeze protection.

.2 Verify operation of vacuum breakers.

.13 Pressure regulators, PRV assemblies:

.1 Adjust settings to suit locations, flow rates, pressure conditions.

.14 Strainers:

.1 Clean out repeatedly until clear.

.2 Verify accessibility of cleanout plug and basket.

.3 Verify that cleanout plug does not leak.

.15 Hose bibbs, sediment faucets:

.1 Verify that flow and pressure meet design criteria.

.2 Check for leaks, replace compression washer if required.

.16 Hydronic system water Make-up Assembly:

.1 Verify flow, pressure, and connection.

.17 Water meters:

.1 Verify location and accessibility.

.2 Test metre reading accuracy.

.18 Emergency fixtures:

.1 Adjust the water flow rate to design flow rates.

.2 Check Thermostatic controls:

.3 Verify temperature settings, operation of control, limit and safety controls.

.4 Verify system is capable of delivering emergency water flow for specified time frames of 75.7 lpm for 15 minutes for the shower and 11.4 lpm for 15 minutes for the eye wash.

.19 Thermostatic Mixing Valves

.1 Adjust the water flow rate to design flow rates.

.2 Check Thermostatic controls:

.1 Verify temperature settings, operation of control, limit and safety controls.

3.17 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

3.18 PROTECTION

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

.2 Repair damage to adjacent materials caused by plumbing specialties and accessories installation.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 National Research Council Canada (NRC)

.1 National Fire Code of Canada 2015 (NFC).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 10 00.

.2 Product Data:

.1 Provide manufacturer's printed product literature, specifications and datasheets for piping and equipment and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 DELIVERY, STORAGE AND HANDLING

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

.2 Delivery and Acceptance Requirements:

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 APPLICATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 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.

.3 Use double swing joints when equipment mounted on vibration isolation and when piping subject to movement.

3.3 CLEARANCES

.1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer and National Fire Code of Canada.

.2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer without interrupting operation of other system, equipment, and components.

3.4 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.

.1 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.

3.1 AIR VENTS

.1 Install automatic air vents to in piping systems at all high points.

.2 Install isolating valve at each automatic air valve.

.3 Install drain piping to approved location and terminate where discharge is visible.

3.2 DIELECTRIC 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 unions or bronze valves.

.4 Over NPS 2: isolating flanges.

3.3 PIPEWORK INSTALLATION

.1 Screwed fittings jointed with Teflon tape.

.2 Protect openings against entry of foreign material.

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

.4 Assemble piping using fittings manufactured to ANSI standards.

.5 Saddle type branch fittings may not be used on mains.

.6 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.

.7 Install concealed pipework to minimize furring space, maximize headroom, conserve space.

.8 Slope piping, except where indicated, in direction of flow for positive drainage and venting.

.9 Install, except where indicated, to permit separate thermal insulation of each pipe.

.10 Group piping wherever possible.

.11 Ream pipes, remove scale and other foreign material before assembly.

.12 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.

.13 Provide for thermal expansion as indicated.

.14 Valves:

.1 Install in accessible locations.

.2 Remove interior parts before soldering.

.3 Install with stems above horizontal position unless indicated.

.4 Valves accessible for maintenance without removing adjacent piping.

.5 Install globe valves in bypass around control valves.

.6 Use ball valves or butterfly valves at branch take-offs for isolating purposes except where specified.

.7 Install butterfly valves on chilled water and related condenser water systems.

.8 Install butterfly valves between weld neck flanges to ensure full compression of liner.

.9 Install ball valves or butterfly valves for glycol service.

.10 Use chain operators on valves NPS 2 1/2 and larger where installed more than 2400 mm above floor in Mechanical Rooms.

.15 Check Valves:

.1 Install silent check valves on discharge of pumps, in vertical pipes with downward flow, and as indicated.

.2 Install swing check valves in horizontal lines and as indicated.

3.4 SLEEVES

.1 General: install where pipes pass through masonry, concrete structures, fire rated assemblies, and as indicated.

.2 Material: schedule 40 black steel pipe.

.3 Construction: use annular fins continuously welded at mid-point at foundation walls and where sleeves extend above finished floors.

.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.

.6 Sealing:

.1 Foundation walls and below grade floors: fire retardant, waterproof non-hardening mastic.

.2 Elsewhere:

.1 Provide space for firestopping.

.2 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.

3.5 ESCUTCHEONS

.1 Install on pipes passing through walls, partitions, floors, and ceilings in finished areas.

.2 Construction: one piece type with set screws.

.1 Chrome or nickel plated brass or type 302 stainless steel..

.3 Sizes: outside diameter to cover opening or sleeve.

.1 Inside diameter to fit around pipe or outside of insulation if so provided.

3.6 PREPARATION FOR FIRE STOPPING

.1 Install firestopping within annular space between pipes, ducts, insulation and adjacent fire separation in accordance with Section 07 84 00 - Firestopping.

.2 Uninsulated unheated pipes not subject to movement: no special preparation.

.3 Uninsulated heated pipes subject to movement: wrap with non-combustible smooth material to permit pipe movement without damaging fires topping material or installation.

.4 Insulated pipes and ducts: ensure integrity of insulation and vapour barriers.

3.7 FLUSHING OUT OF PIPING SYSTEMS

.1 Flush out, disinfect and rinse system to requirements of authority having jurisdiction.

.2 Before start-up, clean interior of piping systems in accordance with requirements of relevant mechanical sections.

.3 Preparatory to acceptance, clean and refurbish equipment and leave in operating condition, including replacement of filters in piping systems.

3.8 PRESSURE TESTING OF EQUIPMENT AND PIPEWORK

.1 Advise ONTC Representative 48 hours minimum prior to performance of pressure tests.

.2 Pipework: test as specified in relevant sections of heating, ventilating and air conditioning work.

.3 Maintain specified test pressure without loss for 4 hours minimum unless specified for longer period of time in relevant mechanical sections.

.4 Prior to tests, isolate equipment and other parts which are not designed to withstand test pressure or media.

.5 Conduct tests in presence of ONTC Representative.

.6 Pay costs for repairs or replacement, retesting, and making good.

.7 Insulate or conceal work only after approval and certification of tests by ONTC Representative.

3.9 EXISTING SYSTEMS

.1 Connect into existing piping systems at times approved by ONTC Representative.

.2 Request written approval by ONTC Representative 10 days minimum, prior to commencement of work.

.3 Be responsible for damage to existing plant by this work.

3.10 CLEANING

.1 Clean in accordance with Section 01 10 00.

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Comply with the General Requirements of Section 20 05 00.

.2 Read and conform to:

.1 The Contract CCDC 2, Stipulated Price Contract as amended in the Contract Documents;

.2 Division 01 requirements and documents referred to therein.

1.2 SECTION INCLUDES

.1 Flexible pipe connectors

.2 Expansion joints and compensators

.3 Pipe loops, offsets, and swing joints

.4 Anchors and guides.

1.3 REFERENCES

.1 Refer to the latest edition of the following:

.1 CSA B51 Boiler, Pressure Vessel and Pressure Piping Code

.2 ASME B31.1 Code for Power Piping

.3 ASME B31.3 Process piping

.4 MIL-E-17814E - Expansion Joints, Pipe, Slip-Type, Packed

1.4 SUBMITTALS

.1 Product Data:

.1 Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per metre and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.

.2 Expansion Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.

.2 Design Data: Submit shop drawings for expansion compensation, signed and sealed by a professional engineer licensed where the work is to be performed (ie. Province of Ontario). Provide selection criteria used.

.3 Manufacturer's Installation Instructions: Indicate special procedures, and external controls.

1.5 QUALITY ASSURANCE

.1 Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three (3) years documented experience.

.2 Design expansion compensating system under direct supervision of a Professional Engineer experienced in the design of this work and licensed where the work is to be performed.

1.6 DELIVERY, STORAGE AND PROTECTION

.1 Accept expansion joints on site in factory packing with shipping bars and positioning devices intact. Inspect for damage.

.2 Protect equipment from exposure by leaving factory coverings, pipe end protection, and packaging in place until installation.

1.7 WARRANTY

.1 Warranty: Five (5) year replacement warranty.

1.8 EXTRA MATERIALS

.1 Provide two (2) 0.77oz (340gm) containers of packing lubricant and cartridge style grease gun.

1.9 PERFORMANCE REQUIREMENTS

.1 Provide structural work and equipment required to control expansion and contraction of piping.

.2 Verify that anchors, guides, and expansion joints provided will adequately protect the system for which they are installed.

.3 Arrange all piping so that expansion and contraction of any piping may take place without placing undue strain on the piping or connections to the equipment. Use swing joints and suitable expansion joints wherever necessary due to field conditions and where indicated on the drawings.

.4 This Section shall analyze each section of pipe installed between constraints and shall determine the potential for expansion of the pipe based on pipe temperature at installation and pipe temperatures throughout the pipe's operating range. Where potential expansion exceeds 1" (25mm) over the length of the pipe section, expansion compensators shall be installed. Pipe sections are constrained where they penetrate walls, partitions, floors, ceilings, roofs and movement of the pipe is restricted and where the pipe is anchored to the building structure.

.5 Expansion Calculations:

.1 Safety Factory: 30 percent.

.2 Installation Temperature: 50°F (10°C).

.3 Hot Water Heating: 180°F (82°C).

.4 Domestic Hot Water: 140°F (60°C).

.5 Steam 100psig (689kPa): 350°F (177°C).

.6 Steam 15psig (103kPa): 300°F (150°C).

.7 Condensate to 125psig (862kPa): 350°F (177°C).

.8 Condensate & feed water to 300psig (2,068kPa): 500°F (260°C).

2 PRODUCTS

2.1 MANUFACTURERS

.1 Manufacturers must be certified by the Expansion Joint Manufacturers Association (EJMA)

.2 Flexible Pipe Connectors

.1 Flex-Pression Ltd.

.2 Senior Flexonics Canada

.3 Ontario Hose Specialties Ltd.

.4 Colton Industries

.3 Expansion Joints

.1 Flex-Pression Ltd.

.2 Hyspan Precision Products, Inc.

.3 Senior Flexonics Canada

.4 Pipe Alignment Guides

.1 Flex-Pression Ltd.

.2 Hyspan Precision Products, Inc.

.3 Senior Flexonics Canada

.5 Alternates are subject to shop drawing review.

2.2 PIPE ALIGNMENT GUIDES

.1 Steel Pipe:

.1 Radial "spider" type, minimizing piping motions in non-axial planes.

.2 Constructed of carbon steel with a 360° two-piece bolted housing, and a 360° two-piece bolted clamps with spider type legs.

.3 Provide an insulation clearance of 1.5" (38mm) on sizes 6" (150mm) IPS and smaller, and 2.0" (50mm) on sizes 8" (200mm) IPS and over.

.4 Axial travel shall be 3" (75mm) for sizes 2" (50mm) IPS and smaller, and 6" (150mm) for sizes 2-1/2" (65mm) IPS and over.

.5 Refer to piping and expansion joint schedules for specific insulation and motion requirements.

.6 Basis of design: Hyspan Series 9500.

.2 Copper Pipe:

.1 Radial "spider" type, minimizing piping motions in non-axial planes.

.2 Constructed of carbon steel with non-metallic coating on the tube clamps, and a 360° two-piece bolted housing, and 360° two-piece bolted clamps with spider type legs.

.3 Provide an insulation clearance of 1.5" (38mm).

.4 Axial travel shall be 3" (75mm) for sizes 2-1/2" (65mm) and smaller, or 6" (150mm) for sizes 3" (75mm) and larger.

.5 Refer to piping and expansion joint schedules for specific insulation and motion requirements.

.6 Basis of design: Hyspan Series 9500.

2.3 FLEXIBLE PIPE CONNECTORS

.1 Copper Piping:

.1 Inner Hose: Bronze

.2 Exterior Sleeve: Braided bronze.

.3 Pressure Rating: 125psi (862kPa) WSP and 450°F (232°C).

.4 Joint: As specified for pipe joints.

.5 Size: Use pipe sized units

.6 Maximum offset: 3/4" (19mm) on each side of installed centre line.

.2 Steel Piping: 2" (50mm) diameter and smaller:

.1 Inner Hose: Braided bronze.

.2 Exterior Sleeve: None.

.3 Pressure Rating: 125psi (862kPa) WSP and 450°F (232°C).

.4 Joint: Threaded.

.5 Size: Use pipe sized units.

.6 Maximum offset: 3/4" (19mm) on each side of installed centre line.

.3 Steel Piping: 2-1/2" to 3" (65mm to 75mm) diameter:

.1 Inner Hose: Braided bronze.

.2 Exterior Sleeve: None.

.3 .Pressure Rating: 125psi (862kPa) WSP and 450°F (232°C).

.4 Joint: Flanged.

.5 Size: Use pipe sized units.

.6 Maximum offset: 3/4" (19mm) on each side of installed centre line.

.4 Steel Piping: 4" (100mm) diameter and larger:

.1 Inner Hose: Braided 321 stainless steel.

.2 Exterior Sleeve: None.

.3 Pressure Rating: 125psi (862kPa) WSP and 450°F (232°C).

.4 Joint: Flanged.

.5 Size: Use pipe sized units.

.6 Maximum offset: 3/4" (19mm) on each side of installed centre line.

2.4 EXPANSION JOINTS – COPPER PIPING

.1 Bronze Bellows Type:

.1 Construction: 2-ply bronze with anti-torque device, limit stops, and internal guides.

.2 Pressure Rating: 125psi (862kPa) WSP and 400°F (204°C).

.3 Maximum Compression: 1-3/4" (45mm).

.4 Maximum Extension: 1/4" (6mm).

.5 Joint: Soldered.

.6 Size: Use pipe line sized units.

2.5 EXPANSION JOINTS – 150PSIG (1,034KPA) / 500°F (260°C)

.1 Ratings

.1 Design Pressure: 150psig (1035kPa)

.2 Test Pressure: 225psig (1552kPa)

.3 Design Temperature: 500°F (260°C)

.2 Stainless Steel Bellows Type:

.1 Construction multi-ply ASTM A240 type 321 stainless steel bellows, ASME A53, Gr. B carbon steel housing,

.2 Maximum Compression: 1-3/4" (45mm).

.3 Maximum Extension: 1/4" (6mm).

.4 Joint: Flanged.

.5 Size: Use pipe line sized units

.6 Application: Steel piping 2-1/2" (65mm) and smaller.

2.6 EXPANSION JOINTS – 300PSIG (2,070KPA) / 500°F (260°C)

.1 Ratings

.1 Test Pressure: 450psig (3105kPa)

.2 Externally Pressurized:

.1 Construction: Self-equalizing type with three or four ply ASTM A240 type 321 stainless steel bellows; ASME A53, Grade B carbon steel housing and pipe nipples; ASME-A36 steel plate guide rings and flanges; ASME A105, 3000-lb thread-o-let drain port & plug.

.2 Pressure Rating: 300psi (2,070kPa) WOG and 500°F (260°C).

.3 Maximum Compression: 8" (200mm).

.4 .Maximum Extension: 2" (50mm).

.5 Joints: Flanged.

.6 Size: Use pipe line sized units.

.7 Application: Steel piping 3" (75mm) and larger.

3 EXECUTION

3.1 INSTALLATION

.1 Install flexible pipe connectors and expansion joints to manufacturer's instructions.

.2 Ratings and bolt patterns for flanges shall suit design pressure and design temperature of piping system and match those of installed components.

.3 Construct spool pieces to exact size of flexible connection for future insertion.

.4 Install flexible pipe connectors on pipes connected to equipment supported by vibration isolation. Provide line size flexible connectors.

.5 Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor other end. Install in horizontal plane unless indicated otherwise.

.6 Pipe anchors shall be installed securing the piping system to the building structure in order to control the direction and the amount of pipe movement. In addition, pipe anchors shall be installed to prevent separation of pipe due to hydraulic pressures. Pipe anchors shall be designed by the Contractor to accommodate all forces experienced. Prepare calculations for each anchor and submit to Consultant for review and approval. Provide pipe guides so movement is directed along axis of pipe only. Not less than two guides shall be provided on each side of an expansion joint. Erect piping such that strain and weight is not on cast connections or apparatus.

.7 Provide support and equipment required to control expansion and contraction of piping. Provide pipe offsets, and swing joints, or expansion joints where required. The Contractor may elect to install expansion loops in place of expansion compensators where there is adequate space to do so; subject to the approval of the Consultant. The Contractor shall prepare and submit detailed design calculations for each expansion loop proposed to the Consultant for review and approval prior to installation.

3.2 MANUFACTURER'S FIELD SERVICES

.1 Provide inspection services by manufacturer's representative for final installation and certify installation is to manufacturer's recommendations and connectors are performing satisfactorily.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)

.1 ANSI/ASME B31.1, Power Piping.

.2 ANSI/ASME B31.3, Process Piping.

.3 ANSI/ASME Boiler and Pressure Vessel Code:

.1 BPVC 2007 Section I: Power Boilers.

.2 BPVC 2007 Section V: Nondestructive Examination.

.3 BPVC 2007 Section IX: Welding and Brazing Qualifications.

.2 American National Standards Institute/American Water Works Association (ANSI/AWWA)

.1 ANSI/AWWA C206, Field Welding of Steel Water Pipe.

.3 American Welding Society (AWS)

.1 AWS C1.1M/C1.1, Recommended Practices for Resistance Welding.

.2 AWS Z49.1, Safety in Welding, Cutting and Allied Process.

.3 AWS W1, Welding Inspection Handbook..

.4 Canadian Standards Association (CSA International)

.1 CSA W48, Filler Metals and Allied Materials for Metal Arc Welding.

.2 CSA B51, Boiler, Pressure Vessel and Pressure Piping Code.

.3 CSA-W117.2, Safety in Welding, Cutting and Allied Processes.

.4 CSA W178.1, Certification of Welding Inspection Organizations.

.5 CSA W178.2, Certification of Welding Inspectors.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

1.3 QUALITY ASSURANCE

.1 Qualifications:

.1 Welders:

.1 Welding qualifications in accordance with CSA B51.

.2 Use qualified and licensed welders possessing certificate for each procedure performed from authority having jurisdiction.

.3 Submit welder's qualifications to ONTC Representative.

.4 Each welder to possess identification symbol issued by authority having jurisdiction.

.5 Certification of companies for fusion welding of aluminum in accordance with CSA W47.2.

.2 Inspectors:

.1 Inspectors qualified to CSA W178.2.

.3 Certifications:

.1 Registration of welding procedures in accordance with CSA B51.

.2 Copy of welding procedures available for inspection.

.3 Safety in welding, cutting and allied processes in accordance with CSA-W117.2.

1.4 DELIVERY, STORAGE AND HANDLING

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

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

Part 2 Products

2.1 ELECTRODES

.1 Electrodes: in accordance with CSA W48 Series.

Part 3 Execution

3.1 APPLICATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 QUALITY OF WORK

.1 Welding: in accordance with ANSI/ASME Boiler and Pressure Vessel Code, Sections I and IX and ANSI/AWWA C206, using procedures conforming to AWS B3.0, AWS C1.1, applicable requirements of provincial authority having jurisdiction and special procedures specified elsewhere in Division 23.

3.3 INSTALLATION REQUIREMENTS

.1 Identify each weld with welder's identification symbol.

.2 Backing rings:

.1 Where used, fit to minimize gaps between ring and pipe bore.

.2 Do not install at orifice flanges.

.3 Fittings:

.1 NPS 2 and smaller: install welding type sockets.

.2 Branch connections: install welding tees or forged branch outlet fittings.

3.4 INSPECTION AND TESTS - GENERAL REQUIREMENTS

.1 Review weld quality requirements and defect limits of applicable codes and standards with ONTC Representative before work is started.

.2 Formulate "Inspection and Test Plan" in co-operation with ONTC Representative.

.3 Do not conceal welds until they have been inspected, tested and approved by inspector.

.4 Provide for inspector to visually inspect welds during early stages of welding procedures in accordance with Welding Inspection Handbook. Repair or replace defects as required by codes and as specified.

3.5 SPECIALIST EXAMINATIONS AND TESTS

.1 General:

.1 Perform examinations and tests by specialist qualified to CSA W178.1 and CSA W178.2 and approved by ONTC Representative.

.2 To ANSI/ASME Boiler and Pressure Vessels Code, Section V, CSA B51 and requirements of authority having jurisdiction.

.3 Inspect and test 10 % of welds in accordance with "Inspection and Test Plan" by non-destructive visual examination full gamma ray radiographic (hereinafter referred to as "radiography") tests.

.2 Hydrostatically test welds to ANSI/ASME B31.1.

.3 Visual examinations: include entire circumference of weld externally and wherever possible internally.

.4 Failure of visual examinations:

.1 Upon failure of welds by visual examination, perform additional testing as directed by ONTC Representative 10 radiographic tests.

.5 Full radiographic tests for steam piping systems.

.1 Spot radiography:

.1 Conduct spot radiographic tests of up to 10 % of welds, selected at random by ONTC Representative from welds which would be most difficult to repair in event of failure after system is operational.

.2 Radiographic film:

.1 Identify each radiographic film with date, location, name of welder, and submit to ONTC Representative. Replace film if rejected because of poor quality.

.3 Interpretation of radiographic films:

.1 By qualified radiographer.

.4 Failure of radiographic tests:

.1 Extend tests to welds by welder responsible when those welds fails tests.

3.6 DEFECTS CAUSING REJECTION

.1 As described in ANSI/ASME B31.1 and ANSI/ASME Boiler and Pressure Vessels Code.

.2 In addition, chilled water systems:

.1 Undercutting greater than 0.8 mm adjacent to cover bead on outside of pipe.

.2 Undercutting greater than 0.8 mm adjacent to root bead on inside of pipe.

.3 Undercutting greater than 0.8 mm at combination of internal surface and external surface.

.4 Incomplete penetration and incomplete fusion greater than total length of 38 mm in 1500 mm length of weld depth of such defects being greater than 0.8 mm.

.5 Repair cracks and defects in excess of 0.8 mm in depth.

.6 Repair defects whose depth cannot be determined accurately on basis of visual examination or radiographic tests.

3.7 REPAIR OF WELDS WHICH FAILED TESTS

.1 Re-inspect and re-test repaired or re-worked welds at Contractor's expense.

3.8 CLEANING

.1 Clean in accordance with Section 01 10 00.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 20 05 00 – General Requirements.

.2 Section 23 21 16 – Hydronic Piping Specialties.

.3 Section 23 21 23 – Hydronic Pumps.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers International (ASME)

.1 ANSI/ASME B16.15, Cast Bronze Threaded Fittings, Classes 125 and 250.

.2 ANSI/ASME B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.

.3 ANSI/ASME B16.22, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

.4 ANSI/ASME B16.24, Cast Copper Alloy Pipe Flanges and Flanged Fittings, Class 150, 300, 400, 600, 900, 1500 and 2500.

.5 ANSI/ASME B16.4, Cast Iron Threaded Fittings, Classes 125 and 250.

.6 ANSI/ASNE B31.9, Building Services Piping.

.2 ASTM International Inc.

.1 ASTM A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

.2 ASTM A105, Standard Specification for Carbon Steel Forgings for Piping Applications.

.3 ASTM A234, Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.

.4 ASTM A312/A312M, Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.

.5 ASTM A743/A743A, Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application.

.6 ASTM B62, Standard Specification for Composition Bronze or Ounce Metal Castings.

.7 ASTM B88, Standard Specification for Seamless Copper Water Tube.

.8 ASTM B283, Standard Specification for Copper and Copper-Alloy Die Forgings (Hot-Pressed).

.9 ASTM F492, Standard Specification for Propylene and Polypropylene (PP) Plastic-Lined Ferrous Metal Pipe and Fittings.

.10 ASTM F876, Standard Specification for Crosslinked Polyethylene (PEX) Tubing.

.11 ASTM F877, Standard Specification for Crosslinked Polyethylene (PEX) Hot- and Cold-Water Distribution Systems.

.12 ASTM F1969, Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-linked Polyethylene (PEX) Tubing.

.3 Canadian Standards Association (CSA International)

.1 CAN/CSA B242, Groove and Shoulder Type Mechanical Pipe Couplings.

.2 CAN/ULC-S102.2, Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Covering and Miscellaneous Materials and Assemblies

.3 CAN/ULC-S115, Standard Method of Fire Tests of Firestop Systems

.4 Ontario Building Code 2012 (OBC)

1.3 SUBMITTALS

.1 Provide Submittals in accordance with Section 01 33 00 Submittal Requirements.

.2 Product Data:

.1 Provide the manufacturer's printed product literature and datasheets for insulation and adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit WHIMS MSDS – Materials Safety Data Sheets.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed to practice in the Province of Ontario, Canada.

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

.4 Closeout Submittals:

.1 Provide maintenance data for incorporation into manual specified in Section 01 77 00 – Closeout Procedures.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver materials to site in original factory packaging, labelled with the Manufacturer's name and address.

.3 Store at temperatures and conditions recommended by the Manufacturer.

2 Products

2.1 HYDRONIC PIPING, FITTINGS AND JOINTS

.1 **Black Steel – Grooved Joint:** Schedule 40, mild black carbon steel, Grade B, ASTM A53, factory or site roll grooved, complete with:

.1 Cast ductile iron grooved end fittings conforming to ASTM A536.

.2 Victaulic Style 07 "Zero-Flex", Victaulic Corporation Style 107 "QuickVic", Tyco Grinnell (Tyco Mechanical Products) Style 772, Anvil International, Gruvlok Fig. 7401 "Rigidlok" or Shurjoint Model Z07 rigid couplings for piping in the Mechanical Rooms and for piping risers, Victaulic Corporation Style 77, Tyco Grinnell (Tyco Mechanical Products) Style 707, Anvil International, Gruvlok Fig. 700 or Shurjoint (Tyco Mechanical Products) Model 7707 standard flexible couplings for all other piping.

.3 Gaskets shall be EPDM compound, rated -34º C to +110º C (-30º F to +230º F).

.2 **Black Steel – Screwed Joint:** Schedule 40, mild black carbon steel, Grade B, ASTM A53, complete with Class 125 cast iron threaded fittings to ANSI/ASME B16.4, and screwed joints.

.3 **Black Steel – Welded Joint:** Schedule 40, mild black carbon steel, Grade B, ASTM A53, mill or site beveled, complete with factory made seamless carbon steel butt welding fittings to ASTM A234, Grade WPB, long sweep pattern wherever possible, and welded joints.

.4 **Black Steel – Press Joint**: Schedule 40, mild black carbon steel, Grade B, ASTM A53, complete with carbon steel fittings conforming to the performance criteria of IAPMO PS 117 and ASME B31.9. Sealing elements for pressing fittings shall be EPDM and shall be factory installed or supplied by fitting manufacturer. Press fittings shall feature a design leakage path, assuring leakage of liquids and/or gases from inside the system past the sealing element of an unpressed

connection. System to be rated to a minimum pressure of 1379 kPa (200 psi) and a temperature range of -18ºC to 120ºC (0F to 250ºF).

.1 Acceptable Manufacturers

.1 Viega LLC. “MegaPress”

.2 Apollo Valves “PowerPress”

.5 **Copper – Solder Joint**: Type “L” hard drawn seamless copper to ASTM B88, plain ends. All joints made with 95-5 tin-antimony or tin-silver solder.

.6 **Copper – Press Joint:** Type “L” hard drawn seamless copper to ASTM B88, complete with wrought copper press fittings (ANSI/ASME B16.22) or cast copper alloy press fittings (ANSI/ASME B16.18) conforming to the performance criteria of IAPMO PS 117. Sealing elements for pressing fittings shall be EPDM and shall be factory installed or supplied by fitting manufacturer. Press fittings shall feature a design leakage path, assuring leakage of liquids and/or gases from inside the system past the sealing element of an unpressed connection. System to be rated to a minimum pressure of 1379 kPa (200 psi) and a temperature range of -18ºC to 120ºC (0F to 250ºF).

.1 Acceptable Manufacturers

.1 Viega LLC. “ProPress”

.2 Apollo Valves “Press”

.3 Nibco Inc. “Press Fittings”

2.2 PIPING UNIONS

.1 Screwed Steel Piping: Dart Union Co. of Canada Ltd. or approved equivalent malleable iron, ground joint, brass to iron or bronze to bronze seat screwed unions and union elbows with a minimum pressure rating of 1725 kPa (250 psi) steam at 260ºC (500ºF).

.2 Press Steel Piping: Viega MegaPress union or approved equivalent carbon steel press connection with a minimum pressure rating of 1379 kPa (200 psi) at a temperature range -18ºC to 120ºC (0F to 250ºF).

.3 Welded Steel Piping: Forged carbon steel slip-on type raised face welding flange unions in accordance with ASTM A105, 150 lb. Class.

3 Execution

3.1 HYDRONIC PIPING MATERIAL AND JOINT TYPES:

.1 Heating water piping, Chilled water piping and Glycol water piping; unless otherwise specified, is to be as follows:

.1 For pipe up to 50 mm (2 in.) diameter, Schedule 40 **Black Steel – Screwed Joint.** As an alternative Schedule 40 **Black Steel – Press Joint**, Type “L” **Copper - Press Joint,** and Type “L” **Copper – Solder Joint** may be used.

.2 For short, individual branch connections to heating/cooling equipment, when pipe diameters are less than 25 mm (1 in.) and when working pressures are below 1034 kPa (150 psi) **Hydronic PEX** piping may be used as an acceptable alternative.

3.2 GENERAL PIPING INSTALLATION REQUIREMENTS

.1 Slope all piping so that it can be completely drained. Horizontal piping mains to be sloped to provide a minimum continuous up-grade of 25 mm (1") in 6 m (20') to high points. Branch supply

and return piping connections to be sloped towards equipment a minimum of 25 mm (1") in 1.2 m (4'). Leave sufficient room at high points for installation of air vents.

.2 Install automatic control valves, piping wells and similar piping and/or equipment mounted control components required for automatic temperature control systems supplied as part of the work specified in Section 25 05 00 – Building Automation System.

.3 Connect equipment provided as part of the Work of other Sections with piping as indicated in and/or required by the Contract Drawings. Refer to pipe connection details on Drawings.

.4 Unless otherwise specified in the Contract Documents, locate and arrange horizontal pipes above or at the ceiling on floors on which they are shown, arranged so that under consideration of all other work in the area, the maximum ceiling height and/or usable space is maintained.

.5 Unless otherwise specified in the Contract Documents, install all work concealed in finished spaces, and concealed to the degree possible in partially finished and unfinished spaces. Refer to and examine the Architectural drawings and room finish schedules to determine finished, partially finished, and unfinished areas. Note that walls which are painted are considered finished.

.6 Install all pipes and ducts parallel to building lines (all piping shall run parallel with closest wall).

.7 Piping in walk-in pipe spaces shall be installed as close to one wall as possible.

.8 Neatly group and arrange all exposed work.

.9 Locate all valves and any other equipment which will or may need maintenance or repaired in accessible spaces, equipment shall be easily accessible from access doors. Where valves and similar piping accessories occur in vertical service spaces (ie. in shafts, pipe spaces or partitions) locate the accessories at the floor level.

.10 Make all connections between pipes of different materials using proper approved adapters. Provide proper dielectric unions in all connections between copper pipe and ferrous pipe or equipment. Dielectric fitting to conform to ASTM F492 complete with thermoplastic liner.

.11 Ensure that the equipment and material manufacturers' installation instructions are followed unless otherwise specified in this Section or on the Drawings, and unless such instructions contradict governing codes and regulations.

.12 Carefully clean all pipes and fittings prior to installation. Temporarily cap or plug ends of pipes and equipment which are open and exposed during construction.

.13 Install piping which is to be insulated so that they have sufficient clearance to permit insulation to be applied continuously and unbroken around the pipe, except at fire barriers, in which case the insulation will be terminated at each side of the fire barrier.

.14 Inspect surfaces and structure prepared by other trades before performing the work of this Section. Verify that surfaces or the structure to receive the work have no defects or discrepancies which could result in poor application or cause latent defects in installation and workmanship. Report defects in writing to the Consultant. Installation of the work shall constitute the Contractor’s acceptance of such surfaces as being satisfactory.

3.3 PIPE JOINT REQUIREMENTS

.1 Do not make pipe joints in walls or slabs.

.2 Ream all piping ends prior to making joints.

.3 Properly cut threads in screwed steel piping and coat male threads, unless otherwise specified in the Contract Documents, with red lead, Teflon tape or paste, or an equivalent thread lubricant. After the pipe has been screwed into the fitting, valve, union, or piping accessory, not more than two pipe threads are to remain exposed.

.4 Unless otherwise specified in the Contract Documents, make all soldered joints in copper piping using flux suitable for and compatible with the type of solder being used. Clean the outside of the pipe end and the inside of the fitting, valve, or similar accessory prior to soldering.

.5 Install mechanical joint fittings and couplings in accordance with the manufacturer's instructions.

.6 If grooved fittings and couplings are used, ensure that all valves and piping accessories are suitable. Grooves shall be rolled. Make arrangements with the coupling and fitting manufacturer for shop and/or site instructions and demonstrations as required, and adhere to the manufacturer's instructions with respect to pipe grooving, support, anchoring and guiding the grooved piping system. Note that all grooved end piping system products shall be supplied by a single manufacturer who is operating to an ISO 9001 program.

3.4 PRESSURE TESTS

.1 Conform to requirements of Section 20 05 93 – Testing, Adjusting and Balancing.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 20 05 00 – General Requirements.

.2 Section 23 21 13 – Hydronic Piping.

.3 Section 23 21 23 – Hydronic Pumps.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers International (ASME)

.1 ANSI/ASME B16.15, Cast Bronze Threaded Fittings, Classes 125 and 250.

.2 ANSI/ASME B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.

.3 ANSI/ASME B16.22, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

.4 ANSI/ASME B16.24, Cast Copper Alloy Pipe Flanges and Flanged Fittings, Class 150, 300, 400, 600, 900, 1500 and 2500.

.5 ANSI/ASME B16.4, Cast Iron Threaded Fittings, Classes 125 and 250.

.6 ANSI/ASNE B31.9, Building Services Piping.

.2 ASTM International Inc.

.1 ASTM A105, Standard Specification for Carbon Steel Forgings for Piping Applications.

.2 ASTM A234, Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.

.3 ASTM A743/A743A, Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application.

.4 ASTM B62, Standard Specification for Composition Bronze or Ounce Metal Castings.

.5 ASTM B283, Standard Specification for Copper and Copper-Alloy Die Forgings (Hot-Pressed).

.6 ASTM F1969, Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-linked Polyethylene (PEX) Tubing.

.3 Canadian Standards Association (CSA International)

.1 CAN/CSA B242, Groove and Shoulder Type Mechanical Pipe Couplings.

.2 CAN/ULC-S102.2, Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Covering and Miscellaneous Materials and Assemblies

.3 CAN/ULC-S115, Standard Method of Fire Tests of Firestop Systems

.4 Ontario Building Code 2012 (OBC)

1.3 SUBMITTALS

.1 Provide Submittals in accordance with Section 01 33 00 Submittal Requirements.

.2 Product Data:

.1 Provide the manufacturer's printed product literature and datasheets for insulation and adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit WHIMS MSDS – Materials Safety Data Sheets.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed to practice in the Province of Ontario, Canada.

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

.4 Closeout Submittals:

.1 Provide maintenance data for incorporation into manual specified in Section 01 77 00 – Closeout Procedures.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver materials to site in original factory packaging, labelled with the Manufacturer's name and address.

.3 Store at temperatures and conditions recommended by the Manufacturer.

2 Products

2.1 SHUT-OFF VALVES

.1 Ball Type for nominal pipe sizes from 12 to 50 mm (½" to 2"): Class 600, 4140 kPa (600 psi) WOG rated full port ball valves, each complete with a forged brass or bronze body and cap, blowout-proof stem, solid forged brass chrome plated ball, "Teflon" or "PTFE" seat, threaded or press joint ends, and removable lever handle. Where piping is insulated provide stem extensions to clear insulation. Acceptable products are:

.1 Kitz Corp. Code 58

.2 Toyo Valve Co. Fig. 5044A

.3 Nibco T-585-70

.4 Watts Water Technologies (Canada) Inc. #FBV-3C

.5 Equivalent manufacturers: Apollo Valves, Viega, Victaulic, Tyco Grinnell, M.A Stewart & Sons, NCI.

.2 Butterfly Type for nominal pipe sizes 65 mm (2-1/2") and larger: Ductile iron, lug body style or grooved, 1200 kPa (175 psi) rated, butterfly valve, each complete with a neck to permit 50 mm (2 inches) of insulation above the flange, an EPDM seat, aluminum bronze or stainless steel disc, stainless steel shaft with EPDM seal, a lever handle for valves to and including 100 mm (4 inch) diameter, and a handwheel and gear type operator for valves larger than 100 mm (4 inch) diameter and each suitable for bubble-tight dead end service with the valve in position and either side of the connecting piping removed. Where piping is insulated provide stem extensions to clear insulation. Acceptable products are:

.1 Kitz Corp. Code 6122EL or 6122EG

.2 Toyo Valve Co. #918 BESL-2 or 918 BESG-2

.3 Nibco # LD-2000

.4 Equivalent manufacturers: Apollo Valves, Viega, Victaulic, Tyco Grinnell, M.A. Stewart & Sons, DeZurik of Canada Ltd.

2.2 SWING CHECK VALVES

.1 Bronze – Screwed: Class 125, 1380 kPa (200 psi) WOG rated horizontal swing check valves, each complete with a "Y" pattern bronze body, hinged brass disc, easy access screw-in cap, and screwed ends. Acceptable products are:

.1 Kitz Corp. Code No. 22

.2 Toyo Valve Co. Fig. 236

.3 Nibco #T-413

.4 Equivalent manufacturers: Apollo Valves, Watts Water Technologies (Canada) Inc.

.2 Steel – Grooved Ends: Victaulic Co. of Canada Ltd. Series 716 "Vic-Check", Tyco Grinnell Model 590, Gruvlok Series 7811 or Shurjoint #SJ-900 grooved end carbon steel check valves suitable for mounting horizontally or vertically.

.3 Cast Iron –Flanged: Cast iron, bronze trim, 1380 kPa (200 psi) rated swing check valves, each complete with a bronze disc and seat, malleable iron hinge, bolted cover and flanged ends as required. Acceptable products are:

.1 Kitz Corp. Code No. 78

.2 Toyo Valve Co. Fig. 435A

.3 Nibco #F-918-B

.4 Equivalent manufacturers: Apollo Valves, Watts Water Technologies (Canada) Inc.

2.3 VERTICAL LIFT CHECK VALVES

.1 Class 125, 1380 kPa (200 psi) WOG rated bronze vertical lift check valves, each complete with screwed ends and a bronze disc. Acceptable products are:

.1 Kitz Corp. Code No. 36

.2 Toyo Valve Co. Fig. 231

.3 Nibco #T-480

.4 Watts Water Technologies (Canada) Inc. #LF600

.5 Equivalent manufacturers: Apollo Valves, Viega, M.A. Steward & Sons.

2.4 WAFER CHECK VALVES

.1 Threaded lug body type, full bore, Class 125, 1380 kPa (200 psi) rated at 38 degrees C (100 degrees F), non-slam dual wafer check valves, each complete with a carbon steel or cast iron body, stainless steel discs, a shaft, springs, disc stop and thrust bearings constructed of type 316 stainless steel, and seat materials to suit the application. The inside diameter of the valve must equal the inside diameter of the connecting pipe. Acceptable products are:

.1 Nibco #W-920

.2 The Metraflex Co. Style CVXX

.3 Watts Water Technologies (Canada) Inc. Series #ICV-125

.4 Equivalent manufacturers: Crane Valve Co, Mueller Steam Specialty, Gulf Valve Co.

2.5 DRAIN VALVES

.1 Minimum 2070 kPa (300 psi) WOG rated, 20 mm (3/4-inch) diameter straight pattern full port bronze or brass ball valves, each complete with a threaded outlet suitable for coupling connection of 20 mm (3/4-inch) diameter garden hose, and a cap and chain. Acceptable products are:

.1 Kitz Corp. Code No. 68AC

.2 Toyo Valve Co. Ltd. Fig. 5046

.3 Nibco # T-585-70-HC

.4 Watts Regulator #B-6000-CC

.5 Equivalent manufacturers: Apollo Valves.

2.6 CIRCUIT BALANCING VALVES

.1 Valves 12 to 50 mm (1/2 to 2 in.) 'Y' pattern, equal percentage globe-style and provide three functions: 1) Precise flow measurement, 2) Precision flow balancing, 3) Positive drip-tight shut-off. Valves shall provide multi-turn, 360 degree adjustment with micrometer type indicators located on the valve handwheel. Valves shall have a minimum of five full 360 degree handwheel turns. 90 degree 'circuit-setter' style ball valves are not acceptable. Valve handle shall have hidden memory feature, which will provide a means for locking the valve position after the system is balanced. Valves shall be furnished with precision machined venturi built into the valve body to provide highly accurate flow measurement and flow balancing. The venturi shall have two, 6.35 mm (1/4 in.) threaded brass metering ports with check valves and gasketed caps located on the inlet side of the valve. Valves shall be furnished with flow smoothing fins downstream of the valve seat and integral to the forged valve body to make the flow more laminar. The valve body, stem and plug shall be brass. The handwheel shall be high-strength resin.

.2 Valves 65 to 300 mm (2-1/2 to 12 in.) 'Y' pattern, equal percentage globe-style and provide three functions: 1) Precise flow measurement, 2) Precision flow balancing, 3) Positive drip-tight shut-off. Valves shall provide multi-turn, 360 degree adjustment with micrometer type indicators located on the valve handwheel. Valves shall have a minimum of five full 360 degree handwheel turns. 90 degree 'circuit-setter' style ball valves are not acceptable. Valve handle shall have hidden memory feature, which will provide a means for locking the valve position after the system is balanced. Valve body shall be either cast iron with integrated cast iron flanges or ductile iron with industrial standard grooved ends. Valve stem and plug disc shall be bronze with ergonomically designed handwheel that permits multi-turn adjustments. Sizes 65 and 75 mm (2-1/2 and 3 in.) – 5 turns; sizes 100 mm to 150 mm (4 to 6 in.) – 6 turns; sizes 200 and 250 mm (8 and 10 in.) – 12 turns and size 300 mm (12 in.) – 14 turns. Flange adapters shall be supplied, to prevent rotation.

.3 Acceptable products are:

.1 Armstrong Fluid Technology. Series "CBV" screwed, flanged or grooved

.2 Victaulic Co. of Canada Ltd. (Tour & Anderson) Series 787 screwed, Series 788 flanged, and 789 grooved end

.3 Tyco Grinnell Series CB800 screwed, flanged, or grooved end

.4 Gruvlok series "GBV" screwed or grooved

.5 RWV #9517 screwed or 9474P flanged

2.7 AUTOMATIC FLOW LIMITING VALVES

.1 Valves 12 to 50 mm (1/2 to 2 in.) 'Y' pattern, pressure independent, cartridges shall be stainless steel with a spring loaded cup designed to dynamically absorb pressure fluctuations resulting from changes in system conditions due to varying heating/cooling loads. Flow shall be controlled within+/- 5% of the design flow, with a WOG rating of no less than 300 psi. Valves shall arrive fully assembled and include:

.1 **Cartridge:** AISI Type 304 stainless steel cartridge complete with an AISI Type 17-7 PH stainless steel spring.

.2 **Strainer:** 20 mesh stainless steel.

.3 **Body Material:** 12 to 40 mm (1/2 to 1-1/2 in.) to be constructed of forged brass (ASTM B283), 40 to 50 mm (1/2 to 1-1/2 in.) to be constructed of cast brass.

.4 **End Connections:** Brass – NPT, Sweat or Press joint.

.5 **Ball Valve Seals:** Teflon

.6 **Union Seal:** EPDM O-Ring

.7 **Body Tappings:** Port 1 and 2 shall be combination P/T test valves and manual air vent; Port 4 shall be a drain.

.8 **Ball Valve:** Nickel-plated brass ball.

.2 Acceptable manufacturers:

.1 Griswold Controls LLC.

.2 Hays Fluid Controls.

.3 Bell & Gossett (Xylem Inc.)

2.8 PRESSURE RELIEF VALVES:

.1 ASME tested, rated, and certified, bronze or cast iron bronze fitted, 1035 kPa (150 psi) rated pressure relief valves, each capable of relieving the full output of the equipment it is associated with, and each factory set at the pressure as noted in Part 3 of this specification. Acceptable products are:

.1 Bell & Gossett (Xylem Inc.), 3301/4100, or 790/1170

.2 Spirax Sarco Ltd. SVI Series

.3 Watts Water Technologies (Canada) Inc. 174A or 740

.4 Equivalent manufacturers: Dresser Industries, McDonnell & Miller, Conbraco, Kunkel.

2.9 AIR VENTS

.1 Manual Air Vents: Apollo Valves (Johnson Paterson) 27-Series or approved equivalent, 3.2 mm (1/8-inch) dia. manual valve with key.

.2 Automatic Air Vents: Float actuated air vents, each complete with a cast iron body and a cap, a stainless steel float assembly and seat, and an EPDM valve head. Acceptable products are:

.1 Spirax Sarco Ltd., Type 13 WS for system working pressures to 1035 kPa (150 psi), 13WH for system working pressures greater than 1035 kPa (150 psi)

.2 Armstrong International, No. 1-AV

2.10 STRAINERS

.1 Cast iron or bronze wye shaped strainers, minimum 860 kPa (125 psi) rated and complete with a removable type 304 stainless steel screen with perforations sized to suit the application, and, for strainers 50 mm (2 inch) diameter and larger, a blowdown pipe connection tapping. Acceptable products are:

.1 Kitz Fig. 15 screwed or Fig. 80 flanged

.2 Toyo Valve Co. Ltd. Fig. 380A screwed or Fig. 381 flanged

.3 Watts Water Technologies (Canada) Inc. #77SCI

.4 Victaulic Co. of Canada Style 732 "Vic-Strainer"

.5 Equivalent manufacturers: Spirax Sarco Ltd., Muller Steam Specialties, Tyco Grinnell, Gruvlok, Shurjoint.

2.11 PIPING ALIGNMENT GUIDES

.1 Prime coat painted black carbon steel pipe alignment guides sized and fabricated to suit the pipe size and the pipe insulation thickness. Acceptable products are:

.1 Mason Industries Inc. Series SPG.

.2 Hyspan Precision Products, Series 9500.

.3 The Metraflex Co. Style IV.

.4 Equivalent manufacturers: Senior Flextronics Inc., E. Myatt & Co, Anvil Inc., Empire Tool & Mfg. Inc.

2.12 PIPE ANCHORS

.1 Welded structural black steel anchors of a size and type to securely anchor the pipe at the point shown. Each anchor is to be designed and detailed by a professional structural engineer registered in the Province of Ontario. Submit anchor shop drawings, stamped by the design engineer, for review.

3 Execution

3.1 INSTALLATION OF SHUT-OFF VALVES

.1 Provide shut-off valves in piping connections to equipment, on branch line connections to mains, on each piping riser, at 30 m (100 foot) intervals on main lines, and wherever else indicated on the Drawings.

.2 Valves in piping to and including 50 mm (2 inch) diameter are to be ball type. All other shut-off valves are to be ball or butterfly type unless otherwise specified.

.3 Locate all valves so that they are easily accessible. Wherever possible, install valves at uniform height. Provide chain operators for valves which are inaccessible for operation from floor level.

3.2 INSTALLATION OF CHECK VALVES

.1 Provide a check valve in the discharge piping of every pump, and elsewhere in piping where shown on the Drawings.

.2 In horizontal piping swing or vertical lift check valves shall be used. Where check valves are required in vertical piping, ensure that they are suitable in all respects for the application; vertical lift check valves shall be used wherever possible.

.3 Wafer check valves may be used as an alternative to swing check valves when necessary.

.4 Note that check valves for vertical in-line and/or base mounted circulating pumps are integral with the discharge accessory supplied with the pump.

3.3 INSTALLATION OF DRAIN VALVES

.1 Provide a drain valve at the base of each piping riser, in drain connections to equipment, in low points of horizontal piping, and wherever else shown and/or specified.

3.4 INSTALLATION OF CIRCUIT BALANCING VALVES

.1 Provide circuit balancing valves in piping connections to all equipment (including but not limited to coils, heat exchangers (both circuits), boilers, unit heaters, radiation, radiant ceiling panels, pumps, 3-way control valves (2 ports), by-pass around control valves, etc.).

.2 Confirm locations with the consultant prior to installation.

3.5 INSTALLATION OF AUTOMATIC FLOW LIMITING VALVES

.1 Provide automatic flow limiting valves, as an alternative to circuit balancing valves and where required by these specifications and the drawings.

.2 Confirm locations with the consultant prior to installation.

3.6 INSTALLATION OF PRESSURE RELIEF VALVES

.1 Provide factory set pressure relief valves in all closed loop HVAC systems wherever else shown on the drawings.

.1 For glycol-filled systems, pipe the discharge of each relief valve to the glycol make-up package storage tank unless otherwise shown or specified.

.2 Pressure relief valve settings shall be selected based on the following order of priority:

.1 As noted on the drawings.

.2 The relief pressure specified for the loop's expansion tank.

.3 10% lower than the component in the system with the lowest pressure rating.

.3 Confirm all pressure relief valve settings with the consultant prior to purchase and installation.

3.7 INSTALLATION OF AIR VENTS

.1 Provide an air vent in piping mains at all high points, at equipment connections, and wherever else shown and/or specified. Install vents in accordance with the Drawing detail(s).

3.8 INSTALLATION OF STRAINERS

.1 Provide strainers in piping where shown.

.2 Locate strainers so that baskets are easily accessible and removable.

.3 Clean strainer baskets after piping system flushing and cleaning is complete, and before water quantity balancing commences.

3.9 INSTALLATION OF PIPING ANCHORS

.1 Provide anchors to secure pipework to the structure where shown and/or specified.

.2 Anchors are to be in accordance with reviewed shop drawings.

END OF SECTION

1 General

1.1 SCOPE OF WORK

.1 The scope of work for this Section includes, but is not limited to, the following:

.1 Materials and procedures for the provision and installation of hydronic pumps and related accessories.

1.2 RELATED WORK

.1 This Section may not contain all materials, equipment and requirements required for the completion of this project. This Section is to be read in conjunction with the relevant Sections of Division 21, 22, 23, and 26 and all related works.

.2 Division 1 forms an integral part of Division 21, 22 and 23 related requirements.

1.3 REFERENCES

.1 American Society of Heating Refrigeration and Air-Conditioning Engineers (ASHRAE):

.1 Standard 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Provide manufacturer's printed product literature and datasheets for pump, circulator, and equipment, and include product characteristics, performance criteria, physical size, finish and limitations indicate point of operation, and final location in field assembly.

.3 Submit manufacturer's detailed composite wiring diagrams for control systems showing factory installed wiring and equipment on packaged equipment or required for controlling devices or ancillaries, accessories and controllers.

1.5 CLOSEOUT SUBMITTALS

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

1.6 MAINTENANCE

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle 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.

2 Products

2.1 EQUIPMENT

.1 Size and select components to CSA-B214.

2.2 VERTICAL IN-LINE CIRCULATORS

.1 Close-coupled, inline for vertical or horizontal installation.

.2 Cast iron construction.

.3 Suitable for standard operations at up to 212F (100°C) and 150 psig (1040 kPag) working pressure.

.4 Pump internals capable of being serviced without disturbing piping connections.

.5 Solid alloy steel shaft integral to motor. Non-ferrous shaft sleeve employed to completely cover the wetted area under the seal.

.6 Motor bearings support shaft via heavy-duty, grease lubricated ball bearings.

.7 Mechanical seal assembly internally flushed and installed in an enlarged tapered seal chamber complete with stainless steel housing, Buna bellows and seat gasket, stainless steel spring, and be carbon ceramic design with carbon face rotating against stationary ceramic face.

.8 Stainless steel impeller keyed to shaft and secured by stainless steel locking capscrew or nut.

.9 Impeller hydraulically and dynamically balanced to Hydraulic Institute Standards.

.10 Pump volute Class 30 cast iron design with integral cast iron flanges drilled for 125# ANSI companion flanges. Include gauge ports at nozzles, vent and drain ports. Volute designed with base ring matching ANSI 125# flange to simplify pump support.

.11 Motor:

.1 Power, speed, and voltage as scheduled.

.2 Heavy-duty grease lubricated ball bearings.

.3 Non-overloading at any point on the pump curve and meet NEMA specifications.

.12 Controls:

.1 Integrated VFD with sensorless pump control.

.2 Factory mounted, wired, with a disconnect switch and menu-driven graphical interface.

.3 Provide near unity displacement power factor (cos Ø) without need for external power factor correction capacitors at all loads and speeds using VVC-PWM type integrated controls.

.4 Includes dual DC link reactors equivalent to 5% impedance line reactors, for reduction of mains borne harmonic currents and DC link ripple current to increase DC link capacitor lifetime.

.5 EMI/RFI filters conforming to DIN EN61800-3 to ensure integrated controls meets low emission and immunity requirements.

.6 System pressure to be maintained at 33 feet (10 m) (adj.) head minimum.

.7 Supports direct communication with the building management system (BMS) with builtin support for BACnet™ MS/TP protocol.

.8 Enclosure rated to ULc Type 12 suitable for indoor operation.

.9 Supports programmable skip frequencies and adjustable switching frequency for noise and vibration control.

.10 Provide a temperature controlled fan for cooling of the heat sink in the back panel.

.11 Rated to operate in ambient working conditions of minus 10°C to 45°C.

.12 Inputs and Outputs:

.1 Two (2) analog inputs (current or voltage).

.2 One (1) current output.

.3 Six (6) programmable digital inputs with 2 configurable as outputs.

.4 Supports two (2) programmable pulse inputs and two (2) programmable relay outputs.

.5 One (1) RS485 communication port.

.13 Software capable of sensorless control in variable volume systems without need for pump mounted (internal/external) or remotely mounted differential pressure sensor.

.14 Operates under quadratic pressure control (QPC) to ensure head reduction with reducing flow conforms to quadratic control curve.

.15 Supports a minimum head of 40% of design duty head.

.16 Provide user adjustable control mode settings and minimum/maximum head set points using built-in programming interface.

.17 Software capable of controlling pump performance for non-overloading power at every point of operation.

.18 Software capable of maintaining flow rate data.

.13 Factory tested and name-plated before shipment.

3 Execution

3.1 APPLICATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

.1 Install pumps to CSA-B214.

.2 In line circulators: install as indicated by flow arrows.

.1 Support at inlet and outlet flanges or unions.

.2 Install with bearing lubrication points accessible.

.3 Base mounted type: supply templates for anchor bolt placement.

.1 Include anchor bolts with sleeves. Place level, shim unit and grout.

.2 Align coupling in accordance with manufacturer's recommended tolerance.

.3 Check oil level and lubricate.

.4 Ensure that pump body does not support piping or equipment.

.1 Provide stanchions or hangers for this purpose.

.2 Refer to manufacturer's installation instructions for details.

.5 Decrease from line size, with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings.

.6 Pipe drain tapping to floor drain.

.7 Install volute venting pet cock in accessible location.

.8 Check rotation prior to start-up.

.9 Install pressure gauge test cocks.

3.3 START-UP

.1 General:

.1 In accordance with Section 01 10 00 - General Requirements: supplemented as specified herein.

.2 In accordance with manufacturer's recommendations.

3.4 CLEANING

.1 Clean in accordance with Section 01 10 00 - General Requirements.

.1 Remove surplus materials, excess materials, rubbish, tools, and equipment.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 20 05 00 – General Requirements.

.2 Section 23 33 00 – Air Duct Accessories.

.3 Section 23 37 13 – Diffusers, Registers, and Grilles.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/ American Society of Mechanical Engineers International (ASME)

.1 ASHRAE Standard 52.1, Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter.

.2 ASHRAE Standard 52.2, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.

.2 American Society for Testing and Materials International (ASTM)

.1 A240/A240M, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.

.2 A480/A480M, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat- Resisting Steel Plate, Sheet, and Strip.

.3 A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.4 A924/A924M, Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process

.5 B209/B209M, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

.3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).

.1 HVAC Duct Construction Standards - Metal and Flexible.

.2 HVAC Air Duct Leakage Test Manual.

.4 Canadian Standards Association (CSA):

.1 CSA/ULC S102.2, Standard Method of Test for Surface Burning Characteristics of building Materials and Assemblies.

.2 CAN/ULC-S110, Standard Methods of Test For Air Ducts.

.5 Underwriters' Laboratories, Inc. (UL)

.1 UL 181, Standard for Safety Factory-Made Air Ducts and Connectors.

.6 Ontario Building Code 2012 (OBC)

1.3 SUBMITTALS

.1 Provide Submittals in accordance with Section 01 33 00 Submittal Requirements.

.2 Shop Drawings:

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

.2 Duct Construction: Provide the manufacturer's product literature of all catalogued components to be supplied. Include manufacturer's data sheets for certification, performance criteria, ratings, and physical dimensions and finishes.

.3 Submit marked up prints showing detailed locations of all devices mounted in or on ductwork, dimensioning their locations.

.3 Test Data:

.1 Submit duct leakage test data prior to ductwork being covered from view.

.4 Closeout Submittals:

.1 Provide maintenance data for incorporation into manual specified in Section 01 77 00 – Closeout Procedures.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver materials to site in original factory packaging, labelled with the Manufacturer's name and address.

.3 Separate for reuse and recycling and place in designated containers Steel, Metal and Plastic.

.4 Store at temperatures and conditions recommended by the Manufacturer.

2 Products

2.1 DUCTWORK

.1 General**:**

.1 All ductwork shall be designed, constructed, supported and sealed in accordance with SMACNA HVAC Duct Construction Standards and pressure classifications, unless otherwise noted in the Contract Documents.

.2 Material:

.1 Galvanized steel with Z90 designation zinc coating lock forming quality: to ASTM A653/A653M.

.2 Thickness: to SMACNA.

2.2 CASING AND PLENUM MATERIAL

.1 Unless otherwise specified in the Contract Documents, casing and plenum material shall be the same as the connecting duct material. If connecting duct is galvanized steel the galvanizing shall be G90.

.2 Unless otherwise specified in the Contract Documents, each plenum shall have a hinged access door and each intake plenum shall have a watertight drainage pan and 25mm drainage port.

2.3 DUCT SYSTEM JOINT SEALANT

.1 High Velocity Duct Sealant

.2 ULC listed and labelled.

.3 Premium grade, grey colour, water base, non-flammable duct sealer, brush or gun applied, with a maximum flame spread rating of 0 and smoke developed rating of 0.

2.4 ROUND TO RECTANGULAR DUCT CONNECTIONS

.1 G90 galvanized steel, flared notched and beaded round duct take-off collar complete with damper and associated hardware (including spring loaded damper clip, threaded damper clip, locking wing-nut and aluminum handle) to be installed in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible

.1 Acceptable manufacturers are:

.1 Peppertree Air Solutions Inc.

.2 Westaflex Inc.

.3 Approved equivalent.

3 Execution

3.1 FABRICATION OF DUCTWORK

.1 Unless otherwise specified in the Contract Documents, construct, install and seal ductwork in accordance with SMACNA HVAC Duct Construction Standards Metal and Flexible to suit the duct pressure class designations positive and negative as listed below. Construct ductwork so the manufacturer's gauge markings are external. Provide any additional structural steel channels, angles, inserts, beam champs and similar accessories required for hanging or supporting ductwork. Unless otherwise shown or specified, hang or support ductwork from the structure only. Where the ductwork is insulated, supports and hangers shall be of sufficient length to allow the insulation and covering to pass between the hangers unbroken.

.2 The following low pressure and medium pressure construction is based on the SMACNA method of construction, and gives a minimum standard of construction. Proposed alternatives are acceptable provided they follow the SMACNA HVAC Duct Construction Standards. Submit alternatives for review prior to fabrication.

.3 **Low Pressure Rectangular Ducts:** For systems less than 0.5 kPa (2" w.g.) static pressure and under 10.2 m/s (2000 fpm) velocity. Construct low pressure rectangular ducts as follows in Table 2:

.1 Bracing spacing shown is maximum spacing between two bracings or between bracing and joint.

.2 Locate bracings mid-way between joints.

.3 Make longitudinal joints Pittsburgh lock seam at edge of duct, and grooved seam on face of duct.

Table 1: Low Pressure Rectangular Duct Construction

Max. Duct Dimension	Sheet Metal (ga)	Transverse Joint Connection and Bracing
Up to 300 mm (12 in.)	26	Flat drive or flat 'S' no bracing
325 mm to 425 mm (13 in. to 18 in.)	24	Flat drive or flat 'S' no bracing

.4 **Low and medium pressure round ducts:** For systems below 6 inch Water Column (1.5 kPa) static pressure. Use products specified in Part 2 - Products wherever possible, otherwise construct low and medium pressure ducts as follows:

.1 Round ducts up to 750 mm (30 in.) dia. shall be factory fabricated, helically wound galvanized iron strips with spiral lock seam as follows. Join with galvanized iron coupling sleeves or conduit fittings of welded construction:

Table 2: Low and Medium Pressure Round Duct Construction (Up to 750mm)

Diameter	Strip Metal (ga)	Strip Joint	Girth Joint
Up to 200 mm (8 in.)	26	100 mm (4 in.)	50 mm (2 in.) long slip

225 mm to 550 mm (9 in. to 22 in.)	24	100 mm (4 in.)	50 mm (2 in.) long slip
575 mm to 750 mm (23 in. to 30 in.)	22	150 mm (6 in.)	100 mm (4 in.) long slip

.5 All ductwork shall be sealed in accordance with SMACNA Seal Class "A", except for round duct with self-sealing gasketed fittings and couplings.

3.2 GENERAL INSTALLATION OF DUCTWORK

.1 Make all laps in the direction of air flow. Use no sheet metal screws in the duct where it is possible to use rivets and bolts. Hammer down all edges and slips so as to leave smooth finished surface inside the ducts.

.2 Brace and stiffen all ducts, and make tight so that they will not breathe, rattle, vibrate or sag. Cross-break all rectangular ducts with heights or widths of 300 mm (12 in.) or larger.

.3 Where rectangular ducts are shown, round ducts may be substituted at the Contractor's option, provided there is sufficient room. Conversion from rectangular to round duct, sizing shall be as shown on charts in ASHRAE.

.4 Where the reinforcing of ductwork is required use of tie rods is the preferable method.

.5 For insulated ductwork, size the hanger support to suit the insulated duct and install the hanger or support on the outside of the insulation and covering.

.6 **Rectangular Duct Support Inside Building:** Coordinate with discipline responsible for Section 20 05 29 - Hangers and Supports to support horizontal rectangular ducts inside the building in accordance with SMACNA HVAC Duct Construction Standards Metal and Flexible, but use trapeze hangers with galvanized steel channels and galvanized steel hanger rods for all ducts that are exposed, and all concealed ducts wider than 500 mm (20").

.7 **Round and Flat Oval Duct Support Inside Building:** Coordinate with discipline responsible for Section 20 05 29 - Hangers and Supports to support round and flat oval ducts inside the building in accordance with SMACNA HVAC Duct Construction Standards Metal and Flexible. Unless otherwise specified in the Contract Documents, for both uninsulated and insulated ducts exposed in finished areas, use bands and secure at the top of the duct to a hanger rod, all similar to Ductmate Canada Ltd. type "BA". If the duct is insulated, size the strap to suit the diameter of the insulated duct.

.8 **Watertight Ductwork:** Where watertight horizontal ductwork is required inside the building, construct the ducts without bottom longitudinal seams. Solder or weld the joints of bottom and side sheets. Seal all other joints with duct sealer. Slope horizontal duct to hoods, risers, or drain points. Provide the drain points. Provide watertight ductwork for:

.1 Lockers shower/ washroom exhaust air ductwork (ERV)

.2 Wherever else shown on the Drawings.

.9 **Leakage Testing:** Leakage testing shall be performed in accordance with the ANSI/SMACNA HVAC Air Duct Leakage Test Manual Second Edition – 2012 and shall be witnessed by the Consultant.

.1 Acceptable Leakage shall be calculated based on the following criteria:

.1 Rectangular metal ductwork - Leakage Class 6 (cfm/100ft^2 @ 1" w.g.)

.2 Round metal ductwork - Leakage Class 3 (cfm/100ft^2 @ 1" w.g.)

.3 No less than 25% of all ductwork shall be tested at the rated static pressure of the supply or exhaust duct. If the test result is "pass" then no additional testing shall be required. If the test result is "fail" then additional leak testing shall be

performed on 50% of all ductwork. If the test result is “pass” then no additional testing shall be required. If the second test result is “fail” then all 100% of ductwork shall be tested.

.4 All ductwork shall be tested prior to the installation of dampers, grilles, registers, coils, openings, etc that could cause a failure in the pressure test. Sections of ductwork shall be completely replaced where this occurs prior to the passing of the leakage testing.

.5 Positive pressure leakage testing is acceptable for negative pressure ductwork.

.6 Leakage factor to be calculated based on surface area of metal contained within the section and the specified test pressure using ANSI/SMACNA HVAC Air Duct Leakage Test Manual Second Edition – 2012 Fig’s 5-1 & 5-1L.

.7 To be certified by the same testing, adjusting, and balancing agency approved by the Consultant to undertake testing, adjusting, and balancing on this project.

.10 **Application of Sealants:** Apply sealants by brush or gun to cleaned metal surfaces. Where bare ductwork is exposed, apply neat uniform lines of sealant. Randomly brushed, sloppy looking sealant applications will be rejected and must be repaired or replaced with a neat application of the sealant. For Seal Class A apply the sealant on the interior of the duct.

3.3 INSTALLATION OF FLEXIBLE DUCTWORK

.1 Provide maximum 1.5 m (5') long lengths of flexible ductwork for connections between galvanized steel duct mains and branches, and necks of ceiling grilles and diffusers.

.2 At rectangular galvanized steel duct, accurately cut holes and provide flanged or "Spin-in" round flexible duct connection collars. Seal joints with duct sealer.

.3 Install flexible ducts as straight as possible and support in accordance with requirements of SMACNA HVAC Duct Construction Standards Metal and Flexible, and secure at each end with nylon or stainless steel gear type clamps, and seal joints. Provide long radius duct bends where they are required.

.4 Do not penetrate fire barriers with flexible duct.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 20 05 00 – General Requirements.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/ American Society of Mechanical Engineers International (ASME)

.1 ASHRAE Standard 52.1, Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter.

.2 ASHRAE Standard 52.2, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.

.2 American Society for Testing and Materials International (ASTM)

.1 A240/A240M, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.

.2 A480/A480M, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat- Resisting Steel Plate, Sheet, and Strip.

.3 A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.4 A924/A924M, Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process

.5 B209/B209M, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

.3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).

.1 HVAC Duct Construction Standards - Metal and Flexible.

.2 HVAC Air Duct Leakage Test Manual.

.4 Canadian Standards Association (CSA):

.1 CSA/ULC S102.2, Standard Method of Test for Surface Burning Characteristics of building Materials and Assemblies.

.2 CAN/ULC-S110, Standard Methods of Test For Air Ducts.

.5 Underwriters' Laboratories, Inc. (UL)

.1 UL 181, Standard for Safety Factory-Made Air Ducts and Connectors.

.6 Ontario Building Code 2012 (OBC)

1.3 SUBMITTALS

.1 Provide Submittals in accordance with Section 01 33 00 Submittal Requirements.

.2 Shop Drawings:

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

.2 Duct Construction: Provide the manufacturer's product literature of all catalogued components to be supplied. Include manufacturer's data sheets for certification, performance criteria, ratings, and physical dimensions and finishes.

.3 Submit marked up prints showing detailed locations of all devices mounted in or on ductwork, dimensioning their locations.

.3 Test Data:

.1 Submit duct leakage test data prior to ductwork being covered from view.

.4 Closeout Submittals:

.1 Provide maintenance data for incorporation into manual specified in Section 01 77 00 – Closeout Procedures.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver materials to site in original factory packaging, labelled with the Manufacturer's name and address.

.3 Separate for reuse and recycling and place in designated containers Steel, Metal and Plastic waste in accordance with Waste Management Plan (WMP).

.4 Store at temperatures and conditions recommended by the Manufacturer.

2 Products

2.1 DUCTWORK

.1 Material:

.1 Galvanized steel with Z90 designation zinc coating lock forming quality: to ASTM A653/A653M.

.2 Thickness: to SMACNA.

.2 Construction: round.

.1 Ducts: factory fabricated, welded seam or spiral wound, with matching fittings and specials.

.2 SMACNA standard.

.1 Dust carrying ducts to be two gauges thicker than SMACNA standard recommendations.

.3 Transverse joints up to 36 in. (900 mm): slip type with tape and sealants.

.4 Transverse joints over 36 in. (900 mm): Vanstone.

.5 Fittings:

.1 Elbows: 5 piece (for 90 degrees), 3 piece (for 45 degrees)]. Centreline radius: 1.5 x diameter.

.2 Branches: conical transition with conical branch at 45 degrees and 45 degrees elbow.

.3 Construction: rectangular:

.1 Clean air only.

.2 Ducts: to SMACNA.

.3 Transverse joints: welded.

.4 Fittings:

.1 Elbows: smooth radius; centreline radius 1.5 x width of duct. No vanes.

.2 Branches: with conical branch at 45 degrees and 45 degrees elbow.

.4 Fire stopping:

.1 Retaining angles around duct, on both sides of fire separation in accordance with Section .

.2 Coordinate with Section 07 84 00 - Fire Stopping to ensure fire stopping materials and installation does not distort duct.

2.2 SEAL CLASSIFICATION

.1 Clean air duct classification as follows:

Maximum Pressure "WC (Pa)	SMACNA Seal Class
10 (2500)	[A]
6 (1500)	[A]
4 (1000)	[A]
3 750)	[B]

.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 gaskets, sealant tape, or combination thereof.

2.3 SEALANT

.1 Sustainability Characteristics:

.1 Adhesives and sealants: VOC limit 250 g/L maximum to SCAQMD Rule 1168.

.2 Oil resistant, water-borne polymer type flame resistant high velocity duct sealing compound.

.1 Temperature range of minus 30 degrees C to plus 93 degrees C.

2.4 TAPE

.1 Tape: polyvinyl treated, open weave fibre glass, [50] mm wide.

2.5 HANGERS AND SUPPORTS

.1 Hangers and supports: in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping Equipment.

.1 Band hangers: use on round and oval ducts up to 20 inch (500 mm) diameter, of same material as duct but next sheet metal thickness heavier than duct.

.2 Trapeze hangers: ducts over 20 inch (500 mm) diameter or longest side, to SMACNA.

.3 Hangers: galvanized steel angle with galvanized steel rods to most restrictive of SMACNA and following table.

Duct Size (mm)	Angle Size (mm)	Rod Size (mm)
up to 750	25 x 25 x 3	6
751 to 1050	40 x 40 x 3	6
1051 to 1500	40 x 40 x 3	10
1501 to 2100	50 x 50 x 3	10
2101 to 2400	50 x 50 x 5	10
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 or steel plate washer.

.3 For steel beams: manufactured beam clamps:

3 Execution

3.1 EXAMINATION

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

.1 Visually inspect substrate in presence of ONTC Representative.

.2 Inform ONTC Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from ONTC Representative.

3.2 GENERAL

.1 Do work in accordance with ASHRAE and SMACNA.

.2 Do not break continuity of insulation vapour barrier with hangers or rods.

.1 Insulate band hangers 4 inches (100) mm beyond insulated duct.

.2 Ensure diffuser is fully seated.

.3 Support risers in accordance withASHRAE and SMACNA.

.4 Install breakaway joints in ductwork on sides of fire separation.

3.3 HANGERS

.1 Band hangers: install in accordance with SMACNA.

.2 Angle hangers: complete with locking nuts and washers.

.3 Hanger spacing: [in accordance with most restrictive of SMACNA and following:

Duct Size	**Spacing**
(mm)	(mm)
to 1500	3000
1501 and over	2500

3.4 SEALING AND TAPING

.1 Apply sealant in accordance with SMACNA and to manufacturer's recommendations.

.2 Bed tape in sealant and recoat with minimum of one coat of sealant to manufacturer's recommendations.

3.5 LEAKAGE TESTS

.1 In accordance with SMACNA HVAC Duct Leakage Test Manual.

.2 Perform leakage tests in sections.

.3 Perform trial leakage tests, as instructed to demonstrate quality of work.

.4 Do not install additional ductwork until trial tests have been achieved.

.5 Test section minimum of 100 ft. (30) m long with not less than 3 branch takeoffs and two 90 degrees elbows.

.6 Complete tests before performing insulation or concealment Work.

3.6 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 in accordance with Section 01 74 00 - Cleaning.

.3 Waste Management: separate waste materials for reuse and recycling.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 20 05 00 – General Requirements.

.2 Section 23 30 00 – HVAC Ducts and Plenums.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers International (ASME)

.1 ASHRAE Standard 52.1, Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter.

.2 ASHRAE Standard 52.2, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.

.2 American Society for Testing and Materials International (ASTM)

.1 A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 A924/A924M, Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process

.3 B209/B209M, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

.3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).

.1 HVAC Duct Construction Standards - Metal and Flexible.

.2 HVAC Air Duct Leakage Test Manual.

.4 Canadian Standards Association (CSA):

.1 CSA/ULC S102.2, Standard Method of Test for Surface Burning Characteristics of building Materials and Assemblies.

.2 CAN/ULC-S110, Standard Methods of Test For Air Ducts.

.5 Underwriters' Laboratories, Inc. (UL)

.1 UL 181, Standard for Safety Factory-Made Air Ducts and Connectors.

.6 Ontario Building Code 2012 (OBC)

1.3 SUBMITTALS

.1 Shop Drawings:

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

.2 Submit shop drawings for all equipment in this Section.

.2 Test Data:

.1 Submit duct leakage test data prior to ductwork being covered from view.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver materials to site in original factory packaging, labelled with the Manufacturer's name and address.

.3 Separate for reuse and recycling and place in designated containers Steel, Metal and Plastic waste in accordance with Waste Management Plan (WMP).

.4 Store at temperatures and conditions recommended by the Manufacturer.

2 Products

2.1 GENERAL

.1 The following shall not apply to dust transporting duct work.

2.2 SPLITTER DAMPERS

.1 Minimum 0.95 mm thick (20 ga) damper blade constructed of the same material as the duct, reinforced as required to suit blade size, system velocity, and to prevent "chatter", and complete with operating hardware DynAir Inc. #Q-50 "DYN-A-QUAP Single Shear" quadrant regulator with RW-50 backup washers to prevent leakage, long square bearing pin, and slide pin or approved equivalent.

2.3 AIR TURNING VANES

.1 For square elbows – Ductmate "PROrail" multiple-radius turning vanes, interconnected with bars, adequately reinforced to suit the pressure and velocity of the system, constructed of the same material as the duct they are associated with, and in accordance with SMACNA HVAC Duct Construction Standards Metal and Flexible.

.2 For short branch ducts at grille and diffuser connections - air extractor type, each equipped with a matching bottom operated 90 degree opposed blade volume control damper, constructed of the same material as the duct it is associated with, and in accordance with SMACNA HVAC Duct Construction Standards Metal and Flexible.

2.4 MANUAL BALANCING (VOLUME) DAMPERS

.1 Flanged and drilled, single or parallel blade (depending on damper size) manual balancing dampers, each constructed of the same material as the connecting ductwork unless otherwise specified in the Contract Documents (where aluminum is not available use stainless steel), each designed to maintain the internal free area of the connecting duct, and each complete with:

.1 A round shaft extension through the frame;

.2 Non-stick, non-corrosive bronze bearings for rectangular dampers, flange, non-stick, non-corrosive oilite bronze bearings for round dampers;

.3 No blade stops;

.4 Linkage for multiple blade dampers;

.5 Nailor # HL2 locking hand quadrant damper operator with 50 mm (2") standoff mounting.

.2 Rectangular Dampers: Nailor Model #1810FDB-(GLV or SS)-DSB-BO-HLF, Spinnaker Industries Inc Model SK-1810-FF-16-CL-CB or Ruskin Model CD80VG1 (GLV or SS), maximum size 1.2m x 1.2m (4' x 4') for a single damper, and equipped with a 1.613 mm thick (16 ga) flanged type frame with 40 mm (1½") bolt hole centres, non-stick, non-corrosive bronze bearings, no sill and linkage out of air stream.

.3 Round Dampers: Nailor Model #1090 BO FMS, galvanized or stainless steel, non-stick, non-corrosive oilite bronze bearings, full perimeter blade stop, maximum 1.2 m (4') diameter equipped with a minimum 200 mm (8") deep frame, and blade stiffeners where required.

.4 Multiple Rectangular Damper Section Assembly: Rectangular assembly supplied with the dampers or site constructed, of the same material as the damper and designed for tight and secure mounting of the individual dampers.

.5 Acceptable manufacturers are:

.1 Nailor Industries Inc.

.2 Greenheck Fan Corporation

.3 E.H. Price Ltd.

.4 Ruskin Company

2.5 CONTROL DAMPERS:

.1 Motorized dampers shall be sized as indicated. Maximum damper section shall be 1200 mm x 1500 mm (48 in. x 60 in.). For dampers larger than the section maximum, use an assembly of multiple, equally sized sections.

.2 Two-Position motorized dampers shall be parallel blade. Modulating motorized dampers shall be opposed blade. Exception: Parallel blade dampers may be used for return air and bypass application.

.3 Frames shall be constructed of extruded aluminum.

.4 Provide in duct mounting dampers.

.5 Blades shall be extruded aluminum airfoil type.

.6 Blade seals shall be extruded EPDM. Frame seals shall be extruded silicone. Seals shall be secured in an integral slot within the aluminum extrusions. Blade and frame seals shall be mechanically fastened to eliminate shrinkage and movement over the life of the damper. Adhesive or clip-on type blade seals shall not be acceptable.

.7 Maintenance free bearings shall be composed of a Celcon inner bearing fixed to an aluminum blade pivot pin, rotating within a polycarbonate outer bearing inserted into the frame. No metal to metal or metal to plastic contact.

.8 Drive rods, U bolt fasteners and retaining nuts shall be corrosion resistant zinc plated steel.

.9 All linkage hardware shall be installed on the frame side. All linkage crank arm and rod hardware parts shall be constructed of aluminum.

.10 Dampers shall be designed for operating in temperatures between -40ºC to 100ºC (-40ºF to 212ºF).

.11 Leakage shall not exceed 15 l/s/m2 (2.95 cfm/ft2) against 250 Pa (0.036 psi) of differential pressure across fully closed damper when tested to AMCA Standard 511.

.12 Acceptable manufacturers are:

.1 T.A. Morrison & Co. Inc

.2 Nailor Industries Inc.

.3 Greenheck Fan Corporation

.4 E.H. Price Ltd.

.5 Ruskin Company.

.6 Ventex Inc.

2.6 FUSIBLE LINK (FIRE) DAMPERS

.1 Curtain blade type, dynamic, galvanized steel (unless otherwise specified in the Contract Documents) fusible link dampers, ULC classified to Standard CAN/ULC-S112 and in accordance with NFPA 90A requirements, factory tested for closure under airflow, 1.5 hour or 3 hour rated as required by the Contract Documents, and complete with a constant force type 301 stainless steel closure spring, a blade lock assembly, an integral steel sleeve c/w retaining angles, and, unless otherwise specified in the Contract Documents, a 74ºC (165ºF) rated standard fusible link.

.2 Fusible link dampers shall be type "B" or type "C" (as required) with the folded curtain blade out of the air stream except where damper size or location requires the use of type "A" dampers with the curtain blade in the air stream.

.3 Fusible link dynamic types shall consist of the following:

.1 Dynamic curtain type shall not exceed a single section as follows:

.1 Horizontal mount Type "A": 610 mm wide x 610 mm high (24" wide x 24" high) Nailor Model D0114 c/w factory sleeve.

.2 Vertical mount Type "A": 914 mm wide x 914 mm high (36" wide x 36" high) Nailor Model D0114 c/w factory sleeve.

.3 Horizontal Type "B": 533 mm wide x 610 mm high (24" wide x 21" high) Nailor Model D0124 c/w factory sleeve

.4 Horizontal Type "B": 914 mm wide x 813 mm high (36" wide x 32" high) Nailor Model D0124 c/w factory sleeve.

.5 Type "A" dampers with folded blades in the airstream are only acceptable with the prior approval of the consultant

.2 Dynamic airfoil muli-blade for sizes above 600 mm wide x 533 mm high (24" wide x 21" high):

.1 Vertical mount Type "A" shall not exceed 1829 mm wide x 1219 mm high (72" wide x 48" high) or 914 mm high x 2438 mm wide (36" wide x 96" high) maximum consisting of two sections. Nailor Industries Inc. Model D1201 c/w factory sleeve

.2 Horizontal mount Type "A" not to exceed 1626 mm wide x 1219 mm high (64" wide x 48"high) or 813 mm wide x 2438 mm high (32" wide x 96" high) maximum consisting of two sections. Nailor Industries Inc. Model D1201 c/w factory sleeve.

.3 Dampers with duct heights less than 203 mm (8") require Type B Nailor Industries Inc. Model D1202 c/w factory sleeve or Type "C".

.4 Type "A" dampers with folded blades in the airstream are only acceptable with the prior approval of the consultant

.4 Fusible link dampers in ductwork other than galvanized steel shall be as specified above but constructed of type 316 stainless steel. Nailor Model D1201SS c/w factory sleeve:

.1 Type "A" single section minimum 203 mm wide x 203 mm high (8" wide x 8" high) or 914 mm high x 1219 mm wide (36" x 48") maximum single section. Vertical mount only. Nailor Model D1201SS c/w factory sleeve.

.2 Type "A" multi section assembly 203 mm wide x 203 mm high (72" wide x 96" high) or 914 mm wide x 1219 mm high (144"wide x 48" high) vertical mount only. Nailor Model D1201SS c/w factory sleeve.

.5 Acceptable manufacturers are:

.1 Nailor Industries Inc.

.2 Greenheck Fan Corporation

.3 E.H. Price Ltd.

.4 Ruskin Company

2.7 FLEXIBLE CONNECTION MATERIAL

.1 Waterproof indoor-outdoor woven fibreglass fabric coated on both sides with a specially compounded synthetic rubber, off-white in colour, flexible material between the fan discharge and the casing opening, with spring thrust restraints secured to welded brackets on the fan housing and by steel rods though the fan casing with a steel back-up plate. Acceptable products are:

.1 Duro Dyne Canada Inc. "DUROLON"

.2 DynAir Inc. "HYPALON"

.2 Waterproof, flameproof, high temperature flexible connection material meeting requirements of NFPA 90A, consisting of a woven glass fibre fabric coated on both sides with silicone rubber to produce a material with an operating temperature range of from -50ºC to 260ºC (-60ºF to 500ºF). Acceptable products are:

.1 Duro Dyne Canada Inc. "Thermofab"

.2 DynAir Inc. "SILICON HI-T"

2.8 DUCT ACCESS DOORS

.1 Nailor Model Series 0800 flat oval access doors or approved equivalent complete with safety chain. Frame shall be of flat oval design, double flange frame mounting type M-1, die-formed of minimum 0.85 mm (22 ga) galvanized steel. Door shall be die-formed of minimum 0.85 mm (22 ga) galvanized steel and be of double skin construction with 25 mm (1") of insulation fully enclosed within and an integral bulb type seal fastened to the door with sizes suitable in all respects for the purpose for which they are provided, and, unless otherwise specified in the Contract Documents, constructed of the same material as the duct they are associated with. Manufacturer shall submit leakage data tested to a minimum of 2 kPa (8" w.g.).

.2 Acceptable manufacturers are:

.1 Nailor Industries Inc.

.2 Ductmate Industries Inc.

.3 Ruskin Company

2.9 DUCTWORK DRAIN POINT

.1 Ductmate Canada Ltd. "Moisture Drain", or approved equivalent 20 mm (3/4") in diameter moisture drains with galvanized sheet metal funnel, and chrome plated brass threaded drain, nut and cap.

2.10 INSTRUMENT TEST PORTS

.1 Duro Dyne of Canada Ltd. #TH1 or #IP2 (to suit insulation thickness where applicable) or approved equivalent gasketed, leakproof instrument test ports for round or rectangular ducts as required, each complete with a neoprene expansion plug and a plug securing chain.

2.11 FILTERS FOR COMMISSIONING

.1 Supplied with each air handling unit as follows:

.1 Construction filter - Camfil Farr "CG-3000" 25 mm (1") thick, high-loft fibreglass (white/yellow), MERV 8, synthetic roll media secured in place in the filter section prior to shipping.

3 Execution

3.1 INSTALLATION OF SPLITTER DAMPERS

.1 Provide splitter dampers in supply ductwork at branch duct connections off supply air mains, and wherever else shown and/or specified on the Drawings. Install splitter dampers so they cannot vibrate and rattle and so that the damper operation mechanisms are in an easily accessible and operable location.

3.2 INSTALLATION OF TURNING VANES

.1 Provide turning vanes in all ductwork elbows (supply, exhaust, return) where due to site installation routing and duct elbow radius of less than one and a half (1½) times width (smooth radius elbows with a R/W of 1.5) is not possible, turning vanes and splitter vanes shall be in accordance with SMACNA HVAC Duct Construction Standards Metal and Flexible.

.2 Provide volume extractor type turning vanes in short branch supply duct connections off mains to grilles and diffusers where shown and/or specified in the Contract Documents.

3.3 INSTALLATION OF MANUAL BALANCING (VOLUME) DAMPERS

.1 Provide manual balancing dampers in all open end ductwork, in all supply and return air duct mains, in all branch ducts, at each individual grille, register, diffuser and wherever else shown and/or specified in the Contract Documents.

.2 Install the dampers so that the operating mechanism is accessible and positioned for easy operation, and so that the dampers cannot move or rattle.

.3 Where a duct for which a balancing damper is required has dimensions larger than the dimensions of the maximum size volume damper available, provide multiple dampers bolted together in a properly sized assembly, or bolted to a heavy-gauge black structural steel angle or channel framework which is properly sized. Seal to prevent air by-pass, and provide connecting linkage.

.4 Confirm exact damper locations with personnel doing air quantity balancing testing work and install dampers to suit.

3.4 INSTALLATION OF BACKDRAFT DAMPERS

.1 Provide backdraft dampers where shown on the Drawings.

.2 Install and secure the dampers so that they cannot move or rattle.

3.5 INSTALLATION OF CONTROL DAMPERS

.1 Provide control dampers for all exhaust fans, exhaust air louvres, air intake louvres, and wherever else shown on the Drawings.

.2 Install dampers in accordance with manufacturer’s Installation Instructions.

.3 Dampers must be accessible to allow inspection, adjustment, and replacement of components. The sheet metal contractor shall furnish any access doors in ductwork or plenums required to provide this access. The general contractor shall furnish any access doors required in walls, ceilings, or other general building construction.

.4 Install dampers square and free from racking.

.5 The installing contractor shall provide and install bracing for multiple section assemblies to support assembly weight and to hold against system pressure.

.6 Do not compress or stretch the damper frame into the duct or opening.

.7 Attach multiple damper section assemblies together in accordance with manufacturer’s instructions. Install support mullions as reinforcement between assemblies as required.

.8 Handle dampers using the frame or sleeve. Do not lift or move dampers using blades, actuator or jackshaft

.9 Install connections to actuators as per manufacturer’s recommendation.

3.6 INSTALLATION OF FUSIBLE LINK (FIRE) DAMPERS

.1 Provide fusible link dampers where shown and/or specified on the Drawings. Ensure that the damper rating (1.5 or 3 hr.) is suitable for the fire barrier it is associated with.

.2 Install dampers with retaining angles on all four sides of the sleeve on both sides of the damper and connect with ductwork in accordance with the damper manufacturer's instructions and details to meet OBC requirements.

.3 Provide expansion clearance between the damper or damper sleeve and the opening in which the damper is required. Ensure that the openings are properly sized and located, and that all voids between the damper sleeve and the opening are properly sealed to maintain the rating of the fire barrier.

.4 Where the size of the fire barrier opening requires the use of a sectionalized fire damper assembly, provide multiple fusible link dampers (sized to CAN/ULC - S112) bolted together in a properly sized assembly or bolted to a heavy-gauge black structural steel angle or channel framework.

.5 Operational Testing: All fusible link dampers shall be tested in accordance with NFPA 80 and NFPA 105 as follows:

.1 An operational test shall be conducted after the building's HVAC system has been balanced.

.2 The operational test shall be conducted under normal HVAC airflow conditions as well as static flow conditions. The damper shall fully close/seal under both test conditions.

.3 After the installation of a damper is completed, an operational test shall be conducted to verify that:

.1 The dampers shall fully close from the open position.

.2 It shall be verified that the system airflow where the damper is installed is within the design velocity.

.4 All inspections and testing shall be documented, indicating the location of the fire damper, date(s) of inspection, name of inspector, and deficiencies discovered The documentation shall have a space to indicate when and how the deficiencies were corrected rating of the damper listing.

.5 Demonstrate re-setting of all fire dampers to the Owner's representative after fan start/air handling unit startup and air balancing.

.6 After testing, all fusible links shall be reset into the "closed" positon, holding the damper blades in the in the open position, allowing airflow to pass through.

3.7 INSTALLATION OF FLEXIBLE CONNECTION MATERIAL

.1 Provide a minimum of 100 mm (4") of flexible connection material where ducts, plenums, and/or casings connect to fans, where ducts cross building expansion joints, and wherever else shown or specified in the Contract Documents.

.2 Rigidly secure a minimum of 75 mm (3") of duct material (minimum 24 ga) to each edge of the flexible fabric and to the fan, duct, plenum, etc., in accordance with Figures 7-8 and 7-9 in SMACNA HVAC Duct Construction Standards Metal and Flexible Third Edition.

.3 Ensure that connections to the flexible fabric material are arranged and supported so as to not impose any external forces on the fabric.

3.8 INSTALLATION OF DUCT ACCESS DOORS

.1 Provide access doors in ductwork for access to all components which will or may need maintenance and/or repair, including reheat coils (upstream and downstream), fire dampers, smoke dampers, duct mounted smoke detectors, control and operating dampers, equipment requiring maintenance, duct mounted instrumentation or control devices.

.2 Install in accordance with requirements of SMACNA HVAC Duct Construction Standards Metal and Flexible.

.3 Identify access doors provided for fusible link damper maintenance with "FLD" stencil painted or marker type red lettering and ensure that the doors are properly located for damper maintenance.

.4 When requested, submit a sample of proposed duct access doors for review.

.5 Where sectionalized fusible link dampers and/or balancing dampers are provided in large ducts, provide a plenum type access door to suit, and adequately reinforce the ductwork to suit the access door installed.

3.9 INSTALLATION OF INSTRUMENTS TEST PORTS

.1 Provide instrument test ports in all main ducts at connections to fans, plenums or casings, in all larger branch duct connections to mains, and wherever else required for proper air quantity balancing and testing.

.2 Locate test ports where recommended by personnel performing air quantity testing and balancing work.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 20 05 00 – General Mechanical Requirements

.2 20 05 48 - Vibration Isolation

.3 23 33 00 - Air Duct Accessories

1.2 REFERENCE STANDARDS

.1 American National Standards Institute/Air Movement and Control Association (ANSI/AMCA)

.1 ANSI/AMCA Standard 99-[2010], Standards Handbook.

.2 ANSI/ASHRAE 51-[07] (ANSI/AMCA 210-[07]), Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.

.3 ANSI/AMCA Standard 300-[2008], Reverberant Room Method for Sound Testing of Fans.

.4 ANSI/AMCA Standard 301-[1990], Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

.2 Canada Green Building Council (CaGBC)

.1 LEED Canada-NC Version 1.0-[2004], LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For New Construction and Major Renovations (including Addendum [2007]).

.2 LEED Canada-CI Version 1.0-[2007], LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide For Commercial Interiors.

.3 LEED Canada 2009 for Design and Construction-[2010], LEED Canada 2009 for Design and Construction Leadership in Energy and Environmental Design Green Building Rating System Reference Guide.

.4 LEED Canada for Existing Buildings, Operations and Maintenance-[2009], LEED Canada 2009 Leadership In Energy and Environmental Design Green Building Rating System Reference Guide.

.3 The Master Painters Institute (MPI)

.1 Architectural Painting Specification Manual.

.1 MPI #18, Primer, Zinc Rich, Organic.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 10 00.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for HVAC fans and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Alberta, Canada.

.2 Provide:

.1 Fan performance curves showing point of operation, kW and efficiency.

.2 Sound rating data at point of operation.

.3 Indicate:

.1 Motors, sheaves, bearings, shaft details.

.2 Minimum performance achievable with variable speed controllers

.4 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Management Plan, Waste Reduction Workplan highlighting recycling and salvage requirements.

.2 Recycled Content:

.1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of [post-consumer][and][post-industrial] content, and total cost of materials for project.

1.4 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Materials:

.1 Submit in accordance with Section 01 10 00.

.1 Provide:

.1 Matched sets of belts.

.2 Furnish list of individual manufacturer's recommended spare parts for equipment, include:

.1 Bearings and seals.

.2 Addresses of suppliers.

.3 List of specialized tools necessary for adjusting, repairing or replacing.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 10 00 and with manufacturer's written instructions.

.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 HVAC fans from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 SYSTEM DESCRIPTION

.1 Performance Requirements:

.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards in force.

.2 Capacity: flow rate, total and static pressure, W, efficiency, revolutions per minute, power, model, size, sound power data and as indicated on schedule.

.3 Fans: statically and dynamically balanced, constructed in conformity with ANSI/AMCA Standard 99

.4 Sound ratings: comply with ANSI/AMCA Standard 301, tested to ANSI/AMCA Standard 300. Supply unit with ANSI/AMCA certified sound rating seal.

.5 Performance ratings: based on tests performed in accordance with ANSI/AMCA Standard 210. Supply unit with ANSI/AMCA certified rating seal, except for propeller fans smaller than 300 mm diameter.

2.2 FANS GENERAL

.1 Motors:

.1 For use with variable speed controllers.

.2 Sizes as indicated.

.2 Accessories and hardware: matched sets of V-belt drives, adjustable slide rail motor bases, belt guards, coupling guards fan inlet safety screens as indicated.

.3 Factory primed before assembly in colour standard to manufacturer.

.4 Scroll casing drains: as indicated.

.5 Bearing lubrication systems plus extension lubrication tubes where bearings are not easily accessible.

.6 Vibration isolation: to Section 20 05 48 - Vibration Isolation.

.7 Flexible connections: to Section 23 33 00 - Air Duct Accessories.

2.3 CENTRIFUGAL ROOF EXHAUST FANS

.1 Description:

.1 Fan shall be a single width, single inlet, backward inclined airfoil, belt driven centrifugal vent set.

.2 Construction:

.1 The fan shall be of bolted and welded construction utilizing corrosion resistant fasteners. The scroll wrapper shall be a minimum 14 gauge steel and the scroll side panels shall be a minimum 12 gauge steel. The entire fan housing shall have continuously welded seams for leak proof operation. A performance cut-off shall be furnished to prevent the recirculation of air in the fan housing. The fan housing shall be field rotatable to any one of eight discharge positions and shall have a minimum 1-1/2 inch outlet discharge flange.

Bearing support shall be minimum 10 gauge welded steel. Side access inspection ports shall be provided with quick release latches for access to the motor compartment without removing the weather cover. Lifting lugs shall be provided for ease of installation. Unit shall bear an engraved aluminum nameplate. Nameplate shall indicate design CFM, static pressure, and maximum fan RPM. Unit shall be shipped in ISTA certified transit tested packaging.

.3 Coating:

.1 Steel fan components shall be coated with an electro statically applied, baked polyester powder coating. Each component shall be subject to a five stage environmentally friendly wash system, followed by a minimum 2 mil thick baked powder finish. Paint must exceed 1,000 hour salt spray under ASTM B117 test method.

.4 Fan wheels:

.1 Wheel shall be steel centrifugal airfoil blade type. Blades shall be continuously welded to the back plate and deep spun inlet shroud. Wheel hub shall be keyed and securely attached to the fan shaft. Wheel inlet shall overlap an aerodynamic aluminum inlet cone to provide maximum performance and efficiency. Wheel shall be balanced in accordance with AMCA Standard 204-05, Balance Quality and Vibration Levels for Fans

.5 Bearings:

.1 Bearings shall be designed and tested specifically for use in air handling applications. Construction shall be heavy duty regreasable ball or roller type in a cast iron pillow block housing selected for a minimum L50 life in excess of 200,000 hours at maximum cataloged operating speed

.6 Shaft on exhaust fans:

.1 Blower shaft shall be AISI C-1045 hot rolled and accurately turned, ground and polished. Shafting shall be sized for a critical speed of at least 125% of maximum RPM.

.7 Housings:

.1 Volute with inlet cones: fabricated steel for wheels 300 mm or greater, steel for smaller wheels, braced, and with welded supports.

.2 For horizontally and vertically split housings provide flanges on each section for bolting together, with gaskets of non-oxidizing non-flammable material.

.3 Provide bolted airtight access doors with handles.

.8 Belts and Drives:

.1 Belts shall be oil and heat resistant, static conducting. Drives shall be precision machined cast iron type, keyed and securely attached to the wheel and motor shafts. Drives shall be sized for 150% of the installed motor horsepower. The variable pitch motor drive must be factory set to the specified fan RPM

.9 Variable volume control devices:

.1 Mounted by fan manufacturer.

.10 Acceptable Manufacturers:

.1 The following manufacturers and model series have been deemed compliant with general capacity requirements and refrigerant requirements.

.1 Loren Cook

.2 Greenheck
.3 Pennbarry
.4 Twin City

.2 Alternate manufacturers complying with overall capacity requirements and refrigerant requirements shall submit request for consideration prior to close of tender period.

2.4 IN-LINE CENTRIFUGAL FANS

.1 Description:

.1 Fan shall be duct mounted, direct driven centrifugal inline.

.2 Construction:

.1 The fan shall be of bolted construction utilizing corrosion resistant fasteners. Housing shall be minimum 18 gauge galvanized steel with integral duct collars. Bolted access doors shall be provided on three sides, sealed with closed cell neoprene gasketing. Housing shall be pre-drilled to accommodate universal mounting feet for vertical or horizontal installation. Unit shall bear an engraved aluminum nameplate. Nameplate shall indicate design CFM and static pressure. Unit shall be shipped in ISTA certified transit tested packaging.

.3 Wheel:

.1 Wheel shall be centrifugal backward inclined, constructed of 100% aluminum, including a precision machined cast aluminum hub. Wheel inlet shall overlap an aerodynamic aluminum inlet cone to provide maximum performance and efficiency. Wheel shall be balanced in accordance with AMCA standard 204-05, balance quality and vibration levels for fans.

.4 Provide AMCA arrangements 1 or 9 as indicated with stiffened flanges, smooth rounded inlets, and stationary guide vanes.

.5 Acceptable Manufacturers:

.1 The following manufacturers and model series have been deemed compliant with general capacity requirements and refrigerant requirements.
.1 Loren Cook
.2 Greenheck
.3 Pennbarry
.4 Twin City

.2 Alternate manufacturers complying with overall capacity requirements and refrigerant requirements shall submit request for consideration prior to close of tender period.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for HVAC fans installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of ONTC Representative.

.2 Inform ONTC Representative and Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from ONTC Representative.

3.2 FAN INSTALLATION

.1 Install fans as indicated, complete with resilient mountings specified in Section 20 05 48 - Vibration Isolation, flexible electrical leads and flexible connections in accordance with Section 23 33 00 - Air Duct Accessories.

.2 Provide sheaves and belts required for final air balance.

.3 Bearings and extension tubes to be easily accessible.

.4 Access doors and access panels to be easily accessible.

3.3 ANCHOR BOLTS AND TEMPLATES

.1 Size anchor bolts to withstand velocity forces as specified.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 10 00.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 10 00.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 20 05 00 – General Mechanical Requirements.

.2 Section 23 30 00 – HVAC Ducts and Plenums.

.3 Section 23 33 00 – Air Duct Accessories.

1.2 REFERENCES

.1 Air Movement and Control Association (AMCA)

.1 AMCA Publication 511, Product Rating Manual for Air Control Devices.

.2 Air Conditioning, Heating, and Refrigeration Institute (AHRI)

.1 ANSI/AHRI 885, Procedure for Estimating Occupied Space Sound Levels in the Application of Air Terminals and Air Outlets.

.3 American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)

.1 ANSI/ASHRAE 36B-63, Method of Testing for Rating the Acoustic Performance of Air Control and Terminal Devices.

.2 ASHRAE Standard 70, Method of Testing for Rating the Performance of Air Outlets and Inlets.

.4 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

.1 SMACNA, HVAC Duct Construction Standards - Metal and Flexible.

.5 Ontario Building Code 2012 (OBC)

1.3 SUBMITTALS

.1 Shop Drawings:

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

.2 Submit product literature for all equipment in this Section.

.2 Colour Chart(s): Submit manufacturer's colour chart(s) for all items for which a finish colour is to be selected.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver materials to site in original factory packaging, labelled with the Manufacturer's name and address.

.3 Separate for reuse and recycling and place in designated containers Steel, Metal and Plastic waste in accordance with Waste Management Plan (WMP).

.4 Store at temperatures and conditions recommended by the Manufacturer.

2 Products

2.1 GENERAL

.1 Grilles, registers, and diffusers for inlets to exhaust and return air system and as outlet for supply air systems shall be sized shown on the Contract Drawings.

.2 Refer to the Grilles and Diffusers Schedule at the end of the Section for additional details.

.3 Where special colour finish or material is noted submit samples for the Consultant selection. Refer to the Contract Drawings for model and capacity.

.4 Diffusers shall meet test requirements of ASHRAE Standard 36B-63, including air pattern and noise levels for air quantities from 10% to 110% of the required maximum air flow. Sound power tests shall be measured in accordance with ASHRAE Standards 36B-63.

.5 Acceptable manufacturers are:

.1 E.H. Price Ltd.

.2 Nailor Industries Inc.

.3 Titus HVAC.

.4 Krueger.

.5 Enviro-Tec.

2.2 SQUARE SUPPLY DUFFUSERS

.1 All diffusers shall be steel plaque diffusers constructed of square, coned metal with a powder coat finish.

.2 Diffusers shall consist of a precision formed back cone of one piece seamless construction which shall incorporate a round (or square) inlet collar of sufficient length for connecting rigid or flexible duct as shown.

.3 An inner plaque assembly shall be incorporated that drops no more than 1/4" below the ceiling plane to assure proper air distribution performance. The inner plaque assembly shall be completely removable from the diffuser face to allow full access to any dampers or other ductwork components located near the diffuser neck.

2.3 RETURN, EXHAUST AND TRANSFER GRILLES

.1 Return, exhaust and transfer registers shall be standard return grilles with horizontal fixed bars set at approximately 45 deg. for wall returns and set straight for ceiling return.

.2 The integral volume control damper shall be of the opposed blade type and shall be constructed of cold rolled steel. The damper shall be operable from the register face. The damper shall be coated or galvanized steel.

.3 General appearance, type of material and finish shall match supply grilles within item 2.4.

2.4 EGGCRATE RETURN GRILLE

.1 Return grilles shall be egg crate type with aluminum construction. Egg crate shall be 12 mm (1/2 in.) deep, formed of 12 mm (1/2 in.) wide aluminum strips on 12 mm (1/2 in.) centres. Strips shall be approximately 0.64 mm (0.025 in.) thick.

.2 Grilles shall be enclosed in a channel frame for inverted T-bar mounting or with a flanged frame for plaster or gypsum ceiling mounting. Grilles shall lay on inverted T-bar ceiling suspension system.

.3 Colour shall match adjacent surfaces.

3 Execution

3.1 INSTALLATION OF DIFFUSERS, REGISTERS, AND GRILLES

.1 Provide grilles and diffusers where shown on the Drawings. Refer to the architectural drawings for actual locations of diffusers, grilles and registers and install to suit. The mechanical drawings show intent and number of diffusers, grilles and registers required.

.2 Wherever possible, diffusers, registers, and grilles shall be the product of one manufacturer. Unless otherwise specified connect diffusers, registers, and grilles in accordance with requirements of SMACNA HVAC Duct Construction Standards Metal and Flexible.

.3 Install in accordance with manufacturer's instructions.

.4 Confirm diffuser, register, and grille finishes prior to ordering.

GRILLE AND DIFFUSER SCHEDULE

Tag	Service	Model	Description	Finish	Mounting

*Models selected based on EH Price

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 General Conditions, Supplementary Conditions and Division 01 apply to this section.

1.2 SUMMARY

.1 This Section includes requirements for the supply, installation, testing and commissioning of a Purified Breathing Air (PBA) system, supplied from existing shop compressed air, including:

.1 PBA filtering system

.2 Remote Carbon Monoxide (CO) visual/audible alarming system.

.3 Piping, fittings and valves.

.4 PBA Quick disconnect couplings.

.5 Final air sampling, and testing by 3rd party accredited laboratory

.2 Use:

.1 The systems will be used by up to 3 end users performing abrasive blasting within a designated blasting room. End users are assumed to be wearing full hood type respiratory protection with anticipated maximum airflow rates of 15 CFM (7 litres/second) each.

.3 Distribution System to include:

.1 Two drops and festooning system hose for connection to two travelling person lifts.

.1 Coordinate hose with festooning system provided by lift supplier.

.2 Eight drops with quick disconnect couplings in blast room. (refer to the drawings)

1.3 RELATED REQUIREMENTS

.1 Not used

1.4 DEFINITIONS

.1 Not used

1.5 REFERENCE STANDARDS

.1 All references and standards specified herein imply the latest edition of the standards.

.2 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)

.1 ANSI/ASME B1.20.1, Pipe Threads, General Purpose (Inch).

.2 ANSI/ASME B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.

.3 ASTM International

.1 American Society for Testing and Materials International, (ASTM)

.1 ASTM B16/B16M-Standard Specification for Free-Cutting Brass Rod, Bar and Shapes for Use in Screw Machines

.2 ASTM B62- Standard Specification for Composition Bronze or Ounce Metal Castings

.3 ASTM B88 Standard Specification for Seamless Copper Water Tube

.4 ASTM B283, Standard Specification for Copper and Copper Alloy Die Forgings (Hot-Pressed).

.5 ASTM B505/B505M, Standard Specification for Copper-Base Alloy Continuous Castings.

.6 ASTM A653/A653M-02a, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 Canadian Standards Association

.1 CSA Standard C22.1, Canadian Electrical Code.

.2 CSA Standard Z180.1 Compressed Breathing Air and Systems

.3 European Union

.1 EU REGULATION (EU) 2016/425 - Personal protective equipment' which include the following standards:

.1 SS-EN 14594: Respiratory protective devices - Continuous flow compressed air line breathing devices - Requirements, testing and marking.

.2 SS-EN 14593-1: Respiratory protective devices - Compressed air line breathing devices with demand valve - Part 1: Devices with a full face mask - Requirements, testing and marking.

.4 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS)

.1 MSS-SP-25, Standard Marking System for Valves, Fittings, Flanges and Unions.

.2 MSS-SP-80, Bronze Gate Globe, Angle and Check Valves.

.3 MSS-SP-110, Ball Valves, Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

.5 Province of Ontario

.1 Ontario Occupational Health and Safety Act

.2 R.R.O. 1990, Regulation 833 – Control of Exposure to Biological or Chemical Agents

.6 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S102-1988 (R2000), Surface Burning Characteristics of Building Materials and Assemblies.

.4 In addition, comply with all Local and Regional Statutory Regulations, Codes and Standards.

.5 In the event of conflict between the drawings, specifications, data sheets and/or the purchase order, obtain clarification before proceeding with the work.

1.6 SUBMITTALS

.1 Submit the following information in electronic document format (pdf, etc.) with the additional requirements as specified for each:

.1 Shop Drawings shall include all the major systems including and not limited to the following information:

.2 PBA unit

.1 Overall system information

.2 Purification system details

.3 Piping Systems.

.1 Piping, fittings, valves, flux, solders.

.2 System purging and cleaning procedures and products.

.3 Quick connectors

.4 Electrical.

.1 Single line wiring diagram showing all devices and electrical components.

.2 Remote alarm annunciator circuit diagram/schematic.

.5 Controls.

.1 Control Panel features and alarms.

1.7 QUALITY ASSURANCE SUBMITTAL(S):

.1 Submit design data and test reports related to PBA system performance.

.2 Submit final air purity testing by an independent recognized agency.

1.8 COMMISSIONING SUBMITTAL(S):

.1 In accordance with Section 01 91 00:

.2 Submit Test Procedures.

.3 Submit Certificate of Readiness.

.4 Submit Test Reports.

.5 Submit Closeout Report.

1.9 CLOSEOUT SUBMITTAL(S):

.1 Submit the following for incorporation into Operation and Maintenance Manuals in accordance with Section 01 78 23:

.2 Identification: Manufacturing name, type, year, serial number, number of units, capacity and identification of related systems.

.3 Functional description detailing operation and control of components.

.4 Performance criteria and maintenance data.

.5 Operating instructions and precautions.

.6 Safety precautions.

.7 Spare parts list in accordance with Section 20 05 00.

.8 Maintenance and troubleshooting guidelines/protocol and recommended equipment for analysis and repair.

.9 Manufacturer’s installation instructions for replaceable components and consumables.

1.10 PRE-START HEALTH AND SAFETY:

.1 Submit Pre-Start Health and Safety Review Report in accordance with the requirements of Ontario Regulation 851/90 Industrial Establishments, and of this Section.

1.11 MANUFACTURER QUALIFICATIONS:

.1 The Manufacturer(s) of the filtration system shall:

.2 Demonstrate at least ten (10) years of experience designing, manufacturing, supervising installation, and providing product support for this type of equipment.

.3 Be capable of providing product support in the areas of operation, installation, engineering and product development, repair departments, and spare parts.

1.12 MANUFACTURER'S REPRESENTATIVE:

.1 A qualified manufacturer's representative shall be available to:

.1 Provide technical support to the installer, by telephone throughout the installation period, between 7am and 5pm Eastern Time, Monday through Friday throughout the installation period.

.2 On site for a minimum of 8 hours per day at each of the following milestones (1 site day in total):

.1 Initial start-up and ongoing testing. Include for 1 site day.

.2 Training: Provide technical representative to train Owner's Representative's maintenance personnel in operation and maintenance of specified equipment as indicated in Section 1.14 – Training.

1.13 DELIVERY, STORAGE, AND HANDLING

.1 Reject equipment delivered to site in damaged condition.

.2 Store in manufacturer's unopened packaging in clean, dry area prior to installation.

.3 Unpack and handle in accordance with manufacturer's instructions.

1.14 SPARE PARTS

.1 Provide one complete filter change for unit, at Substantial Performance

2 Products

2.1 PURIFIED BREATHING AIR (PBA) FILTERING SYSTEM.

.1 Compressed air based system.

.1 Wall mounted panel type system.

.2 Cartridge type filtration.

.3 Minimum rated capacity: 45 CFM (21 L/sec) at 90 psig (620 kPa)

.4 Treatment to the requirements of CSA Z180, including but not limited to the acceptable levels of:

.1 Solid particles

.2 Oil mists, vapours, and fumes

.3 Water mists

.2 Minimum 3 stage purification including:

.1 Coalescing filtering

.2 Activated carbon filtering

.3 Onboard Monitoring and Diagnostic system

.1 Filter change indicator

.2 Integrated CO Monitor with visual and audible alarming on unit.

.3 CSA components.

.4 Activation at 5ppm, or as per local Authority Having Jurisdiction, whichever is most stringent.

.5 120vac

.6 Integrated pressure indicator gauge

.7 Integrated remote alarming output

.1 Dry contact relay.

.8 Refer also to section 2.3

.4 Acceptable products:

.1 Air Systems International – BB50 series

.2 Nano BAP 050

.3 Parker-Domnick-Hunter BAFP-064P

.4 Approved equivalent.

2.2 PURIFIED BREATHING AIR SYSTEM DISTRIBUTION

.1 Distribution to 8 room air outlets, and to 2 festooning system connections for travelling person lifts.

.2 To the requirements of CSA Z180.1

.3 Pipe:

.1 Copper: ASTM B88 type L

.4 Valves:

.1 Lead Free Bronze full port ball valves to MSS SP-110

.5 Connections and Fittings:

.1 Bronze union at filter pack discharge.

.2 Threaded bronze fittings at all outlets.

.3 Lead free silver soldered pipe to pipe only

.6 Breathing Air Outlets with quick disconnects:

.1 Locations:

.1 Room: eight quick disconnect couplers at 1200mm above floor, as indicated o the drawings, and

.2 Person-lifts – one quick disconnect coupler on each lift, applied to lift threaded pipe end.

.3 Orient outlet vertically downwards to minimize obstruction into space or with any equipment in space.

.4 Installed in a recess in the room's metal liner to avoid interference with travelling person-lifts.

.2 Quick disconnect coupling shall be approved for Breathing Air.

.1 Configuration to be distinct from regular shop compressed air outlet.

.2 Brass body, with nickel plated surface.

.3 Single hand operation for coupling.

.4 Safety lock to prevent inadvertent disconnection.

.5 CEJN 344 interchangeability

.6 Dust cap with retainer chain to close off coupler when not being used.

.7 Acceptable product:

.1 ONTC preferred PBA quick disconnect, or in absence of same:

.2 Parker- Rectus 95KS series, or approved equivalent

.3 Make, model, type to be confirmed with ONTC

.3 Provide permanent labelling at each outlet

.1 Indicating “Breathing Air Only”.

.2 Stainless steel , with contrasting etched/engraved red characters.

.1 Characters: minimum 13mm (nominal)

.2 Sign Size: minimum 2 inch x 4 inch (50mm x 100 mm)

.3 Colour to be determined with ONTC.

.4 Mechanically fastened to wall.

.7 PBA Festooning Hose

.1 For supply to travelling person-lifts

.2 Refer to drawings and lift system supplier for festoon system length.

.3 All hose and components approved for breathing air use.

.1 Meeting requirements for NIOSH Type C respirator use

.2 Provide manufacturer certification of suitability

.4 Working pressure: minimum 150 psig (10 bar)

.5 Burst pressure: minimum 600 psig (40 bar)

.6 Threaded end connections.

.7 Heavy wall construction for longevity

.8 Suitable for festooning with hose saddles.

.9 Minimum nominal inside diameter: 1/2 inch

.10 Approved product:

.1 Kuri Tec Corporation A1243 series

.2 Approved equivalent

2.3 PURIFIED BREATHING AIR REMOTE ALARMING SYSTEM

.1 Contractor shall provide remote visual/audible annunciator system

.2 Design by controls system integrator.

.1 Submit shop drawings and electrical schematic for review.

.3 CSA/ULc components.

.4 Rated for the electrical classification of the area of installation (Refer to Electrical drawings).

.5 Locations as indicated on the drawings.

.6 System Power: 120 vac. Refer to electrical drawings.

.7 Designed to operate with the breathing air filtration system's remote alarming function.

.1 Audible:

.1 Minimum sound pressure level: 80 dBA at 1 meter from device (adjustable).

.2 Tone to be distinct from any fire alarm notification tone.

.2 Visual:

.1 Aluminum housing

.2 Polycarbonate lens

.3 Omnidirectional.

.4 Programmable flashing LED.

.5 Flash frequency: adjustable

.6 Minimum peak intensity: 750 candelas unless otherwise approved.

.7 Colour to be confirmed with ONTC.

.8 Keyed electrical alarm reset/silence switch at breathing air filtration unit location.

.1 Provide minimum of 4 keys.

.9 Alarm signage:

.10 Provide permanently installed warning sign at all breathing air alarm annunciator locations, and at key switch location.

.1 Stainless steel sign with contrasting minimum 1/4 inch etched characters.

.2 Minimum size: 6 inch x 6 inch (150mm x 150mm)

.3 Submit shop drawings for review

.4 Annunciator (remote alarm) location text:

.1 "BREATHING AIR FILTRATION SYSTEM CO ALARM – DO NOT USE SYSTEM WHEN IN ALARM MODE".

.5 Main Alarm/key switch location text:

.1 "BREATHING AIR FILTRATION SYSTEM CO ALARM SILENCE – DO NOT USE SYSTEM WHEN IN ALARM MODE. SHUT OFF SYSTEM AIR SUPPLY (LOCKOUT/TAGOUT) UNTIL DEFECT CORRECTED. ADVISE SUPERVISORY PERSONNEL AND ALL END USE PERSONNEL OF SYSTEM SHUTOFF"

.11 Refer also to Electrical for details.

.12 Acceptable alarm component manufacturers:

.1 Edwards General-Signal

.2 Federal Signal

.3 Approved Equivalent

3 Execution

3.1 PRE-START HEALTH AND SAFETY REPORT

.1 Prepare and submit documentation required to support Pre-Start Health and Safety Review Report.

.2

3.2 TESTING AND COMMISSIONING

.1 Perform filtration system testing in accordance with the requirements of CSA Z180.1

.2 Perform remote alarm system testing.

.3 Perform Commissioning in accordance with Sections 01 91 00 and 20 05 00.

.4 Verify operational performance in general conformance with following outlines:

.1 Measurements: Maximum available outlet airflow.

.2 Air quality sampling and testing be accredited laboratory to confirm conformance to CSA Z180 requirements.

3.3 MAINTENANCE

.1 Maintain all equipment and systems installed until Substantial Performance.

.2 Carry out regular scheduled maintenance of equipment and systems following Substantial Performance until Contract Completion.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:

.1 Condensing Natural Gas Boilers.

.2 Venting.

.2 Related Requirements

.1 Section 21 05 01 - Common Work Results for Mechanical.

1.2 REFERENCES

.1 American Boiler Manufacturer's Association (ABMA):

.2 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME):

.1 ANSI/ASME Boiler and Pressure Vessel Code, Section IV.

.3 Canadian Standards Association (CSA):

.1 CSA B51, Boiler, Pressure Vessel, and Pressure Piping Code.

.2 CSA B149.1, Natural Gas and Propane Installation Code.

.4 Electrical and Electronic Manufacturers Association of Canada (EEMAC).

.5 Health Canada/Workplace Hazardous Materials Information System (WHMIS):

.1 Safety Data Sheets (SDS).

1.3 ACTION AND INFORMATIONAL 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 Shop Drawings:

.1 Submit Shop Drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Indicate the following:

.1 General arrangement showing connection points.

.2 Clearances for operation, maintenance, servicing, tube cleaning, tube replacement.

.3 Foundations with loadings, anchor bolt arrangements.

.4 Piping hook-ups.

.5 Equipment electrical drawings.

.6 Burners and controls.

.7 All miscellaneous equipment.

.8 Flame safety control system.

.9 Breeching and stack configuration.

.10 Stack emission continuous monitoring system to measure C0, 0, N0x, S0, stack temperature and smoke density of flue gases.

.3 Engineering data to include:

.1 Boiler efficiency at 25%, 50%, 75%, and 100% of design capacity.

.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.

1.4 QUALITY ASSURANCE

.1 Regulatory Requirements: work to be performed in compliance with applicable Provincial codes and regulations and the Authority Having Jurisdiction.

.2 Health and Safety:

.1 Do construction occupational health and safety in accordance with 01 10 00 - General Requirements.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Packing, shipping, handling, and unloading:

.1 Deliver, store and handle in accordance with manufacturer's written instructions and 01 10 00 - General Requirements.

1.6 MAINTENANCE

.1 Extra materials:

.1 Special tools for burners, manholes, handholes and Operation and Maintenance.

.2 Spare parts for one (1) year of operation.

.3 Spare gaskets.

.4 Probes and sealants for electronic indication.

2 Products

2.1 CONDENSING BOILER

.1 General:

.1 Natural gas fired, fully condensing, fire tube design.

.2 Fully modulating power burner, 20:1 turndown.

.3 Positive pressure vent.

.4 Boiler efficiency increases with decreasing load (output) while maintaining setpoint.

.5 Factory-fabricated, factory-assembled and factory-tested, condensing boiler with heat exchanger sealed pressure-tight, built on a steel frame, including insulated jacket, flue-gas vent, combustion-air intake connections, water supply, return and condensate drain connections, and controls.

.6 Ready for attachment to piping, electrical power, controls, flue gases exhaust.

.7 Designed and constructed to ANSI/ASME Boiler and Pressure vessel Code and bear label.

.8 CRN (Canadian Registration Number), to CSA B51.

.9 Boiler/burner package and controls to bear ULc label.

.2 Heat Exchanger:

.1 Welded stainless steel.

.2 ASME stamped for a working pressure not less than 1,100 kPa.

.3 Access to heat exchanger available by burner and exhaust manifold removal. Minimum access opening shall be no less than 200 mm diameter.

.3 Modulating Air/Fuel Valve and Burner:

.1 Capable of a 20-to-1 turndown ratio of the firing rate without loss of combustion efficiency or staging of gas valves.

.2 Burner produces less than 20 ppm of NOx corrected to 3% excess oxygen.

.3 Burner constructed of metal-fiber mesh covering a stainless steel body with spark ignition and flame rectification. All burner material exposed to the combustion zone stainless steel construction.

.4 No moving parts within the burner itself.

.5 Modulating air/fuel valve meters the air and fuel input.

.6 Modulating motor must be linked to both the gas valve body and air valve body with a single linkage. Linkage requires no field adjustment.

.7 Variable speed, cast aluminum, pre-mix blower ensures optimum mixing of air and fuel between the air/fuel valve and the burner.

.4 Controls:

.1 The control panel shall consist of circuit boards using state-of-the-art surface-mount technology in a single enclosure. These circuit boards shall include:

.1 A display board incorporating LED display to indicate temperature and a vacuum fluorescent display module for all message enunciation.

.2 A CPU board housing all control functions.

.3 A power supply board.

.4 An ignition /stepper board incorporating flame safeguard control.

.5 A connector board.

.6 Each board shall be individually field replaceable.

.2 The combustion safeguard/flame monitoring system shall use spark ignition and a rectification-type flame sensor.

.3 The control panel hardware supports RS-485 remote communications.

.4 The controls shall annunciate boiler and sensor status and include extensive self-diagnostic capabilities that incorporate a minimum of eight separate status messages and 34 separate fault messages.

.5 The control panel shall incorporate three self-governing features designed to enhance operation in modes where it receives an external control signal by eliminating nuisance faults due to over-temperature, improper external signal, or loss of external signal. These features include:

.1 Setpoint High Limit: Setpoint high limit allows for a selectable maximum boiler outlet temperature and acts as temperature limiting governor. Setpoint limit is based on a PID function that automatically limits firing rate to maintain outlet

temperature within a 0 to 10 degree selectable band from the desired maximum boiler outlet temperature.

.2 Setpoint Low Limit: Allow for a selectable minimum operating temperature.

.3 Failsafe Mode: Failsafe mode allows the boiler to switch its mode to operate from an internal setpoint if its external control signal is lost, rather than shut off. This is a selectable mode, enabling the control can shut off the unit upon loss of external signal, if so desired.

.4 The boiler control system shall incorporate the following additional features for enhanced external system interface:

.1 System start temperature feature.

.2 Pump delay timer.

.3 Auxiliary start delay timer.

.4 Auxiliary temperature sensor.

.5 Analog output feature to enable simple monitoring of temperature setpoint, outlet temperature or fire rate.

.6 Remote interlock circuit.

.7 Delayed interlock circuit.

.8 Fault relay for remote fault alarm.

.5 Each boiler shall include an electric, single-seated combination safety shutoff valve/regulator with proof of closure switch in its gas train. Each boiler shall incorporate dual over-temperature protection with manual reset, in accordance with ASME BPVC Section IV and CSD-1.

.6 Each boiler shall have an oxygen monitoring system that will measure the oxygen content of the exhaust gasses in real-time. Output of O2 information shall be displayed on the C-More control panel.

.7 Each boiler shall have integrated Boiler Sequencing Technology (BST), capable of multi-unit sequencing with lead-lag functionality and parallel operation. The system will incorporate the following capabilities:

.1 Efficiently sequence 2 units on the same system to meet load requirement.

.2 Integrated control and wiring for seamless installation of optional isolation valve. When valves are utilized, the system shall operate one motorized valve per unit as an element of load sequencing. Valves shall close with decreased load as units turn off, minimum of one must always stay open for recirculation.

.3 Automatically rotate lead/lag amongst the units on the chain and monitor run hours per unit and balance load in an effort to equalize unit run hours.

.4 Designated master control used to display and adjust key system parameters.

.5 Automatic bump-less transfer of master function to next unit on the chain in case of designated master unit failure; master/slave status should be shown on the individual unit displays.

.6 Designated master control used to display and adjust key system parameters.

.8 When set on Internal Setpoint Mode, temperature control setpoint on the ACS shall be fully field adjustable from 10ºC to 88ºC in operation. When set on Indoor/Outdoor Reset Mode, the ACS will operate on an adjustable inverse ratio in response to outdoor temperature to control the main header temperature. Reset ratio shall be fully field adjustable from 0.3 to 3.0 in operation. When set on 4-20 ma Temperature Control Mode, the ACS will operate the plant to vary header temperature setpoint linearly as an externally applied 4-20 ma signal is supplied.

.9 When set on MODBUS Temperature Control Mode, the ACS will operate the plant to vary header temperature setpoint as an external communication utilizing the MODBUS protocol is supplied via the RS-485 port. The ACS controller shall have a vacuum fluorescent display for monitoring of all sensors and interlocks. Non-volatile memory backup of all control parameters shall be internally provided as standard. The controller will automatically balance the sequence of operating time on each boiler by a first-on first-off mode and provide for setback and remote alarm contacts. Connection between central ACS system and individual boilers shall be twisted pair low voltage wiring, with the boilers 'daisy-chained' for ease of installation.

.6 Venting:

.1 The exhaust vent must be UL Listed for use with Category II, III and IV appliances and compatible with operating temperatures up to 110°C, condensing flue gas service. UL-listed vents of Polypropylene and Al 29-4C stainless steel must be used with boilers.

.2 The minimum exhaust vent duct size for each boiler is 150 mm diameter.

.3 Combustion-Air Intake: Boilers shall be capable of drawing combustion air from the outdoors via a metal or PVC duct connected between the boiler and the outdoors.

.4 The minimum ducted combustion air duct size for each boiler is 150 mm diameter.

.5 Common vent and common combustion air must be an available option for boiler installation. Consult manufacturer for common vent and combustion air sizing.

.6 Follow guidelines specified in manufacturer's venting guide.

.7 Electrical Power:

.1 Single-Point Field Power Connection: Factory-installed and factory-wired switches, motor controllers, transformers and other electrical devices shall provide a single-point field power connection to the boiler.

.2 Voltage: 120V, 60 Hz, single phase.

.3 Full-Load Current: 18 Amps.

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install in accordance with ANSI/ASME Boiler and Pressure Vessels Code Section IV, regulations of Province having jurisdiction, except where specified otherwise, and manufacturers recommendations.

.2 Make required piping connections to inlets and outlets recommended by boiler manufacturer.

.3 Maintain clearances as indicated or if not indicated, as recommended by manufacturer for operation, servicing, and maintenance without disruption of operation of any other equipment/system.

.4 Install boilers level on concrete bases.

.5 Connect gas piping to boiler gas-train inlet with unions. Piping shall be at least full size of gas train connection. Provide a reducer if required.

.6 Install piping from safety relief valves to nearest floor drain.

3.3 CLEANING

.1 Proceed in accordance with Section 01 74 11 - 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 SUMMARY

.1 Section Includes:

.1 Materials, components, and installation for heat recovery equipment.

.2 Unit to be installed on rooftop to provide general ventilation of abrasive blast room area when wet abrasive blasting is performed.

.3 Unit to include hydronic preheat coil as required to minimize probability of core freezing due to moisture laden exhausted air stream.

1.2 REFERENCES

.1 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE):

.1 ASHRAE 84, Method of Testing Air-to-Air Heat/Energy Exchangers (ANSI approved).

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS):

.1 Safety Data Sheets (SDS).

1.3 ACTION AND INFORMATIONAL 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 Shop Drawings:

.1 Submit Shop Drawings in accordance with Section 01 33 00 - Submittal 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 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

.5 Certificates:

.1 Catalogued or published ratings: obtained from tests carried out by manufacturer or those ordered from independent testing agency signifying adherence to codes and standards in force.

1.4 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.

1.5 MAINTENANCE

.1 Extra Materials:

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Furnish list of individual manufacturer's recommended spare parts for equipment include:

.1 Bearings and seals.

.2 Addresses of suppliers.

.3 List of specialized tools necessary for adjusting, repairing, or replacing.

2 Products

2.1 ENERGY RECOVERY VENTILATOR ERV-1

.1 System Description

.1 System consists of a variable volume energy recovery unit with an energy recovery core and electric heating providing conditioned air to spaces. The unit serves ventilation only diffusers in the spaces.

.2 Scheduling

.1 The occupied period shall be initially set to 7:00am to 6:00pm, Monday to Friday. The occupancy schedule shall be confirmed with the client and shall be adjustable by the client at the front end.

.3 Unit Operation

.1 Unit shall be controlled by integral unit controller.

.2 The unit control system shall permit starting and stopping of the unit locally. The unit control system shall be capable of providing a remote alarm indication. The unit control system shall provide for outside air damper actuation, emergency shutdown, remote heat enable/disable, heat indication, and fan operation.

.4 Fan Control

.1 The supply and return fan shall be enabled and run continuously during the occupied period unless shutdown on safeties.

.2 The fans shall be disabled during the unoccupied period.

.5 Temperature Control

.1 The initial setpoint shall be 20°C (adj.). The setpoint shall be reset up to a maximum of 24°C (adj.). The setpoint shall be reset down to a minimum of 15°C (adj.). There is no active cooling on this unit.

.2 The setpoint shall be adjusted as required to maintain a neutral discharge temperature to the ventilation variable air volume boxes. The energy recovery ventilation units are not intended to provide space heating or cooling.

.6 Heating Control

.1 The electric heating shall be enabled for control when the supply fan status is ON and the discharge air temperature is less than setpoint.

.2 The electric heating shall be stepped to maintain the supply air temperature setpoint.

.7 Energy Recovery Core Control

.1 The energy recovery core shall be enabled and run continuously during the occupied mode unless shutdown on safeties or shutdown due to economizer mode.

.2 Pre-heat electric heater to be activated when frosting conditions are expected.

.3 When the outside air temperature is less than the return air temperature the unit shall switch to economizer mode. The face and bypass dampers shall modulate for economizer cooling.

.4 The outdoor air and exhaust air dampers shall be commanded full open prior to unit startup. The dampers shall be commanded fully closed on unit shutdown. The unit is not capable of recirculation.

.8 Monitoring

.1 The following data points shall be monitored:

.1 Supply air temperature and humidity

.2 Return air temperature and humidity

.9 Alarms

.1 Alarms shall be provided as follows:

.1 Fan Alarm – Typical

.1 If the fan has Failed-to-Command after 5 minutes (adj.) or the VFD indicates a fault (no delay)

.2 Low Temperature Alarm

.1 If the low temperature alarm contact indicates an alarm (no time delay).

.3 Coordinate additional alarm requirements with the client.

.10 Capacity and Performance: as scheduled.

3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install in accordance with manufacturers recommendations.

.2 Support independently of adjacent ductwork with flexible connections.

.3 Install access doors in accordance with Section 23 33 00 - Air Duct Accessories for access to coils, dampers, and filters.

3.3 FIELD QUALITY CONTROL

.1 Tests:

.1 Perform tests in accordance with Section 26 05 00.

3.4 CLEANING

.1 Proceed in accordance with Section 01 10 00.

.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 REQUIREMENTS

.1 Section 20 05 00 – General Mechanical Requirements

.2 Section 20 05 93 – Testing, Adjusting, and Balancing (TAB)

.3 Section 23 30 00 – HVAC Ducts and Plenums

.4 Section 23 33 00 – Air Duct Accessories

1.2 REFERENCES

.1 American Bearing Manufacturers Association (ABMA)

.1 ABMA L10, Bearing Life Standard.

.2 American National Standards Institute (ANSI)/Air Movement and Control Association (AMCA)

.1 ANSI/AMCA 204, Balance Quality and Vibration Levels for Fans.

.2 AMCA 211, Certified Ratings Program - Product Rating Manual for Fan Air Performance.

.3 ANSI/AMCA 300, Reverberant Room Method for Sound Testing of Fans.

.3 American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)

.1 ASHRAE 52.2, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.

.4 ASTM International Inc.

.1 ASTM A653, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 ASTM B117, Standard Practice for Operating Salt Spray Apparatus.

.5 Canadian Standards Association (CSA International)

.1 CSA C22.1, Canadian Electrical Code, Part 1.

.2 CAN/CSA C22.2 No. 4, Enclosed and Dead-Front Switches.

.3 CAN/CSA G40.20-13/G40.21, General requirements for rolled or welded structural quality steel / Structural quality steel.

.4 CAN/CSA G164-M, Hot Dip Galvanizing of Irregularly Shaped Articles.

.6 National Fire Protection Association (NFPA)

.1 NFPA 90A, Standard for the Installation of Air Conditioning and Ventilating Systems.

.7 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC S102, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies

.8 Underwriters Laboratories (UL)

.1 UL 181, Standard for Factory-Made Air Ducts and Air Connectors.

.2 UL 1995, Heating and Cooling Equipment.

1.3 SUBMITTALS

.1 **Shop drawings:** Submit complete material, construction and performance shop drawings for makeup air units. Include the following:

.1 Submit drawings stamped and signed by professional engineer registered or licensed to practice in the Province of Ontario, Canada.

.2 Sound analysis consisting of inlet, outlet and radiated sound power levels per unit performed by an AMCA 300 accredited lab.

.3 Shipping and operating weight of unit and/or sections.

.4 Materials of construction.

.5 Certified fan performance curves;

.6 Certified sound power data which conforms to specified levels;

.7 Cross section details of typical wall, floor and roof construction.

.8 Component equipment data as detailed in component specification section.

.9 Unit performance data.

.10 Piping connection sizes and approximate locations.

.11 Door and window sizes and elevations.

.12 Operating and Maintenance Data

.2 **Start-up and Commissioning Data:** Submit start-up and commissioning data in accordance with requirements specified in Section 20 05 93 – Testing, Adjusting, and Balancing (TAB).

.3 **Test Data:** Submit factory and site leakage performance test data.

.4 **Colour Chart:** Submit a colour chart to indicate the standard colour range of the manufacturer of the paint finish proposed for use.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 10 00.

.2 Deliver materials to site in original factory packaging, labelled with the Manufacturer's name and address.

.3 Store at temperatures and conditions recommended by the Manufacturer.

2 Products

2.1 MAKEUP AIR UNIT

.1 General Description: Factory assembled, consisting of fans, motor and drive assembly, hydronic heating section, dampers, plenums, filters and other accessories as indicated on drawings or schedules.

.2 Motor and Electrical Components: Refer to Division 20 05 00 "General Mechanical Requirements."

.3 This specification covers the performance requirements and the material/construction requirements of custom-built makeup air units. The detailed performance and data sheets and/or equipment schedule drawing(s) are considered part of this specification.

.4 Warranty: The manufacturer shall provide the parts warranty for equipment manufactured and all vendor supplied components. The said warranty shall cover replacement of all

defective parts for a period of 12 months from equipment start up, not to exceed 18 months from date of shipment.

.5 General Design Considerations: Fan compartment shall be arranged such that the space between the fan inlet(s) and the housing is a minimum of 75% of fan diameter, unless noted or shown otherwise on the schedule or drawings. Housing shall be designed and sealed to minimize air and water vapor leakage. Housing shall be designed and tested to meet maximum leakage of SMACNA Class 3 when tested in accordance with the procedure outlined in the SMACNA HVAC Air Duct Leakage Test Manual Second Edition – 2012

.6 Approved manufacturers:

.1 Engineered Air

.2 Venmar (EFI Concepts)

.3 Trane

2.2 UNIT CONSTRUCTION

.1 Unit Casing / Floor / Roof:

.1 Manufacturer to provide a full perimeter integral base frame for either ceiling suspension of units or to support and raise all sections of the unit for proper trapping. Base frame will either be bolted construction or welded construction. Unit base height to be included in total height required for proper trap height.

.2 Unit manufacturer shall ship unit in segments as specified by the contractor for ease of installation in tight spaces. The entire air handler shall be constructed of G-90 galvanized steel. Casing finished to meet ASTM B117 250-hour salt-spray test. The removal of access panels or access doors shall not affect the structural integrity of the unit. All removable panels shall be gasketed. All doors shall have gasketing around full perimeter to prevent air leakage. Contractor shall be responsible to provide connection flanges and all other framework that is needed to properly support the unit.

.3 Casing performance - Casing air leakage shall not exceed leak class 6 (CL = 6) per ASHRAE 111 at specified casing pressure, where maximum casing leakage (cfm/100 ft2 of casing surface area) = CL X P0.65.

.4 Air leakage shall be determined at 1.00 times maximum casing static pressure up to 8 inches w.g. Specified air leakage shall be accomplished without the use of caulk. Total estimated air leakage shall be reported for each unit in CFM, as a percentage of supply air, and as an ASHRAE 111 Leakage Class.

.5 Under 55F supply air temperature and design conditions on the exterior of the unit of 81F dry bulb and 73F wet bulb, condensation shall not form on the casing exterior. The MUA manufacturer shall provide tested casing thermal performance for the scheduled supply air temperature plotted on a psychrometric chart. The design condition on the exterior of the unit shall also be plotted on the chart. If tested casing thermal data is not available, MUA manufacturer shall provide, in writing to the Engineer and Owner, a guarantee against condensation forming on the unit exterior at the stated design conditions above. The guarantee shall note that the MUA manufacturer will cover all expenses associated with modifying units in the field should external condensate form on them. In lieu of MUA manufacturer providing a written guarantee, the installing contractor must provide additional external insulation on MUA to prevent condensation.

.6 Unit casing (wall/floor/roof panels and doors) shall be able to withstand up to 1.5 times design static pressure, or 8-inch w.g., whichever is less, and shall not exceed 0.0042 per inch of panel span (L/240).

.7 Floor panels shall be double-wall construction, constructed of 16-ga, G-90 galvanized steel, and designed to support a 300-lb load during maintenance activities and shall deflect no more than 0.0042 per inch of panel span.

.8 Unit casing panels shall be 2-inch double-wall construction, with solid galvanized exterior and solid galvanized interior, to facilitate cleaning of unit interior.

.9 Casing panel inner liners must not extend to the exterior of the unit or contact the exterior frame. A mid-span, no-through-metal, internal thermal break shall be provided for all unit casing panels.

.10 Access panels and/or access doors shall be provided in all sections to allow easy access to heating section, motor, drive components and bearings for cleaning, inspection, and maintenance.

.11 Access panels and doors shall be fully removable without the use of specialized tools to allow complete access of interior surfaces.

.2 Cabinet Insulation:

.1 Unit casing panels (roof, walls, floor) and doors shall be provided with a minimum thermal resistance (R-value) of 13 Hr*Ft2*°F/BTU.

.2 Unit casing panels (roof, walls, floor) and external structural frame members shall be completely insulated filling the entire panel cavity in all directions so that no voids exist.

.3 The fiberglass and foam insulated panels meets erosion requirement of UL 181 facing the air stream and fire hazard classification of 25/50 tested per CAN/ULC S102 for flame and smoke spread, to meet NFPA 90 A and B.

.3 Roof Curbs:

.1 Roof curb shall be 16” high, non-sloped, constructed of 14 ga G90 galvanized steel and support the full perimeter of the makeup air unit, including pipe chases.

.2 A 2" x 4" nominal wood nailing strip shall be supplied attached to the roof curb. Wood nailing strip shall be of #4 Spruce or #4 Yellow Pine. Roof curb shall include frame work necessary to support supply and return duct installation prior to unit placement. Roof curb shall be shipped loose for field installation prior to unit placement.

.4 Rain Hood:

.1 Provide rain hoods on outdoor unit air intakes. Provide moisture screens on outdoor air inlet rain hoods.

2.3 ACCESS DOORS AND PANELS

.1 Access doors shall be 2-inch double-wall construction. Interior and exterior shall be of the same construction as the interior and exterior wall panels.

.2 Gasketing shall be provided around the full perimeter of the doors to prevent air leakage.

.3 Door hardware shall be surface-mounted to prevent through-cabinet penetrations that could likely weaken the casing leakage and thermal performance.

.4 Handle hardware shall be designed to prevent unintended closure.

.5 Access doors shall be hinged and removable without the use of specialized tools.

.6 Hinges shall be interchangeable with the door handle hardware to allow for alternating door swing in the field to minimize access interference due to unforeseen job site obstructions. Hinges shall be constructed of galvanized steel.

.7 Door handle hardware shall be adjustable and visually indicate locking position of door latch external to the section.

.8 All doors shall be a 60-inch high when sufficient unit height is available, or the maximum height allowed by the unit height.

.9 Multiple door handles shall be provided for each latching point of the door necessary to maintain the specified air leakage integrity of the unit.

2.4 PLENUM FANS

.1 Manufacturers:

.1 Must guarantee submitted MUA performance for flow, pressure, and acoustics at the perimeter boundary of the unit.

.2 Any corrective acoustical treatment, added airway tunnel lengths, increased electrical service, and any structural modifications necessary to meet specified and scheduled performance shall be provided at no additional cost to the owner to meet the specified performance criteria.

.2 Fan Wheel:

.1 Fans shall be aluminum airfoil wheel, Class III, direct drive arrangement and shall be individually housed. Fans shall be certified by AMCA 211 for performance.

.2 Fan/motor assembly shall be mounted within the housing on an adjustable slide rail base. Fan/motor assembly must be capable of either horizontal or vertical application.

.3 Each fan/motor assembly shall be dynamically balanced to meet AMCA standard 204, for fan application class BV-5, to meet or exceed a rotational imbalance Grade G.55, producing a maximum rotational imbalance of 0.022 inches per second peak, filter in. "Filter in" measurement indicates that the specified balance grade must be achieved at the submitted design operating speed for the fan(s).

.4 AC Motors:

.1 All motors shall be standard foot mounted type, TEFC or TEAO motors selected at the specified operating voltage, RPM, and efficiency as specified or as scheduled elsewhere.

.2 Motors shall meet the requirements of NEMA MG-1 Part 30 and 31, section 4.4.2.

.3 All motors shall include permanently sealed bearings, selected for an ABMA L10 minimum average bearing life expectancy in excess of 200,000 hours and shaft grounding means to protect the motor bearings from electrical discharge machining due to stray shaft current. Motors provided with hybrid ceramic bearings, when specified, do not require shaft grounding devices.

.4 Steel cased motors and/or ODP motors are not acceptable.

.3 Control Panel:

.1 Makeup air unit will be provided by with a field mounted control panel supplied and installed by the Division 25 contractor.

.2 BACNet controller BTL listed.

.3 Refer to section 2.9 “Electrical” for power connections.

2.5 HYDRONIC HEATING SECTION

.1 Coils shall have 5/8" O.D. diameter tubes as manufactured by Engineered Air and constructed of copper tube, aluminum fin, and copper headers with schedule 40 steel pipe connectors.

.2 Fins constructed of aluminum or copper shall be corrugated for maximum heat transfer and shall be mechanically bonded to the tubes by mechanical expansion of the tubes. The coils shall have a galvanized steel casing. All hydronic coils shall be factory tested with air at 300 psig (2068 kPa) while immersed in an illuminated water tank.

.3 Headers with schedule 40 steel pipe connections up to 4" (100 mm) diameter utilize male NPT connections.

.4 Coils shall be removable from the unit at the header end unless shown otherwise on the drawings. All water coils shall be equipped with a capped vent tapping at the top of the return header or connection and a capped drain tapping at the bottom of the supply header or connection.

.5 Hydronic coils shall be circuited to provide adequate tube velocities to meet design requirements. Internal turbulators are not acceptable.

.6 5/8” O.D. tube diameter water coils shall be AHRI Certified.

.7 Multiple row coils shall be of staggered tube design circuited to optimize capacity with minimum pressure drop.

2.6 DX REFRIGERATION SYSTEM

.1 Compressor(s): Provide scroll compressor with direct drive operating at 3600 rpm. Integral centrifugal oil pump. Provide suction gas cooled motor with winding temperature limits and compressor overloads.

.2 Units shall have cooling capabilities down to 0F as standard for field-installed low ambient accessory, the manufacturer shall provide a factory-authorized service technician that will assure proper installation and operation.

.3 Provide each unit with refrigerant circuit(s) factory-supplied completely piped with liquid line filter-drier, suction and liquid line pressure ports.

.4 Evaporator Coil

.1 Provide configured aluminum fin surface mechanically bonded to copper tubing coil.

.2 Provide an independent expansion device for each refrigeration circuit. Factory pressure test at 450 psig and leak test at 200 psig.

.3 Provide drain pan for base of evaporator coil constructed of PVC with external connections.

.5 Condenser Section

.1 Provide vertical discharge, direct drive fans with aluminum blades. Fans shall be statically balanced. Motors shall be permanently lubricated, with integral thermal overload protection in a weather tight casing.

2.7 FILTERS, FILTER FRAMES, AND FILTER BANKS

.1 Filters

The filter shall consist of a pleated media, media support grid, and enclosing frame. The media shall be non-woven cotton fabric and shall be designed to consistently increase efficiency throughout service life of filter with an initial MERV 8 rating in accordance with ASHRAE Standard 52.2. The media support shall be a welded wire grid with an effective open area of not less than 90%. The grid shall be bonded to the filter media to eliminate media oscillation and pull away. The enclosing frame shall be constructed of rigid, heavy duty, high wet strength beverage board. The frame shall be bonded to the filter pack. Standard sizes shall be 12" x 24" x 2" and 24" x 24" x 2". All filter holding frames must be caulked in between them to minimize bypass air through

the frames. Filters shall be American Air Filter Perfect Pleat, or equal by Cam-Farr, Eco-Air or Airguard. Provide Dwyer Instruments Inc Series 2000 Magnehelic gauges across each filter bank.

.2 Filter Frame Assembly

Constructed of galvanized steel, specifically designed and sized to have matching mounting holes such that frames may be riveted together. Frame shall come with pre-installed gasket so as to provide a surface onto which the filter will self-seal. Filter frames come with stiffeners which are installed between each column of filter frame. All filter holding frames are caulked in between them to minimize bypass air through the frames. Proper structural support (every 5 frames wide) is provided when reinforcement is required for attachment of frame assembly to existing MUA casing / building structure as well as complete safing and proper air seal.

2.8 DAMPERS

.1 Low leakage, insulated, aluminum dampers as made by TAMCO.

.2 Dampers shall be made of extruded aluminum airfoil blades with extruded EPDM blade gaskets and extruded TPE frame seals, 7/16" aluminum hexagon shaft, aluminum linkage crankarm, aluminum pivot pin, acetal copolymer inner bearing and polycarbonate outer, and a 12-ga. aluminum frame.

.3 Blades shall be thermally broken and internally insulated with expanded polyurethane foam.

.4 Acceptable Manufacturers:

.1 T.A. Morrison & Co. Inc. “TAMCO”.

.2 Ruskin.

2.9 ELECTRICAL

.1 Each air handler shall be provided with a single point 460V connection serving all motors and VFDs (supply fan).

.2 A separate 120V connection shall be provided for each makeup air unit serving all lighting and control devices.

.3 Wire sizing shall be determined, and installed, in accordance with applicable NEC standards and local code requirements.

.4 Each fan motor shall be individually wired to a motor control panel containing motor overloads and Variable Frequency Drives (VFD). VFD configuration shall be as described in the Makeup-Air Unit Schedule at the end of this specification.

.5 Units are equipped with vapor proof light fixture(s) with guard. Unit drawing's fixture locations are approximate. Lights shall be controlled by one switch or each light will have its own switch. Refer to unit plans for details. Conduit for lights and outlets shall be electrical metallic tube (EMT). Flexible conduit connections shall be liquid tight. All junction boxes shall be gasketed.

.6 MUA tag must bear the ETL label.

2.10 VARIABLE FREQUENCY DRIVES

.1 Variable Frequency Drives: provide variable frequency drives for units as shown in the Makeup Air Unit Schedule below.

.2 HVAC / drive control wiring interface to be provided Division 25. Each VFD shall be provided with BACnet compatible control interface. Provide points list and integration information to Division 25 contractor as required.

.3 Provide approved VFDs with horsepower ratings to match the fan motors as indicated on the drawing schedules and complete with features and characteristics as follows:

.1 All VFDs of 25 HP and lower shall be supplied complete with Hammond RM Series or MTE three phase input line reactors or approved equivalent, required to provide line transient voltage protection. A minimum of 5% is required.

.2 All VFD's of 30 hp and above shall be equipped with MIRUS International Inc. LINEATOR™ Universal Harmonic Filter (UHF), MTE Matrix Filter or approved equivalent to reduce total harmonic current and voltage distortion to the limits specified by Standard IEEE 519 1992 at the input terminals of the harmonic filters. Input line reactors are not acceptable. A single Lineator is acceptable for use with both the supply and return fans.

.3 The VFD shall be of the fully digital pulse width modulated (PWM) type utilizing insulated gate bipolar transistors (IGBT's) in the inverter section of the VFD. The VFD shall accept AC line voltage variation of +15%. No transformers shall be used on either the input or output of the VFD.

.4 Displacement Power Factor: 0.98 over entire range of operating speed and load.

.5 Minimum efficiency: 96%.

.6 Overload capacity: 120% for Variable Torque Application & 150% for 1 min. for Constant Torque Applications.

.7 All drive parameters (set up, operating and adjustment settings) to be entered via keypad, without tools. Three adjustable set-points to lock out continuous operation at frequencies which may produce mechanical resonance. Drive to be capable of determining the speed and direction of a spinning motor and adjusting its output to "pick-up" the motor at the rotating speed. The flying start feature is to be operable with, or without, encoder feedback.

.8 For indoor applications inside mechanical rooms or electrical rooms, provide surface mounting NEMA 1 enclosure with hinged door and filter suitable for rack mounting, designed to provide electromagnetic shielding. Provide a Hand-Off-Auto switch on face of panel for control of VFD's as per control drawings.

.9 NEMA 1 or Open (Protected) Chassis VFD with keypad/display installed through the door of the VFD panel enclosure (accessible on outside face of door).

.10 Provide incoming, horsepower rated, disconnect switch with an operating mechanism.

.11 Provide input line fuses coordinated with the VFD's electronic protection circuits so as not to blow under normal output faults such as overcurrent, short circuit and ground fault.

.12 Provide output line reactors if the distance between the VFD and motor is greater than 50m.

.13 Where specified, provide three contactor type by-pass arrangement and overloads to permit fan operation if VFD is faulty, with by-pass mode selected manually at the front of the VFD panel. On VFD units that are supplied complete with Lineator UHF units, the UHF must be electrically by-passed with the VFD (does not apply where a single Lineator is used for multiple drives).

.14 If the HOA switch is in "Auto" the fan ramps up to its current assigned speed setting over an adjustable time period (up to 90 seconds). If the HOA switch is in "Hand" the fan ramps up to the minimum speed setting and is controlled thereafter from the VFD keypad display.

.4 Protection:

.1 Provide the VFD with internal protection features.

.2 Fault Sensing shall include but not be limited to:

.1 Power On

.2 Overload protection

.3 Overcurrent Protection

.4 Short Circuit Protection

.5 Inverter Fault

.6 External Fault

.7 Over Voltage

.8 Under Voltage and Phase Loss

.9 DC Bus Under-voltage/Over-voltage Protection

.10 Over Temperature Protection

.11 Power Semi-Conductor Protection

.12 Ground Fault Protection

.13 Heatsink Over-Temperature Protection

.14 Output phase to phase & phase to ground short circuit protection

.5 Environment:

.1 The VFD shall have the following minimum environmental tolerances:

.1 Ambient temperature range of 0°C to 40°C (32ºF to 104ºF). Units located in non-heated areas shall be provided with thermostatically controlled heated weather enclosure.

.2 Maximum humidity of 95% non-condensing.

.3 Maximum altitude of 1000m for rated output.

.6 Performance:

.1 The VFD shall automatically restart after an inverter fault trip. The VFD shall attempt to restart automatically 5 times with Lock Out after the third attempt if a restart has not occurred.

.2 The VFD shall have automatic/manual signal follower for 4 20 mA or 0-10 VDC reference.

.3 All drive parameters (set up, operating and adjustment settings) to be entered via keypad without tools.

.4 “Ride through” of short power interruptions.

.5 Auto restart following fault, except for ground and short circuit faults. The drive shall shut down and annunciate any fault conditions (as a minimum) and display the appropriate fault code on the display of the keypad.

.6 Automatic/manual selection via (Hand/Off/Auto) switch. In manual or hand control, drive speed shall be controlled via the keypad. In automatic control drive speed shall be controlled via 4-20mA and/or a 0-10V DC signal from the BAS (BAS connections by others).

.7 In the event of loss of 4 - 20mA reference signal the drive should give an alarm and maintain last reference (within 10%).

.8 Inverter duty motors with insulated bearings, winding thermistors and suitable for operation from variable frequency drives.

.9 Division 25 contractor to provide all wiring/circuits required to achieve functionality described in the HVAC control drawings, electrical drawings (where applicable) and specifications.

.10 In the Auto mode, the VFD shall modulate motor speeds as instructed by the BAS or other controls device.

.11 Output signals to be monitored by BAS or other controls device via BACnet integration module.

.12 Provide thermistor operated relays.

.7 VFD cabinets are to be complete with door interlocked fused disconnect switch.

.8 VFD supplier is to provide start up assistance and training to the Owner’s staff.

.9 Acceptable Manufactures:

.1 Danfoss

.2 ABB

.3 AC Tech

.4 Yaskawa

.5 Toshiba

.6 Cutler Hammer

3 Execution

3.1 INSTALLATION

.1 Provide makeup air units where shown.

.2 Contractor to rig and hoist each roof mounting unit section to the roof (inside mechanical penthouse) in accordance with the manufacturer's instructions and details, and assemble in place. Unit Manufacturer or Manufacturer's Sales Representative to provide guidance during the installation and written confirmation of satisfactory installation. Give unit manufacturer or Manufacturer's Sales Representative a minimum of seven (7) working days' notice prior to commencement. Refer to Drawing details. Provide continuous compressible gasket material between the curb and the unit base. Properly and adequately protect makeup air unit sections on the ground prior to hoisting.

.3 Secure the base mounting unit(s) in place, level and plumb.

.4 Remove fan base hold-down clamps and all other shipping restraints.

.5 Maintain blanket type temporary filter media in the filter section until commissioning work and air quality balancing is ready to commence, at which time remove the temporary media, vacuum clean the interior of the unit, and install pre-filters and final-filters.

.6 Provide initial installation of complete sets of filters at fan start-up for each unit, and supply three complete spare sets of filters for each unit and store on site where directed. Factory-install first set of filters.

.7 Adjust filter gauges, and mark each scale with a red stick-on arrow to indicate when filter replacement is required.

.8 Supply touch-up paint and touch-up all exterior finish damage when installation is complete. Hand the remainder of touch-up paint in an identified container(s) to the Owner on site.

.9 When installation is complete, Manufacturer's Sales Representative is to arrange for and perform site leakage testing in accordance with requirements specified for factory leakage tests. If results of site tests indicate a higher rate of leakage than that specified, re-seal the entire unit and re-test until satisfactory results are obtained. Perform site leakage testing in accordance with requirements specified for factory leakage tests.

.10 Start-up, test and commission each makeup air unit in accordance with manufacturer recommendations. Supply fan equipment and technical representatives at the site to supervise start-up, testing and commissioning procedures.

.11 Coordinate with Division 25 contractor to provide access to all makeup air units to ensure proper tie-in with BAS controllers.

.12 Install first set of filters prior to commissioning and second set after completion of commissioning.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 Comply with Division One as applicable. Comply with Division One as applicable

1.2 SECTION INCLUDES

1.3 REFERENCES

.1 ARI 210/240 - Unitary Air Conditioning Equipment and Air-Source Heat Pump Equipment.

.2 NFPA 90A - Installation of Air Conditioning and Ventilation Systems.

.3 UL 465 - Central Cooling Air Conditioners.

1.4 SUBMITTALS

.1 Product Data: Provide catalogue data indicating rated capacity, dimensions, duct and service connections, electric nameplate data and wiring diagrams.

.2 Shop Drawings: Indicate layout of system and components.

.3 Manufacturer's Instructions: Indicate installation instructions and recommendations.

.4 Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.

.5 Warranty: Submit manufacturer warranty and ensure forms have been completed in Owners name and registered with manufacturer.

1.5 QUALITY ASSURANCE

.1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.6 REGULATORY REQUIREMENTS

.1 Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.7 WARRANTY

.1 Provide five year manufacturer warranty for compressors.

2 Products

2.1 MANUFACTURERS

.1 Products shall be manufactured by Carrier or other approved manufacturer.

.2 Other Acceptable Manufacturers:

.1 Daikin

.2 Johnson Controls/York.

2.2 PACKAGED HEAT PUMPS, AIR SOURCE

.1 General

.1 Outdoor, electrically controlled, heating and cooling unit utilizing hermetic scroll compressor(s) for cooling duty and heat pump for heating duty

.2 Factory assembled, single piece heating and cooling unit. Contained within the unit enclosure shall be all factory wiring, piping, controls, and special features required prior to field start-up.

.3 Unit shall use R410a or similar 'green' refrigerant.

.4 Unit shall be installed in accordance with the manufacturer's instructions.

.5 Unit must be installed in compliance with all applicable codes and standards.

.2 Quality Assurance

.1 Unit meets ASHRAE 90.1 minimum efficiency requirements.

.2 Unit shall be rated in accordance with AHRI Standards 210/240 and 340/360.

.3 Unit shall be designed to conform to ASHRAE 15, 2001.

.4 Unit shall be UL--tested and certified in accordance with ANSI Z21.47 Standards and UL-- or ETL--listed and certified under Canadian standards as a total package for safety requirements.

.5 Insulation and adhesive shall meet NFPA 90A requirements for flame spread and smoke generation.

.6 Unit casing shall be capable of withstanding 500--hour salt spray exposure per ASTM B117 (scribed specimen).

.7 Unit shall be designed in accordance with ISO 9001, and shall be manufactured in a facility registered by ISO 9001.

.8 Unit shall be constructed to prevent intrusion of snow and tested to prevent snow intrusion into the control box up to 40 mph.

.9 Unit shake tested to assurance level 1, ASTM D4169 to ensure shipping reliability.

.3 Operating Characteristics

.1 Unit shall be capable of starting and running at 125F (52C) ambient outdoor temperature, meeting maximum load criteria of AHRI Standard 210/240 or 340/360 at 10% voltage

.2 Compressor with standard controls shall be capable of operation down to 30F (--1C), ambient outdoor temperatures.

.3 Unit shall be capable of simultaneous heating duty and defrost cycle operation when using electric heaters.

.4 Unit shall discharge supply air horizontally as shown on contract drawings.

.4 Unit Cabinet

.1 Unit cabinet shall be constructed of galvanized steel, and shall be bonderized and coated with a prepainted baked enamel finish on all externally exposed surfaces.

.2 Unit cabinet exterior paint shall be: film thickness, (dry) 0.003 inches minimum, gloss (per ASTM D523, 60_F): 60, Hardness: H--2H Pencil hardness.

.3 Evaporator fan compartment interior cabinet insulation shall conform to AHRI Standards 210/240 or 340/360 minimum exterior sweat criteria. Interior surfaces shall be insulated with a minimum 1/2--in. thick, 1 lb density, flexible fiberglass insulation, neoprene coated

on the air side. Aluminum foil--faced fiberglass insulation shall be used in the heat compartment.

.4 Base Rail a. Unit shall have base rails on a minimum of 2 sides. b. Holes shall be provided in the base rails for rigging shackles to facilitate maneuvering and overhead rigging. c. Holes shall be provided in the base rail for moving the unit by fork truck. d. Base rail shall be a minimum of 16 gauge thickness.

.5 Condensate pan and connections:

.1 Shall be a sloped condensate drain pan made of a non--corrosive material.

.2 Shall comply with ASHRAE Standard 62.

.3 Shall use a 3/4-in. 14 NPT drain connection, possible either through the bottom or end of the drain pan. Connection shall be made per manufacturer's recommendations.

.6 Top panel:

.1 Shall be a single piece on all 04 to 09 models. Two piece on size 12 models.

.7 Electrical Connections

.1 All unit power wiring shall enter unit cabinet at a single, factory prepared, knockout location.

.2 Thru--the--base capability

.1 Standard unit shall have a thru--the--base electrical location(s) using a raised, embossed portion of the unit base pan.

.2 Optional, factory approved, watertight connection method must be used for thru--the--base electrical connections.

.3 No base pan penetration, other than those authorized by the manufacturer, is permitted.

.8 Component access panels (standard)

.1 Cabinet panels shall be easily removable for servicing.

.2 Unit shall have one factory--installed, tool--less, removable, filter access panel.

.3 Panels covering control box, indoor fan, indoor fan motor, and compressors shall have molded composite handles.

.4 Handles shall be UV modified, composite. permanently attached, and recessed into the panel.

.5 Screws on the vertical portion of all removable access panels shall engage into heat resistant, molded composite collars.

.6 Collars shall be removable and easily replaceable using manufacturer recommended parts.

.5 Coils

.1 Standard Aluminum/Copper Coils: on all models.

.1 Standard evaporator and condenser coils shall have aluminum lanced plate fins mechanically bonded to seamless internally grooved copper tubes with all joints brazed.

.2 Evaporator coils shall be leak tested to 150 psig. Pressure tested to 450 psig and qualified to UL 1995 burst test at 1775 psig.

.3 Condenser coils shall be leak tested to 150 psig. Pressure tested to 650 psig and qualified to UL 1995 burst test at 1980 psig.

.6 Refrigerant Components

.1 Refrigerant circuit shall include the following control, safety, and maintenance features:

.1 Thermostatic Expansion Valve (TXV) shall help provide optimum performance across the entire operating range. Shall contain removable power element to allow change out of power element and bulb without removing the valve body.

.2 Refrigerant filter drier on each refrigerant circuit.

.3 Service gauge connections on suction and discharge lines.

.4 Pressure gauge access through a specially designed access port in the top panel of the unit.

.5 Suction line accumulator to provide protection in all operating modes from cooling, heating and reverse cycle switching. Standard on each refrigerant circuit.

.2 There shall be gauge line access port in the top of the unit, covered by a black, removable plug.

.1 The plug shall be easy to remove and replace.

.2 When the plug is removed, the gauge access port shall enable maintenance personnel to route their pressure gauge lines.

.3 This gauge access port shall facilitate correct and accurate condenser pressure readings by enabling the reading with the compressor access panel on.

.4 The plug shall be made of a leak proof, UV--resistant, composite material.

.3 Compressors

.4 Unit shall use one fully hermetic, scroll compressor for each independent refrigeration circuit.

.5 Models shall be available with single compressor designs on 04--07 models, plus additional 2 compressor (stage) models from 08--12 sizes.

.6 Compressor motors shall be cooled by refrigerant gas passing through motor windings.

.7 Compressors shall be internally protected from high discharge temperature conditions.

.8 Compressors shall be protected from an over temperature and over--amperage conditions by an internal, motor overload device.

.9 Compressor shall be factory mounted on rubber grommets.

.10 Compressor motors shall have internal line break thermal, current overload and high pressure differential protection.

.11 Crankcase heaters shall be utilized on all models to protect compressor with specific refrigerant charge.

.7 Filter Section

.1 Filters access is specified in the unit cabinet section of this specification.

.2 Filters shall be held in place by a pivoting filter tray, facilitating easy removal and installation.

.3 Shall consist of factory--installed, low velocity, throw--away 2--in. thick fiberglass filters.

.4 Filters shall be standard, commercially available sizes.

.5 Only one size filter per unit is allowed.

.8 Evaporator Fan and Motor

.1 Evaporator fan motor:

.1 Shall have permanently lubricated bearings.

.2 Shall have inherent automatic--reset thermal overload protection or circuit breaker.

.3 Shall have a maximum continuous BHP rating for continuous duty operation; no safety factors above that rating shall be required.

.2 Electric Drive (Direct Drive) X13 – 5 Speed/Torque Evaporator Fan:

.1 Multi speed motor with easy quick adjustment settings.

.2 Blower fan shall be double inlet type with forward curved blades.

.3 Shall be constructed from steel with a corrosion resistant finish and dynamically balanced.

.4 Standard on all 04--06 models.

.3 Belt--driven Evaporator Fan:

.1 Belt drive shall include an adjustable pitch motor pulley.

.2 Shall use sealed, permanently lubricated ball--bearing type.

.3 Blower fan shall be double inlet type with forward curved blades.

.4 Shall be constructed from steel with a corrosion resistant finish and dynamically balanced.

.5 Standard on all 07--12 size models. Optional on all 04--06 3--phase models.

.9 Condenser Fans and Motors

.1 Condenser fan motors:

.1 Shall be a totally enclosed motor.

.2 Shall use permanently lubricated bearings.

.3 Shall have inherent thermal overload protection with an automatic reset feature.

.4 Shall use a shaft down design on all sizes.

.2 Condenser Fans:

.1 Shall be a direct driven propeller type fan.

.2 Shall have aluminum blades riveted to corrosion resistant steel spiders and shall be dynamically balanced.

.10 Accessories

.1 Standard Integrated economiser, with standard leak rating for single speed indoor fan motor models.

.1 Integrated, gear driven opposing modulating blade design type capable of simultaneous economizer and compressor operation.

.2 Independent modules for vertical or horizontal return configuration shall be available. Vertical return modules shall be available as a factory installed option.

.3 Damper blades shall be galvanized steel with composite gears. Plastic or composite blades on intake or return shall not be acceptable.

.4 Shall include all hardware and controls to provide free cooling with outdoor air when temperature and/or humidity are below setpoints.

.5 Shall be equipped with gear driven dampers for both the outdoor ventilation air and the return air for positive air stream control.

.6 Standard leak rate models shall be equipped with low--leakage dampers, not to exceed 2% leakage at 1 in.wg pressure differential. Economizer controller on electromechanical units shall be Honeywell W7212 that provides:

.1 Combined minimum and DCV maximum damper position potentiometers with compressor staging relay.

.2 Functions with solid state analog enthalpy or dry bulb changeover control sensing.

.3 Contain LED indicates for: when free cooling is available, when module is in DCV mode, when exhaust fan contact is closed.

.2 Condenser Coil Hail Guard Assembly

.1 Shall protect against damage from hail.

.2 Shall be louvered design.

.3 Unit Mounted, Non--Fused Disconnect Switch:

.1 Switch shall be factory--installed, internally mounted.

.2 National Electric Code (NEC) and UL approved non--fused switch shall provide unit power shutoff.

.3 Shall be accessible from outside the unit

.4 Shall provide local shutdown and lockout capability.

.4 Convenience Outlet

.1 Outlet shall be powered from a separate 115--120v power source.

.2 A transformer shall not be included.

.3 Outlet shall be factory--installed and internally mounted with easily accessible 115V female receptacle.

.4 Outlet shall include 15 amp GFI receptacles.

.5 Outlet shall be accessible from outside the unit.

.5 Roof Curb

.1 Full perimeter roof curb with exhaust capability providing separate air streams for energy recovery from the exhaust air without supply air contamination.

.2 Formed galvanized steel with wood nailer strip and shall be capable of supporting entire unit weight.

.3 Permits installation and securing of ductwork to curb prior to mounting unit on the curb.

.6 Electric Heat

.1 Heater element open coil resistance wire, nickel--chrome alloy, 0.29 inches inside diameter, strung through ceramic insulators mounted on metal frame. Coil ends are staked and welded to terminal screw slots.

.2 Heater assemblies are provided with integral fusing for protection of internal heater circuits not exceeding 48 amps each. Auto reset thermo limit controls, magnetic heater contactors (24V coil) and terminal block all mounted in electric heater control box (minimum 18 ga galvanized steel) attached to end of heater assembly.

.7 Hinged Access Panels

.1 Shall provide easy access through integrated quarter turn latches.

.2 Shall be on major panels of filter, control box, fan motor and compressor.

.8 Control / Controller

.1 Shall be ASHRAE 62--2001 compliant.

.2 Shall accept 18--32VAC input power.

.3 Shall have an operating temperature range from --40F (-40C) to 158F (70C), 10% -- 95% RH (non--condensing).

.4 Shall include an integrated economizer controller to support an economizer with 4 to 20 mA actuator input and no microprocessor controller.

.5 Controller shall accept the following inputs: space temperature, setpoint adjustment, outdoor air temperature, indoor air quality, outdoor air quality, indoor relative humidity, compressor lock--out, fire shutdown, enthalpy, fan status, remote time clock/door switch.

.6 Shall provide the following outputs: Economizer, fan, cooling stage 1, cooling stage 2, heat stage 1, heat stage 2, heat stage 3/ exhaust/ reversing valve/ dehumidify/ occupied.

.7 Unit shall provide surge protection for the controller through a circuit breaker.

.8 Shall be Internet capable, and communicate at a Baud rate of 38.4K or faster.

.9 Shall have an LED display independently showing the status of activity on the communication bus, and processor operation.

.10 Shall include an EIA--485 protocol communication port, an access port for connection of either a computer or a Carrier technician tool, an EIA--485 port for network communication to intelligent space sensors and displays, and a port to connect an optional LonWorks plug--in communications card.

.11 Shall have built--in Carrier Comfort Network (CCN) protocol, and be compatible with other CCN devices, including ComfortLink and ComfortVIEW controllers.

.12 Shall have built--in support for Carrier technician tool.

.13 Software upgrades will be accomplished by local download. Software upgrades through chip replacements are not allowed.

.14 Shall be shock resistant in all planes to 5G peak, 11ms during operation, and 100G peak, 11ms during storage.

.15 Shall be vibration resistant in all planes to 1.5G @ 20--300Hz.

.16 Shall support a bus length of 4000ft max, 60 devices per 1000ft section, and 1 RS--485 repeater per 1000ft sections.

3 Execution

3.1 INSTALLATION

.1 Install horizontal heat pumps using hanger kit and rubber isolators provided by heat pump supplier.

.2 Install vertical heat pumps on neoprene vibration isolation pads.

.3 Install all units neat and level following manufacturer’s instructions.

.4 Install flexible pipe ball valves and duct connections between heat pump units and piping/ductwork.

.5 Install loop water controller where shown on drawings and according to manufacturer’s instructions.

.6 Install all control wiring required to provide a complete and operating system between loop water controller and water cooled air conditioning units and to all accessories as per manufacturer's wiring diagrams.

.7 Coordinate with Electrical Division all power wiring to heat pumps, loop water controller and accessories.

.8 Furnish the services of a trained representative of the equipment manufacturer to supervise the installation, wiring, set up and testing of the loop water controller.

END OF SECTION

1 General

1.1 DESCRIPTION

.1 For additional information, refer to Section 21 05 01 - Common Work Results for Mechanical and Division 1 - General Conditions of the Construction Contract.

.2 For a list of applicable codes and standards, refer to Section 21 05 01 - Common Work Results for Mechanical.

.3 The Construction Contractor shall be responsible for coordinating all aspects of this work.

.4 Locations of equipment, ductwork, pipework, and all associated appurtenances indicated on the Drawings are approximate only. The Construction Contractor is responsible for checking and coordinating the locations of equipment, ductwork, pipework, and all associated appurtenances and shall make any necessary adjustments in positions to conform with the architectural features, other services, symmetry and lighting arrangements.

1.2 SCOPE OF WORK

.1 The scope of work for this Section includes, but is not limited to, the following:

.1 Materials and procedures for the provision and installation of explosion proof and non-explosion proof hydronic unit heaters, hydronic cabinet unit heaters, hydronic baseboard heaters, and hydronic radiant ceiling panels.

1.3 RELATED WORK

.1 This Section may not contain all materials, equipment and requirements required for the completion of this project. This Section is to be read in conjunction with the remaining Sections of Division 21, 22 and 23 and all related works.

.2 Division 1 forms an integral part of Division 21, 22 and 23.

1.4 REFERENCES

.1 Except as specified herein, the latest edition of the standards listed below form a part of this Specification to the extent referenced in this Section. Where earlier editions of standards are adopted as referenced in applicable codes, those shall govern. The publications are referred to within the text by the basic designation only.

.2 In each of the standards referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears.

.3 Canadian Standards Association (CSA International):

.1 CSA C22.1, General Requirements, Canadian Electrical Code, Part I.

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS):

.1 Safety Data Sheets (SDS).

.5 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 (ANSI).

.6 Underwriters' Laboratories (UL) Inc.:

.1 UL 2021, Fixed and Location-Dedicated Electric Room Heaters.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

.1 Refer to Section 21 05 01 - Common Work Results for Mechanical and Section 01 33 00 - Submittal Procedures for submission requirements.

.2 Product Data: Provide manufacturer's printed product literature and data sheets for equipment and systems and include product characteristics, performance criteria, physical size, finish, and limitations.

.3 Submit copies of WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 81 01 - Hazardous Materials.

1.6 CLOSEOUT SUBMITTALS

.1 Refer to Section 21 05 01 - Common Work Results for Mechanical, Section 01 33 00 - Submittal Procedures, and Section 01 78 00 - Closeout Submittals" for submission requirements.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Shipping:

.1 All equipment, material and spare parts shall be shipped, stored, handled, and installed in such a manner as not to degrade quality, serviceability, or appearance. Equipment and material warranties shall not be voided by actions of the Construction Contractor.

.2 Ship equipment, material and spare parts complete except where partial disassembly is required by transportation regulations or for protection of components.

.3 Pack spare parts in containers bearing labels clearly designated contents and pieces of equipment for which intended.

.4 Deliver spare parts at same time as pertaining equipment. Deliver to the City after completion of work.

.2 Receiving:

.1 All equipment, material and spare parts shall be delivered to the site in original packages or containers bearing the manufacturer's labels and product identification.

.2 Inspect for damage and correctness, and inventory items, upon delivery to site.

.3 Store equipment, material and spare parts protected for the weather, humidity and temperature variations, dirt and dust or other contaminants. Store and safeguard in accordance with Manufacturer's recommendations.

1.8 QUALITY ASSURANCE

.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.

2 Products

2.1 GENERAL

.1 Provide CSA approved, packaged factory assembled components.

2.2 UNIT HEATERS

.1 Casing: 1.31 mm thick galvanized steel, epoxy coated finish with lugs for unit suspension and hinged door accessed control panel.

.2 Heating Coil:

.1 13 mm nominal diameter seamless copper tubes and shall be mechanically expanded to provide an efficient, permanent bond between the tube and integral collar of the aluminum fin.

.2 Minimum copper tube thickness shall be 0.7 mm.

.3 Fins shall be die-formed and have a high efficiency aluminum surface optimized for heat transfer, air pressure drop and carryover.

.4 Minimum fin thickness shall be 0.25 mm.

.5 Lanced fins shall not be acceptable.

.6 Fins are continuous across width and depth of coil and are vertically oriented to resist collection of dirt and foreign particles.

.7 Coils are of non-ferrous construction and serpentine design or will incorporate brazed steel header tubes.

.8 All coils shall be tested at 1896 kPa air pressure under water, and rated for a maximum 1517 kPa water and 190°C.

.3 Coils have CRN pressure vessel certification.

.4 Fan: Direct drive propeller type, factory balanced, with aluminum alloy blades, steel hub and Occupational Safety & Health Administration approved fan guard.

.5 Motor: Totally enclosed, permanently lubricated ball bearings with thermal overload protection.

.6 Air outlet: Individually adjustable extruded aluminum directional vanes.

.7 Temperature hi-limit: Automatic reset.

.8 Fan-only switch: Built in factory installed.

.9 Contactor: Built in factory installed.

.10 Thermostat: Remote, shipped loose, located as per Drawings.

2.3 HYDRONIC HEATING COILS

.1 General:

.1 Extended surface, staggered tube, plate fin design.

.2 Suitable for 50% propylene glycol.

.3 Capacity and size as scheduled.

.2 Headers:

.1 Made of seamless copper tubing to assure compatibility with primary surface.

.2 Headers to have intruded tube holes to provide maximum brazing surface for tube to header joint, strength, and inherent flexibility. Header diameter should vary with fluid flow requirements.

.3 Vent and drain plugs shall be provided on the coil header. For certain replacement air handler (Vision/Skyline & some LSL models) coils the plugs will be provided on the coil connections.

.3 Connections:

.1 Coil connection should be compatible with the piping to the coil to minimize chance of "galvanic action/electrolysis."

.2 Connections shall be a diameter adequate for specified gpm flow.

.3 The connections are located to permit right or left hand mounting of the coil and assure equal pressure through all the circuits. Contractor to confirm connection location on site prior to ordering coils.

.4 Connection material to be carbon steel pipe. Connection type to be threaded.

.5 Coils are circuited to provide maximum mean effective temperature difference for heat transfer rates.

.6 Coils, greater than 2 rows, must be arranged for counter flow.

.4 Testing and Pressure Ratings:

.1 Completed coils are tested at a minimum of 2170 kPa (315 psig) air pressure while submerged in warm water. Hydronic tests alone are not acceptable.

.2 Standard coil construction is rated for 1725 kPa (250 psig) working pressure at 149°C (300°F).

.5 Primary Surface:

.1 Tubes 16 mm (5/8”) O.D., staggered in direction of airflow on 40 mm (1½”) tube centers.

.2 Wall thickness: 0.5 mm (0.02”) nominal copper.

.3 Tubes mechanically expanded into fin collars to provide a continuous primary to secondary compression bond over entire coil length.

.4 Coil Tube Type. Standard smooth bore.

.6 Secondary Surface:

.1 Corrugated plate style fins.

.2 Fin thickness: 0.2 mm (0.0075") aluminum.

.3 Fins to have collars to determine fin spacing per unit length and support the heat transfer bond to primary surface.

.4 Tubing should not be visible between the fins.

.5 Fin Style: New Ripple fin type.

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 CLEANING

.1 Remove surplus materials, excess materials, rubbish, tools, and equipment.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Design, labour, Products, equipment and services necessary for electric heater Work in accordance with the Contract Documents.

1.2 RELATED REQUIREMENTS

.1 Section 20 01 00 – Mechanical General Requirements

.2 Section 20 05 00 – Common Work Results

1.3 REFERENCES

.1 CSA, Canadian Standards Association.

.2 ULC, Underwriters' Laboratories of Canada.

1.4 SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data and Shop Drawings Package:

.1 Product Data:

.1 Submit manufacturer's Product data for all Products listed in this Section indicating:

.1 Product characteristics.

.2 Performance criteria, minimum operating air flow.

.3 Mounting methods, unit support.

.4 Physical size.

.5 KW rating, voltage, phase.

.6 Cabinet material thicknesses.

.7 Limitations, clearance to combustibles.

.8 Colour and finish.

.2 Shop Drawings:

.1 Submit Shop Drawings in accordance with Section 01 33 00 indicating:

.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.

.3 Commissioning Package:

.1 Submit the following:

.1 Commissioning Plan.

.2 Commissioning Procedures.

.3 Certificate of Readiness.

.2 Submit design data and test reports.

.3 Submit inspection and test reports.

.4 Commissioning Closeout Package:

.1 Submit the following:

.1 Deficiency Report.

.2 Commissioning Closeout Report.

.5 Closeout Submittals:

.1 Submit the following for incorporation into Operation and Maintenance Manuals in accordance with Section 01 78 00:

.1 Identification: Manufacturer name, type, year, serial number, number of units, and capacity.

.2 Functional description detailing operation and control.

.3 Performance criteria and maintenance data.

.4 Operating instructions and precautions.

.5 Component parts availability including names and addresses of spare part suppliers.

.6 Lubrication schedule, maintenance and troubleshooting guidelines.

.7 Manufacturer's installation instructions for the following items:

.1 Force flow heater.

.2 Submit As-Built Drawings in accordance with Section 01 78 00.

1.5 TRAINING

.1 Operation Training:

.1 Allow for minimum of 1 hour of total on-site time to train in all aspects of equipment and system(s) operation(s), per group to be trained.

.2 Operation training of related systems may be combined, at discretion of the City of Toronto, provided all Contract requirements satisfied.

1.6 SPARE PARTS

.1 Provide manufacturer's recommended spare parts list in accordance with Section 20 05 00.

2 Products

2.1 FORCED FLOW WALL HEATERS

.1 Manufacturers:

.1 Ouellet.

.2 Stelpro.

.2 Construction: Wall cabinet mounted, 1 mm thick steel (20 ga) removable and tamperproof panel, glass fibre insulation and integral air outlet and inlet.

.3 Finish: Polyester epoxy powder coat, white.

.4 Electric coils: Nickel-chrome resistance coils embedded in refractory material and enclosed in steel sheathing with brazed spiral steel extended fan.

.5 Fans: Five blade propeller fan, statically and dynamically balanced, direct driven, sleeve bearings, resilient mounted, black anodized mixed flow aluminum fins.

.6 Motor: Totally enclosed type with permanently lubricated bearings, built-in thermal overload protection and resilient rubber isolation mounting.

.7 Capacity: As indicated in schedules.

.8 Controls:

.1 On-off switch with integral overloads in cabinet.

.2 Double pole built-in thermostat.

.3 High temperature limit switch.

.9 Units must be ULC and CSA approved.

2.2 BASEBOARD HEATERS

.1 Low profile wall mount baseboard heaters, each approximately 150 mm (6") high, 65 mm (2-½") deep, complete with:

.1 #22 gauge steel body with #20 gauge steel connection box at both ends of heater, 2 rows of mounting holes, single screw built-in wire holder, and #20 gauge steel removable front panel with rounded upper corners;

.2 standard watt density (900 W/m) tubular steel heating element with aluminium fins, noise free and floating on high temperature nylon bushings;

.3 factory installed, tamperproof, adjustable bi-metal thermostat;

.4 factory supplied enclosure accessories as indicated on drawings and/or heater schedule;

3 Execution

3.1 EXAMINATION

.1 Review proposed locations on-site and co-ordinate installation requirements with general trades, architectural finishes and power requirements.

3.2 INSTALLATION

.1 Install in accordance with manufacturer's instructions.

.2 Check final location with City of Toronto if different from that indicated prior to installation. Should deviations beyond allowable clearances arise, request and follow City of Toronto’s direction.

.3 Clean finned tubes and comb straight.

.4 Provide supplementary suspension steel as required.

.5 Install thermostats in locations indicated.

.6 Before acceptance, set discharge patterns and fan speeds to suit requirements.

3.3 COMMISSIONING

.1 Perform Commissioning in accordance with 20 05 00.

.2 Verify operational performance in general conformance with the following outline:

.1 Operational performance outline:

.1 Thermostat operation.

.2 Element response.

.3 Fan operation.

.4 Disconnect.

.5 Other unit control features/devices.

3.4 PROTECTION

.1 Protect from damage during construction. Do not operate during construction or until unit and area thoroughly cleaned and inspected.

END OF SECTION

1 General

1.1 SUMMARY

.1 This section provides general requirements for complete, interfaced, reliable, continuous operating electrical systems shown, implied, described or required, including but not limited to all labour, equipment, confirmations, co-ordination of equipment, interim set-up and operation, spare parts, fees, service layouts, permits, inspections, investigations, studies, acceptance tests, including 3rd party, demonstrations, reports, bonds, notices, declarations, administration, liaison, reviews, meetings, correspondence and travel. Provide training, warranties and insurance.

.2 The electrical drawings are schematic and indicate major equipment and intended overall arrangement. Exact sizes, dimensions, locations, devices and arrangements shall suit equipment, site conditions and requirements. Review shop drawings for sizes and requirements under Division 26 and ensure compatibility of all systems specified and installed; report problems, concerns and variations. The Engineer shall review shop drawings of equipment prior to installation.

.3 Make, at no additional cost, any changes or additions to materials and/or equipment necessary to accommodate structural conditions (runs around beams, columns, etc.).

.4 Provide all equipment after co-ordinating and reviewing all Division 26 work required by other Sections, service companies and jurisdictional authorities. The omission of work and materials that are required to complete the project is not to be interpreted as relieving this Section of the necessity of providing such work and materials. Ensure all equipment is installed correctly and sequentially.

.5 In case of conflict among authorities, trades, drawings, specifications and other documents, the most stringent requirements shall apply, as directed by the Consultant.

.6 All work and material shall be installed to the manufacturer's and the Consultant's recommendations and satisfaction, as applicable. Construction shall be performed by relevant, competent, qualified and certified trade persons.

.7 Protect materials and equipment after delivery to minimize the probability of condensation or other damage prior to the application of final heating systems.

1.2 RELATED REQUIREMENTS

.1 Coordinate with Division 26 as follows:

.1 Provide line voltage power wiring and terminations to equipment of all Divisions.

.2 Provide low voltage (31 to 750 volts) wiring to equipment of all other Divisions. Unless otherwise indicated on the electrical drawings Division 22/23/25 control and interlock wiring, extra-low (up to & including 30 volts) and/or low voltage shall be by Division 22/23/25.

.3 Provide starters and/or disconnects as noted on drawings.

.2 Coordinate with Division 22, 23 and/or 25 as follows:

.1 Where applicable provide all air handling units, gas fired unit heaters, fans, pumps, motors & domestic water heaters where indicated complete with control panels, starters and/or disconnect switches.

.2 Provide, mount and wire all damper motors.

.3 Provide variable frequency drives as required.

1.3 EXAMINATIONS

.1 Examine the proposed locations of equipment and fixtures of other trades and report any defects or interference with the work of this Division in writing to the Consultant. Affected work shall not commence until any discrepancies adversely affecting the work of this Division are remedied.

.2 Fully understand the function of the systems described in this Division. Have no doubt as to the extent of the systems and/or materials and labour required. Contact the Consultant for clarification. No extras will be allowed to complete systems inadequately installed or not fully operational.

1.4 REGULATIONS

.1 Comply with the latest Ontario Building Code, including amendments, and the requirements of the Municipal Building Department.

.2 Comply with the latest regulations of the Electrical Safety Code and the requirements of the local Electric Safety Authority inspection department, the requirements of the local hydro commission, the recommended standards of the Canadian Standards Association, the Ontario Ministry of Labour, the Occupational Health and Safety Act, Provincial and Federal governments or any other authority having jurisdiction.

.3 The Contract Drawings show the minimum standard acceptable regardless of any lesser standards set by any Codes, Regulations or Authorities Having Jurisdiction.

.4 Refer to Division 01 General Requirements section.

1.5 SUBMITTALS

.1 Refer to Division 01 General Requirements section.

1.6 SHOP DRAWINGS

.1 Refer to Division 01 General Requirements section.

1.7 CERTIFICATES

.1 Refer to Division 01 General Requirements section.

.2 Provide copies of all required certificates of approval, test results and verifications. Insert in Operating and Maintenance Manuals

1.8 RECORD DRAWINGS

.1 Refer to Division 01 General Requirements section.

1.9 WARRANTY

.1 Provide warranty of material and workmanship in accordance with the requirements of Division 01 General Requirements section.

.2 Provide manufacturers' standard warranty if greater than one year.

.3 The Contractor is to submit extended warranties for specific materials and/or work where specified. Extended warranties are to be issued on the Contractor's letterhead, under seal, and issued in the name of the Owner.

1.10 OPERATING AND MAINTENANCE MANUALS

.1 Refer to Division 01 General Requirements section.

2 Products

2.1 MATERIAL

.1 All material shall be specification grade, where applicable, new and carry CSA approval or special approval in accordance with ESA requirements.

.2 Similar devices and items shall be from one manufacturer throughout the project.

.3 Material or equipment specified by technical description shall be provided with the best commercial qualities obtainable for the purposes described.

.4 Requests for extra money, time or equipment substitution due to late ordering of equipment will not receive any consideration.

2.2 ALTERNATE MATERIALS

.1 Whenever a substitute or alternate product is proposed for use, the Contractor shall guarantee that such proposed substitutes or alternates will not adversely affect the requirements allocated on the drawings for the material or item or plant or equipment specified. He shall agree to bear any additional expense incurred due to the use of proposed substitutes or alternates, particularly in connection with any required changes in the work of any other division.

.2 Requests for approval shall be accompanied by complete specifications for the equipment, showing dimensions, ratings, photometrics, cost reductions, etc.

.3 Substitutions or alternates will be allowed after tender close.

.4 Any equipment installed, without the Consultant's written approval, shall be removed and the correct equipment installed at no extra cost.

.5 In the event the approved alternate equipment is not available for any reason, the specified equipment shall be installed.

.6 When proposing an alternative product make all affected parties aware of any structural, architectural, mechanical, or electrical design changes necessary to accommodate the alternative product. The contractor is responsible for paying all costs incurred, which may result, from the acceptance of the alternative. Any cost savings anticipated must include all additional costs incurred for any changes to the original design.

.7 For proposed alternate lighting fixtures, the contractor shall demonstrate that the alternate fixtures meet desired lighting performance targets.

2.3 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

.1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.

.2 Control wiring, conduit and connections: provided by Division 26 where voltage exceeds 30V, provided by Division 22/23/25 where voltage is 30V or less.

2.4 EQUIPMENT IDENTIFICATION

.1 Identify all panel(s), starter(s), disconnect switch(es), etc. with approved, mechanically fastened lamacoid nameplates. Indicate equipment being controlled, voltage and the supply panel/device and its location.

.2 Labels on fused disconnect switches to include size and type of fusing. Also indicate "Equipment to be off before Isolation".

.3 Terminal cabinets, junction boxes and pull boxes: indicate system and voltage and/or circuits.

.4 Use 3mm (1/8”) thick lamacoid plates. White colour background with 6mm (1/4") high black letters. Use client equipment numbers as required.

.5 Within panel boards, provide a typewritten directory of all circuits identifying the loads connected.

.6 Provide warning signs, as specified or to meet requirements of Inspection Department and Consultant. Use porcelain enamel for outdoor and decal for indoor signs, minimum 175 x 250 mm size.

2.5 CONDUIT AND CABLE IDENTIFICATION

.1 Colour code conduits, metal sheathed cables and junction boxes. Code with plastic tape or paint at points where conduit or cable enters wall, ceiling or floor and at 3050mm (120") intervals. Colours to be 25mm (1") wide as follows:

.1	Fire Alarm,	Red
.2	Telephone,	Green
.3	Emergency Power,	Blue

2.6 WIRING IDENTIFICATION

.1 All wiring shall be colour coded and shall be identified at each end with Brady self-sticking wire markers or equivalent. Update and or indicate numbers on "as-built drawings".

.2 Maintain phase sequence and colour coding throughout. Colour coding to CSA C22.1.

.3 Use colour coded wires in communication cables, matched throughout system.

2.7 FINISHES

.1 Prepare and clean surfaces of electrical products requiring painting to SSPC SP3 for rust and SSPC SP1 for oil, grease, dirt and other contaminates.

.2 Apply One coat of primer.

.3 Apply Two coats of finish paint. Colour of manufacturer's standard ASA grey except specified otherwise. Paint all electrical equipment to EEMAC standard.

.4 Apply paint in accordance with manufacturer's instructions regarding application methods, coating thicknesses, equipment, temperature and humidity conditions.

.5 Clean and touch up surfaces scratched or marred during shipment and installation, to match original paint finish.

.6 Clean, prime and paint exposed hangers, racks and fasteners to prevent rust.

.7 Provide touch-up paint.

3 Execution

3.1 EXISTING CONDITIONS AND DEMOLITION

.1 Examine drawings of all other trades and allow for all work such as the removal and re-installation of electrical luminaires, equipment, devices, wiring, raceways, etc. where such work is required due to alterations in or about the existing building. Remove all surplus conduits, wiring, luminaires and devices in renovated areas. Blank off or remove all unused outlet boxes.

.2 Assume that all existing conduits in Work area contain live circuits.

.3 Protect, support and maintain existing active services as required for execution of work without disturbing these services.

.4 Circuit designation on the existing panelboards may not agree with field installation. Trace and verify such circuits, as required.

.5 Do not disrupt existing lighting, power or communication systems.

.6 If temporary connections are required to maintain services during construction period, supply and install necessary material, equipment and labour to electrical safety codes and standards.

.7 Protect personnel during construction from physical danger from exposed energized equipment such as panelboard mains and outlet wiring. Shield and mark live parts LIVE – 600/230 VOLTS AC or 600 VOLTS DC.

.8 Arrange for installation of temporary doors, barriers and similar items, for rooms containing electrical equipment. Keep door closed except when under direct supervision.

.9 Use minimum 1½ hours fire rated temporary door and barriers for rooms containing electrical equipment.

.10 Electrical equipment requiring temporary or permanent relocation or power due to construction is the Contractor's responsibility.

.11 Include and provide additional items and accessories or connections obviously required to provide complete working system for relocated equipment but omitted from Specifications or not shown on the Contract Drawings.

.12 Trace conduits and circuits feeding existing equipment in Work area obstructing and interfering with agreement of work. Maintain circuits live, and if required in use.

.13 Unless "only" suffixes "supply, install and connect" or variation of those words, it means "supply install and connect".

.14 Ensure that all existing equipment/devices which are to be reused and/or relocated and/or are to remain are thoroughly inspected and refurbished to ensure correct operation when put back into service and to meet ESA approval.

3.2 EQUIPMENT INSTALLATION

.1 Do complete installation in accordance with OESC except where specified otherwise.

.2 Do overhead and underground systems in accordance with CSA C22.3 No.1 and CSA C22.3 No.7 respectively, except where specified otherwise.

.3 The location of any panels, equipment, outlet, raceway and wiring may be changed by the Consultant if the new location is within a limit of 3000mm (120") radius of the original location. Provide changes without extra cost if requested before installation.

.4 Do not install wall-mounted equipment at locations where built-in furniture or other equipment is to be installed. In cases of conflict, install equipment above the built-in furniture and clear the trim by approximately 150mm (6") unless otherwise instructed by the Consultant.

.5 In electrical rooms, no equipment to be mounted directly to the walls. The panels and equipment are to be mounted on U channel standoffs or on fire rated plywood complete with 2 coats of fire-retardant paint.

.6 Arrange for openings in the walls and floors for transportation and installation equipment. Extra charges for cutting and making good of walls or floors for the work will not be accepted.

.7 Notify other trades concerned of openings, anchors, hangers or other provisions necessary for installation of electrical work for installation in structure, walls, floors and similar locations or may affect other work. Coordinate electrical installation with other trades. Install electrical items in time to avoid cutting or patching of Work.

.8 Prior to installation and start up, co-ordinate and confirm that all electrical equipment and systems are compatible, are sized correctly and shall work safely as intended.

.9 Provide an acceptable documented procedure for the commissioning of all systems. Contact the Consultant to arrange for a viewing of the system demonstration. All systems shall be fully operational and verification documents available at least 24 hours before requesting a review by the Consultant. Provide hard copies of all programs for review before and after commissioning of equipment. At the discretion of the Owner, back charges for costs incurred may be levied if systems are not commissioned and operational at the time of the Consultants visit and return visit(s) are required.

.10 Install, program, set-up and adjust all equipment as indicated and or required and complete all commissioning.

.11 Electrical work is indicated generally on the Contract Drawings by standard symbols as per the legend. The letters in the symbol indicate the type of device as per the schedules. The letters and numbers outside and adjacent to the symbols indicate the panel and circuit number. If no circuit identification is indicated utilize available circuit(s) and load to acceptable practices.

.12 All row mounted fixtures shall be accurately installed in line with all mounting hardware.

.13 Support every outlet box, junction box, panel tub, etc. independent of conduits running to it.

.14 Surface mounted distribution and control equipment shall be mounted square and level on flame retardant backboard.

.15 Transformers, MCC and panels (as required) shall be mounted on housekeeping pads. Provide 100mm housekeeping pads for this equipment, unless noted otherwise.

.16 Mount exit lights at a level so that they are clearly visible and to the satisfaction of authorities having jurisdiction.

.17 Loading Dock equipment is provided with switches for dock light and dock fan to be hardwired by electrical contractor. Each dock leveler shall be provided with a fused disconnect switch.

3.3 NAMEPLATES AND LABELS

.1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

3.4 CONDUIT AND CABLE INSTALLATION

.1 Install conduit and sleeves prior to pouring of concrete.

.2 Sleeves through concrete: schedule 40 steel pipe, sized for free passage of conduit, and protruding 50mm (2"). All holes through concrete or steel structural members shall be approved by the Structural Consultant.

.3 Install cables, conduits and fittings close to building structure so furring can be kept to minimum.

.4 Relocate temporary or permanent electrical equipment and conduits as required.

3.5 NEUTRAL CONDUCTOR AND PHASING

.1 Install individual grounded neutral conductor for one-pole, two-pole or three-pole branch breakers of balanced, 3 phase, 4 wire circuits unless noted otherwise. Current carrying capacity of neutral conductors shall be equal or greater than the phase conductor to suit load conditions.

.2 Balance single phase loads to minimize unbalance of 3 phase supply.

3.6 NOISE AND VIBRATION

.1 If equipment operates with excessive noise or vibration due to incorrect installation or support, eliminate noise or vibration to acceptance by Owner.

.2 Make connections to noise producing and vibrating equipment with flexible conduit.

.3 Install vibration isolators where indicated. isolate transformers from structure with spring or rubber isolators when suspended and appropriate sandwich pads when floor mounted. .

3.7 EQUIPMENT MOUNTING HEIGHTS

.1 Mounting height of equipment is from finished floor to centreline of equipment unless indicated otherwise. Verify unspecified heights and dimensioned locations before installation. Ensure indicated heights are per current Barrier Free access requirements before installation. Stagger back to back devices (such that they are not located in a common stud wall cavity) to reduce sound transfer and maintain fire separations.

.2 Install switches, receptacles, devices, etc. on one common centre line when shown on the drawings in a grouping.

.3 The top of recessed boxes to be mounted even with the nearest top of block. Alternatively, the bottom of recessed boxes may be mounted even with the nearest bottom of block.

.4 Generally, install electrical equipment at following heights unless indicated otherwise on drawings:

.1 Light switches and thermostats in public spaces: 1200mm (47").

.2 Pit light switches: 305 mm (12") below hatch, right side (preferred).

.3 Wall receptacles:

.1 General: 405mm (16").

.2 Height above top of counters or counter splash backs: 175mm (7").

.3 Mounted high (refrigerator, etc.): 1120mm, (44").

.4 In mechanical rooms: 1120mm (44").

.4 Panelboards: as required by Code or as indicated (Maximum circuit breaker height 1700mm (67")).

.5 Exit lights at ceiling height, to a maximum of 2290mm (90"). Confirm visibility before installation.

.6 Wall mounted emergency lights: 2440mm (96").

.7 Barrier Free door release/opener button & washroom lights: 1,100mm (43").

.8 Motor starters, generally: 1400mm (55").

.9 Telephone outlets: 400mm (16”).

.10 Wall mounted telephone outlets: 1372mm (54”).

.11 Television outlets: as noted on drawings.

.12 Hand dryers: 1200mm (47”).

.13 Fire Alarm Pull Stations: 1,100mm (43“)

.14 Fire Alarm Signal Devices: 2,400mm (94.5“)

3.8 LOAD BALANCING

.1 Measure phase current to panelboards with normal loads operating at time of acceptance. Adjust branch circuit connections as required to obtain best balance of current between phases and record current readings.

.2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment. Measure phase voltages to reflect utility voltage fluctuations and set accordingly.

3.9 CLEAN-UP

.1 Continuously remove surplus and waste material generated by the electrical work.

.2 Clean all supplied equipment and material of dirt, dust and stray paint, immediately prior to final acceptance of the work.

.3 Remove tools, surplus material, scrap and debris (resulting from the work of this Division) on completion of the Contract.

.4 Clean and touch-up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

.5 Clean, prime and paint exposed non-galvanized hangers, racks and fastenings to prevent corrosion.

3.10 CO-ORDINATION OF PROTECTIVE DEVICES

.1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings. Verify prior to energizing of circuits.

3.11 TESTING

.1 Furnish labour, materials, and instruments and bear other costs in connection with all tests, including third party and factory tests, obtain required certificates of approval, acceptance, and compliance with regulations of agencies having jurisdiction and as specified.

.2 Confirm proper operation of each piece of equipment and system for correct function.

.3 Measure amperage readings of each phase at service entrance switchboard and on each panel/equipment feeder. Ensure phase imbalance does not exceed 10% at operating load conditions. Adjust loads as required.

.4 Megger test all feeders prior to energizing; submit test results in Operating & Maintenance Manuals. Provide insulation resistance testing on service entrance cables, panel feeders and feeders to major equipment. Testing to be completed as follows:

.1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.

.2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.

.5 Note: Check resistance to ground and conductor to conductor resistance for conductors in the same conduit before energizing.

.6 Measure voltage at service entrance switchboard, at feeder supply connections and at load connections. Measurements to be taken under normal operating conditions. Submit test results in Operating & Maintenance Manuals.

.7 Confirm continuity of metal raceways where raceway is used in lieu of a bonding conductor.

.8 Demonstrate that the settings described in the co-ordination study have been incorporated.

3.12 INSPECTIONS

.1 Inform the Consultant in writing a minimum of 3 working days prior to any test of any system.

.2 All work and materials covered by these Specifications shall be subject to inspection at any time by the Consultant.

.3 If the Consultant finds that any material or workmanship does not conform to these specifications undertake to correct such workmanship within 5 days of notification by the Consultant.

.4 Work shall not be deemed complete and Certificate of Substantial Performance will not be issued, until all indicated certificates of approval, test results and/or verifications have been delivered to the Consultant.

.5 Notify the Consultant when the final inspection of the work shall be performed. Defects or deficiencies found during this inspection shall be corrected to the satisfaction of the Consultant before final payment is made.

END OF SECTION

1 General

1.1 SUMMARY

.1 All conditions of the Contract apply to the work of this Section.

1.2 RELATED REQUIREMENTS

.1 Section 26 05 00 – General Electrical Requirements

.2 Section 26 05 73 – Electrical Systems Analysis

1.3 REFERENCE STANDARDS

.1	CSA C22.2 No. 41	Grounding and Bonding Equipment
.2	CSA C22.2 No. 38	Thermoset Insulated Wires and Cables
.3	CSA C22.2 No. 51	Armoured Cables
.4	CSA C22.2 No. 52	Underground Secondary and Service - Entrance Cables
.5	CSA C22.2 No. 75	Thermoplastic-Insulated Wires and Cables
.6	CSA C22.2 No. 83.1	Electrical Metallic Tubing - Steel
.7	CSA C22.2 No. 211.1	Rigid Types EB1 and DB2/ES2 PVC Conduit
.8	CSA C22.2 No. 211.2	Rigid PVC Conduit
.9	CSA C22.2 No. 45.1	Electrical Rigid Metal Conduit – Steel
.10	CSA C22.2 No. 45.2	Electrical Rigid Metal Conduit – Aluminum, Red Brass & Stainless Steel
.11	CSA C22.2 No. 56	Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit
.12	CSA C68.3	Power Cables with Thermoset Insulation
.13	CSA C22.2 No. 85	Rigid PVC Boxes and Fittings
.14	CSA C22.2 No. 18.1	Metallic Outlet Boxes
.15	CSA C22.2 No. 18.2	Non-Metallic Outlet Boxes
.16	CSA C22.2 No. 18.3	Conduit, Tubing and Cable Fittings
.17	CSA C22.2 No. 18.4	Hardware for the Support of Conduit, Tubing and Cable
.18	CSA C22.2 No. 40	Cutout, Junction and Pull Boxes
.19	CSA C22.2 No. 65	Wire Connectors
.20	CSA C22.2 No. 14	Industrial Control Equipment
.21	CSA C22.2 No. 177	Clock-Operated Switches
.22	CSA C22.2 No. 42	General Use Receptacles, Attachment Plugs, and Similar Wiring Devices
.23	CSA C22.2 No. 42.1	Cover Pates for Flush Mounted Wiring Devices
.24	C22.2 NO. 182.1	Plugs, Receptacles, and Cable Connectors of the Pin and Sleeve Type
.25	C22.2 NO. 182.2	Industrial Locking Type, Special Use Attachment Plugs, Receptacles and Connectors
.26	C22.2 NO. 182.3	Special Use Attachment Plugs, Receptacles and Connectors
.27	CSA C22.2 No. 4	Enclosed and Dead-Front Switches

.28	CSA C22.2 No. 111	General Use Snap Switches
.29	CSA C22.2 No. 55	Special Use Switches
.30	CSA C22.2 No. 106	HRC Miscellaneous Fuses
.31	CSA C22.2 No. 248	Low-Voltage Fuses
.32	CSA C22.2 No. 39-13	Fuseholder Assemblies
.33	CAN/ULC-S115	Standard Method of Fire Tests of Firestop Systems

1.4 SCOPE

.1 Provide wiring and equipment as detailed on the Contract drawings and specified herein.

1.5 SHOP DRAWINGS

.1 Submit shop drawings for the equipment detailed within this specification section. Shop drawings shall be submitted in accordance with Section 26 05 00 – General Electrical Requirements and the requirements of Division 01.

2 Products

2.1 MATERIAL

.1 All material shall be specification grade, where applicable, new and carry C.S.A. approval or special approval in accordance with the requirements of the Electrical Safety Authority.

.2 Similar devices and items shall be from one manufacturer throughout the project.

2.2 WIRING

.1 All conductors, unless specifically noted otherwise, shall be copper with 600 volt, x-link insulation. Temperature rating to be 90°C or as required by Code.

.2 All wiring shall be copper conductors in overhead conduit.

.3 All feeders 125A and smaller or feeding motors or vibrating equipment shall be copper.

.4 All conductors shall be colour coded consistent with the Ontario Electrical Safety Code.

.5 Conductors up to and including # 10 may be solid copper. Larger conductors shall be stranded.

.6 Branch circuit wiring shall be #12 AWG minimum. For circuit (15Amp, 120VAC) lengths exceeding 30m (100') minimum size shall be #10 AWG and for circuit lengths exceeding 45m (150') minimum size shall be #8AWG. For circuit (20A, 120VAC) Lengths exceeding 20m(70') minimum size shall be #10AWG and for the circuit lengths exceeding 30m (100') minimum size shall be #8AWG. Size wiring to maintain a maximum of 3% voltage drop.

.7 Control wiring to be #16 AWG minimum. Size wiring to maintain a maximum of 2% voltage drop.

.8 Wiring in dry locations shall be: R90 or RW90 installed in EMT conduit (unless noted otherwise).

.9 Wiring in damp locations shall be: RW90 in conduit (conduit type as noted on drawings).

.10 Underground service entrance wiring shall be RWU90 in PVC duct or conduit.

.11 Armoured cable (AC90) shall be permitted in ceiling spaces for interconnection of lighting fixtures. Maximum length per location shall not exceed 3m (10'); utilize EMT conduit for longer lengths.

.12 All feeders shall be run in continuous length between power supply point and the load with no splices.

.13 Provide separate neutrals for electronic ballast lighting circuits (do not share neutrals between lighting circuits).

.14 Sleeve and seal wiring through fire rated walls and floors, per Ontario Building Code requirements.

.15 Wiring in fire rated partitions shall be armoured cable.

2.3 CONDUIT

.1 EMT conduit shall be utilized for typical wiring. Conduit to be concealed wherever possible.

.2 Where conduit is surface mounted and subject to mechanical damage, use rigid galvanized steel threaded conduit to a minimum of 3m (10') above finished floor level. Use electrical metallic tubing (EMT) above 3m (10').

.3 Direct buried conduit shall be rigid PVC conduit with bond, as permitted by Code.

.4 Seal tight (flexible, PVC jacketed, metallic) conduit shall be used to connect motors and vibrating equipment; minimize length of runs where possible.

.5 Concrete encased conduit shall be PVC type DB2 duct with bond wire, as permitted by Code. The minimum cover to concrete surface shall be as per OESC.

.6 Minimum conduit size for lighting and power circuits shall be 21 mm (3/4") unless otherwise stated. All buried conduit or conduit embedded in concrete shall be minimum 27 mm (1") diameter.

.7 Provide all pull boxes, junction boxes, terminal boxes, fittings, drains, plugs, cover plates, bushings, clips, rods and accessories as required and appropriate.

.1 In-grade pull boxes shall be Quazite PG Type polymer concrete with bolt down cover.

.2 Boxes shall have T rating do suit installed location as per manufacturer's recommendations.

.8 Pull boxes installed in heavy vehicular areas such as launchpad and truck docks shall by submitted to the Consultant for approval. EMT conduit connectors to be c/w steel set screw.

.9 Where the potential for box submergence exists, the box is to have a submersible rating with all fittings designed and installed to prevent the entry of water.

.10 Supports for conduit, cable or equipment shall be corrosion resistant (galvanized steel or equivalent).

.11 Raceways on roof shall be EMT with weather-tight compression fittings.

.1 All raceway supports on roof shall be Dura-blok db10 or equal.

.12 Exterior conduits buried in ground or slab shall be PVC.

.13 Exterior above ground conduits shall be rigid galvanized steel.

.14 Power required for dock equipment may be run under-slab in the pour-back area and concealed conduits run in the preformed walls slabs.

.15 Feeders to MDP panels may be run underground. Conduit to be run overhead just under the joist top chord, located to avoid interference with ESFR sprinkler heads.

.16 Conduits serving items along dock wall may be run under slab.

.17 Acceptable manufacturers:

.1 PVC conduit: IPEX or Royal Pipe Systems.

.2 Metallic conduit: Columbia MBF/Allied Tubing or Wheatland Tube.

.3 PVC Coated RGS conduit: Ocal by Thomas & Bets or Perma-Code by Robroy Industries.

2.4 WIRING DEVICES AND COVERPLATES

.1 General

.1 Colour of devices and cover plates (other than stainless) to be confirmed by Consultant.

.2 Receptacles in office areas that are identified to be switched by occupancy sensing devices shall be gray in colour to differentiate from non-switched receptacles.

.3 Acceptable Manufacturers: Hubbell, Bryant, Pass & Seymour, Leviton.

.4 All devices to be of the same manufacturer throughout.

.2 Switches

.1 Refer to 26 09 24 – Lighting Control Devices for low voltage switch requirements.

.3 Receptacles

.1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, with following features:

.1 Urea 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 riveted grounding contacts.

.2 Duplex receptacles, CSA type 5-20 R, 125 V, 20 A, U ground, with features detailed above for 15A device.

.3 Single receptacles CSA type 5-15 R, 125 V, 15 A, U ground with following features:

.1 Urea moulded housing.

.2 Suitable for No. 10 AWG for back and side wiring.

.3 Four back wired entrances, 2 side wiring screws.

.4 Other receptacles with ampacity and voltage as indicated.

.4 Duplex Ground Fault Interrupter Receptacle

.1 Rated 15A or 20A (as per drawings), 125VAC, U-grounded type.

.2 Class A requirement, trip level 4-6 mA, parallel blade, with test and reset switches, CSA 5-15R/20R configuration.

.5 Note: Except as specifically indicated, provision of either GFI receptacle or GFI circuit breaker will be acceptable to ensure ground fault protection of circuits as shown.

.4 Coverplates

.1 Cover plates shall be from one manufacturer throughout project.

.2 Stainless steel (302/302), smooth cover plates, for wiring devices mounted in flush-mounted outlet box.

.3 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.

.4 Sheet metal cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.

.5 Weatherproof locations: Provide cast aluminum cover (“while-in-use cover) complete with adapter plate and gaskets. Cover shall have “wet location” rating with or without a plug inserted into the receptacle.

.5 Receptacle and switches installed in the warehouse below 7' shall be provided with a protective metal cage. The cage shall be prevented typical use when installed. The product shall be a standard manufactured product, not a custom-made guard. Basis of design: American Wire Guards Open Face Rectangle Guards.

2.5 OUTLET & CONDUIT BOXES

.1 General

.1 Gang boxes where wiring devices are grouped.

.2 Provide blank cover plates for boxes which are roughed in only. Cover plate style as detailed above.

.3 Provide 347V outlet boxes for 347V switching devices.

.4 Provide combination boxes with barriers where outlets for more than one system are grouped.

.2 Galvanized Steel Outlet Boxes

.1 One-piece electro-galvanized construction.

.2 Single and multi gang flush device boxes for flush installation, minimum size 76 x 50 x 38mm (3" x 2" x 1½") or as indicated. 102mm (4") square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.

.3 Utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48mm (4" x 2" x 2").

.4 102mm (4") square or octagonal outlet boxes for lighting fixture outlets.

.5 Extension and plaster rings for flush mounting devices in finished tile walls.

.3 Floor Boxes

.1 Adjustable, watertight, concrete tight, cast floor boxes with openings drilled and tapped for 16, 21 and 27 mm conduit. Minimum size: 73 mm deep. Barriered interior compartments to accommodate communication/data and power/receptacle circuits.

.2 Where penetrating fire rated floor assembly, fire rated poke through (flush series) shall be utilized for power and data.

.4 Masonry Boxes

.1 Electro-galvanized steel masonry single and multi gang boxes for devices flush mounted in exposed block walls.

.5 Concrete Boxes

.1 Electro-galvanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

.6 Conduit Boxes

.1 Where subject to mechanical damage (or as noted on drawings) provide cast FS or FD aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of devices.

2.6 GROUND & BONDING

.1 Provide all grounding to the authorities' approval. Use approved connection methods (thermal weld or compression). Provide appropriate mechanical protection for all ground wire.

.2 Provide means for permanent and effective electrical grounding of exposed non-current carrying metal parts, assemblies housing electrical current carrying components (switchgear, transformer, etc.) as required by OESC (Ontario Electrical Safety Code).

.3 Provide appropriately sized ground or bond wire in all conduit systems; including EMT, steel and PVC types.

.4 Provide safety grounding studs, ball type complete with covers on 480V MCC.

.5 All electrical distribution and control equipment doors to have flexible ground braid to extended ground from equipment ground busbar and not rely on hinge.

.6 Provide #6 AWG insulated bond wire main service ground to:

.1 service entrance telecommunication backboard, and

.2 main telecommunication server room.

.7 Install 20 X 3000mm long copper clad steel rod electrodes and make grounding connections at electrical service entrance.

.8 Engage the services of an independent contractor to undertake a ground resistance measurement on the grounding system prior to termination and backfill. A log of measurements shall be provided. Notify the Engineer if the resistance of any rod is greater than 5 ohms.

.9 Acceptable manufacturers: Thomas & Betts, Burndy & Dossert.

2.7 JUNCTION & PULL BOXES

.1 Construction: welded steel enclosure.

.2 Covers Flush Mounted: 25mm (1") minimum extension all around

.3 Covers Surface Mounted: screw-on flat steel covers.

.4 Junction boxes, pull boxes and fittings are to be match the finish of the raceway used.

2.8 CABINETS

.1 Construction: welded sheet steel, hinged door, handle, lock (2 keys) and catch.

.1 NEMA Type 1 for Dry Indoor locations, NEMA Type 3R for indoor wet/damp locations (reclaim room, M/E room), and NEMA Type 4X for outdoor locations unless indicated otherwise.

.2 Cabinet to be supplied complete with back panel and bonding conductor from panel to door.

2.9 DISCONNECT SWITCHES

.1 Fusible, Non-fusible, Horsepower rated disconnect switches in CSDA enclosure to CSA-C22.2 No.4, size to suit circuit ampacity. Contractor to selected suitable type to suit environment.

.1 CSA Type 1: Dry and non-sprinkler.

.2 CSA Type 3R: Sprinkler areas, wet/damp indoor locations (reclaim room, M/E room).

.3 CSA Type 4X: Wet or Outdoor areas.

.2 Provision for padlocking in Off switch position by 3 locks.

.3 Mechanically interlocked door to prevent opening when handle in 'ON' position.

.4 Fuses: Size as indicated or as recommended in the Short Circuit and Protection Co-ordination studies.

.5 Fuseholders: To CSDA C22.2 No.39, relocatable and 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.

2.10 SUPPORTING DEVICES

.1 Every conduit or cable shall have at least one support. Only approved conduit supports will be accepted. Perforated pipe straps, tie wrap or wood support for conduits or outlet boxes etc., will not be accepted.

.2 Single conduit runs: Galvanized conduit straps, ring bolt type hangers or P.V.C. saddles.

.3 Horizontal multiple raceways runs: Conduit rack with minimum 25 percent spare capacity. Trapeze style hanger on threaded rod.

.4 Vertical multiple raceway runs: Electrical strut fastened to structure.

.5 Strut Channels and Components

.1 General: Strut shall be 1-5/8 inches wide in varying heights and welded combinations as required to meet load capacities and designs indicated on the drawings.

.2 Materials and Finish: Hot-dip Galvanized Steel.

.1 Strut shall be manufactured from steel and hot-dip galvanized after fabrication.

.2 Fittings shall be manufactured from steel and hot-dip galvanized after fabrication.

.3 All hardware shall be stainless steel Type 304 or chromium zinc ASTM F1136 Gr. 3.

.3 Acceptable Manufacturers: Cooper B-Line, Thomas & Betts

2.11 ACCESS DOORS

.1 Provide access doors in walls and ceilings to service electrical equipment and concealed devices requiring access. Positive latch system. Minimum 18 gauge steel.

.2 Group devices to minimize doors. Access doors in fire separations are to be ULC labelled. Doors shall match finish and be flush with surface.

.3 All sizes and locations of doors shall be approved in writing by the Owner and or Engineer before installation.

.4 Provide hinged doors for all access panels with a size of 450 x 450 (18" x 18") or larger.

2.12 CUTTING & PATCHING

.1 At all penetrations of the roof, walls and floors and/or as indicated on the Contract Drawings provide Portals Plus Alumi-Flash, Pipe Portal, Pipe Boots and Quadraseals or Portals Plus Retrofit as manufactured by Portals Plus, Inc. and distributed by D.E.L. Roofing Equipment, 905 856 0333. Seals shall be installed to the manufacturer's recommendations, instructions and to the satisfaction of the Engineer.

.2 Cut and patch holes located incorrectly.

.3 Pneumatic hammers, drills, or explosive fasteners shall not be used without prior written approval from the Owner and/or Consultant.

.4 Openings on all electrical metal boxes shall be punched or cut.

2.13 FIRE STOPPING

.1 Provide materials and systems capable of maintaining effective barrier against flame, smoke and gases.

.2 Comply with the requirements of CAN/ULC-S115, and do not exceed opening sized for which they have been tested.

.3 Systems to have an F or FT rating (as applicable) not less than the fire protection rating required for closures in a fire separation.

.4 The fire stopping materials are not to shrink, slump or sag and to be free of asbestos, halogens and volatile solvents.

.5 Fire stopping materials are to consist of a component sealant applied with a conventional caulking gun and trowel.

.6 Fire stop materials are to be capable of receiving finish materials in those areas which are exposed and scheduled to receive finishes.

.7 Acceptable Manufacturers:

.1 Fyresleeve Industries Inc.

.2 General Electric Pensil Firestop Systems

.3 International Protective Coatings Corp.

.4 Rectorseal Corporation (Metacaulk)

.5 Proset Systems

.6 Minnesota Mining and Manufacturing (3M)

.7 Tremco.

.8 Hilti

.8 Submit shop drawings in accordance with Section 26 05 00 – General Electrical Requirements, for the following items:

.1 Fire stopping materials.

.2 Manufacturers literature and installation instructions.

.3 Manufacturers Letter of Certification that project meets or exceeds specified requirements.

3 Execution

3.1 GENERAL

.1 Verify all wall and partition locations, door swings, light switch and other device locations.

.2 Install all equipment according to manufacturer's recommendations with adequate access and clearances.

.3 Provide acceptable painted metal shroud over cables and conduits around exterior or public areas to prevent climbing, as required.

.4 Install all equipment according to manufacturer's recommendations with adequate access and clearances.

.5 All wiring, receptacles, light switches to be added to finished existing walls shall be concealed if possible. If surface mounted equipment and Wiremold raceway is proposed its location and type must be approved by the Owner before installation. At tender specify where surface equipment and conduits are proposed to be installed.

.6 Correct improperly installed work as directed by the Consultant or authorized inspector.

3.2 SHORT CIRCUIT AND COORDINATION STUDY

.1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings. Verify prior to energizing of circuits.

.2 Equipment short circuit ratings shall meet specified values as a minimum and be confirmed by the short circuit calculation before purchasing equipment. Short circuit current ratings are the responsibility of the power system provider. Refer to Spec 26 05 73.

3.3 WIRING

.1 Maximum armoured cable (BX) length of 3 m (10ft) is acceptable in the ceiling space, use EMT conduit otherwise. Minimum lengths of armoured cable may be used in furred ceilings, hollow partitions and hollow walls. EMT only in masonry walls unless otherwise approved. No BX may lay on or clip to ceiling tiles or terminate in panels.

.2 Conductor length for parallel feeders to be identical.

.3 Wire or cable used for feeders shall be free of splices.

.4 Systems of different voltages shall be installed in separate raceways.

3.4 CONDUITS

.1 Provide and locate all sleeves required to pass wiring through building walls and floors and ceilings. Fill voids between conduits and sleeves with material and caulking sealant to suit application and fire rating.

.2 Do not place conduits in slabs in which slab thickness is less than 4 times conduit diameter.

.3 Elevator requirements:

.1 Provide a 16 mm (1/2"), empty conduit through the hoist way wall for elevator cab on each floor, for lanterns and push buttons.

.2 Provide a 63 mm, (2 1/2"), empty conduit from the elevator hoist way on the ground floor and extend to elevator control panel.

.3 Provide a 16 mm. (1/2"), empty conduit from the telephone backboard to the elevator control panel.

.4 Provide complete metal conduit system for door entry wiring.

.5 Provide empty conduit systems for phone, computer, cable TV outlets or as designated. Conduit as indicated or as a minimum: 21 mm (¾") EMT conduit from the outlet to 150 mm (6”) above the ceiling panel. Provide outlet boxes, cover plates, junction and pull boxes and fireproof backboards as required.

.6 Telephone, Computers and Cable TV shall be wired by the Owner authorized company. Provide the authorized installers for these systems with estimated installation dates at the start of construction and two weeks prior to estimated pre-wiring dates. Provide raceways from outlets to accessible ceiling space. Co-ordinate with the end user authority and follow applicable installation guidelines.

.7 Co-ordinate with all trades to locate conduits in slabs, as required, before concrete pouring, record routing on prints.

.8 Co-ordinate and record exact routing of underground ducts and conduits. Establish elevation of ducts, schedule of work before installation.

.9 Supply and install expansion couplings where conduits cross construction joints.

.10 Install conduits on surface at lower trough of roof decking.

.11 All conduit and wiring within the building shall be run neatly and parallel to the building structure, above finished ceilings, within finished walls or below the floor. Conceal conduits as much as

practical. It shall be supported from the building structure. Minimize horizontal runs along walls. Nails or tie wires are not acceptable. Do not caddie clip to ceiling hangers.

.12 Provide fish wire in all empty conduits.

3.5 WIRING DEVICES

.1 Switches:

.1 Switches shall operate vertically, with handle in "UP" position when switch closed. Devices on three way switches shall be off when all toggles are down.

.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 – General Electrical Requirements unless noted otherwise.

.2 Receptacles:

.1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.

.2 Generally, mount receptacles with U-ground oriented down.

.3 Mount receptacles at height in accordance with Section 26 05 00 – General Electrical Requirements unless noted otherwise.

.4 Where split receptacle has one portion switched, mount vertically and switch upper portion.

.5 All receptacles and data outlets mounted on the warehouse columns shall be a minimum of 42” AFF.

.6 Provide module power drops with 120V quad receptacles in warehouse areas (maximum of 1 quad per 20A circuit).

.7 Provide MHE equipment power drops with 120V L5-30 receptacles in warehouse areas (maximum of 1 twist-lock per 30A circuit).

.3 Cover plates:

.1 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.

.2 Install suitable common cover plates where wiring devices are grouped.

.3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

.4 All electrical outlets shall include a permanent label affixed to cover plate indicating panel and circuit designation serving the outlet.

3.6 OUTLET AND CONDUIT BOXES

.1 Gang power, voice and data outlets using gang boxes with barriers. Coordinate with voice and data wiring provider and provide combination cover plates to suit.

.2 Mount all boxes, plumbed-true on vertical installations. Mount level on horizontal installations.

.3 In finished areas, all boxes to be installed flush mounted.

.4 All boxes to be supported independent of conduits or cables.

.5 Openings in all boxes shall be punched or cut, no burning of holes allowed.

.6 Fill all K.O. openings not used with proper filler plates.

.7 Door swings are to be determined from the Architectural drawings for switch locations.

.8 All final locations to be determined in field with Owner.

3.7 GROUNDING AND BONDING

.1 Install complete permanent, continuous grounding and bonding system including, electrodes, conductors, connectors, accessories. Where EMT is used, run bond 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 thermite process, permanent mechanical connectors or inspectable wrought copper compression connectors.

.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 bond conductor to outdoor lighting standards.

.10 Connect building structural steel and metal siding to ground by welding copper to steel.

.11 Make bonding 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 provide non-metallic entry plate at load end.

.13 Equipment Grounding

.1 Install grounding connection to service entrance equipment. Provide bonding connections to typical equipment included in, but not necessarily limited to following list:

.1 Transformers, duct systems, frames of motors, motor control centres, starters, control panels, building steel work, generators, elevators, distribution panels, and outdoor lighting.

3.8 JUNCTION AND PULL BOXES

.1 Install junction and pull junction boxes so they are supported independent of raceways.

.2 Install pull boxes after every 30 m (100') of continuous raceway.

.3 Locate pull boxes above accessible ceiling spaces in inconspicuous locations wherever possible.

.4 Colour code pull boxes to indicate system involved.

.5 Provide 305mm (12”) crushed gravel beneath the box for drainage.

.6 Conduit shall enter on sides with minimum burial depths of 24” below finished grade.

.7 Conduit knockouts shall be drilled or punched on site.

3.9 CABINETS

.1 Mount all surface mounted equipment enclosures on an approved fire rated backing, or Unistrut channels.

.2 All recessed enclosures shall have trim for recessed mounting.

.3 Enclosures mounted in finished areas shall be finished to match.

.4 Terminate wiring in screw type terminal blocks or strips.

3.10 SUPPORTING DEVICES

.1 Install supporting devices to maintain headroom and clearances as described for conduits and conductors.

.2 Maintain a neat appearance and follow building lines where possible.

3.11 ACCESS DOORS

.1 Provide access panels where required for electrical equipment concealed in walls, partitions or floors. Location and type of access panels shall be to the Consultant's approval.

.2 Paint access panels to match surrounding decor or as directed by the Consultant on site.

.3 Keep access doors to a minimum by locating equipment in easily accessible locations.

3.12 FIRE STOPPING

.1 Confirm location and extent of fire separations from architectural drawings.

.2 Inspect surface to be fire stopped. Report unsatisfactory conditions to Consultant in writing prior to commencement of work. Initiation of work to be deemed as acceptance of conditions and surfaces.

.3 Store all materials in accordance with manufacturers recommendations as to acceptable ambient temperatures. Damaged or deteriorated materials are not to be used and are to be removed from the site.

.4 Install fire stopping and smoke seal material and components in accordance with ULC certification and manufacturer’s instructions in all conduit, cable, duct etc. penetrations in new or existing fire separation to provide temperature, flame and smoke rated seals not less than the fire resistance rating of the assembly, or separation.

.5 Seal all holes made by through-penetrations and un-penetrated openings to ensure continuity and integrating of fire separation, including where existing component or device has been removed.

.6 Notify Consultant and/or Authority having jurisdiction for inspection prior to concealing or enclosing fire stopping materials and service penetrations.

.7 Remove excess material and debris and clean adjacent surfaces immediately after application. Leave in a tidy condition.

3.13 TIME SWITCHES

.1 Label each time switch to indicate the device it controls.

.2 Confirm programming of time switches with Consultant/Owner and provide setup of switches.

3.14 CONTACTORS

.1 Install contactors and connect auxiliary control devices.

.2 Locate contactors in a convenient location for accessibility and service. Wherever possible, locate in service spaces such as electrical rooms, mechanical rooms, janitors closets, etc. Provide a self-supporting mounting surface where required.

.3 Label each contactor to indicate the device it controls.

3.15 MOTOR STARTERS

.1 Install starters and control devices in accordance with manufacturer's instructions.

.2 Install and wire starters and controls as indicated.

.3 Ensure correct fuses are installed in starters.

.4 Confirm motor nameplate and adjust overload devices to suit.

.5 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

3.16 DISCONNECT SWITCHES

.1 Label each disconnect switch to indicate the device it controls.

.2 Provide a separate self-supporting structure to support the disconnect device where the equipment or adjacent walls are not capable of supporting the device.

.3 Install disconnect switches complete with fuses if applicable.

3.17 FUSES

.1 Ship fuses in original containers

.2 Do not ship equipment with fuses installed.

.3 Store spare fuses in original containers in fuse storage cabinet. Install fuse storage cabinet in electrical room.

.4 Install fuses in mounting devices immediately before energizing circuit.

.5 Prior to energization of any circuit, verify that the correct fuse is installed:

.1 for the calculated or assumed circuit capacity, and

.2 for the proper equipment and conductor protection requirements.

END OF SECTION

1 General

1.1 SUMMARY

.1 This Section includes requirements for supply and installation of all wiring and equipment detailed on the contract drawings and specified herein.

1.2 RELATED REQUIREMENTS

.1 Section 26 05 00 – General Electrical Requirements

1.3 REFERENCE STANDARDS

.1 CSA Group:

.1 CSA C22.2 No. 0.3, Test Methods for Electrical Wires and Cables

.2 CSA C22.2 No. 38-M, Thermoset Insulated Wires and Cables

.3 CSA C22.2 No. 51-M, Armoured Cables

.4 CSA C22.2 No. 52, Underground Secondary and Service - Entrance Cables

.5 CSA C22.2 No. 75-M, Thermoplastic-Insulated Wires and Cables

.6 CSA C22.2 No. 131-M, TECK 90 Cables

.7 CSA C22.2 No. 123, Metal Sheathed Cables (Applies for Drive RX Cable)

.8 CSA C22.2 No. 174, Cables and Cable Glands in Hazardous Locations

.9 All cables installed in areas requiring fire rating shall conform to test FT-4.

.10 All cables installed in spaces designated as a return air plenum shall conform to test FT 6 or be installed in continuous conduit system.

.2 No “Aluminium” Wiring, Buswork or “Nual” Wiring shall be used on this Contract.

1.4 ACTION SUBMITTAL S

Provide submittals in accordance with Division 01 General Requirements section.

.1 Shop Drawings: Submit shop drawings for the equipment detailed within this specification section. Shop drawings shall be submitted in accordance with Section 26 05 00 – General Electrical Requirements.

1.5 STORAGE, DELIVERY, HANDLING AND PROTECTION

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

.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 in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

2 Products

2.1 BUILDING WIRES

.1 Conductors

.1 Copper conductors, of the size as indicated in the Contract Documents, having a minimum conductivity of 98 percent.

.2 Conductors up to and including #10 may be solid copper. Larger conductors shall be stranded.

.3 Branch circuit conductors shall be minimum No. 12 AWG, size conductor for maximum 3% voltage drop to the furthest outlet on a fully loaded branch circuit.

.4 Control wiring to be No. 16 AWG minimum. Size wiring to maintain a maximum of 2% voltage drop.

.5 Voltage shall be rated at a minimum of 600 V for 120/208 V wiring and 1000 V for 347/600 V wiring.

.6 All feeders shall run in continuous length between power supply point and the load with no splices.

.2 The following shall be used with respect to branch circuit (15 Amp, 120 VAC) wire sizing for voltage drop from the circuits associated panel board.

.1 #12 AWG to be used from 0 to 100 ft, maximum length of branch circuit run from panel board.

.2 #10 AWG to be used from 100 to 150 ft, maximum length of branch circuit run from panel board.

.3 #8 AWG to be used circuits longer than50 ft, maximum length of branch circuit run from panel board.

.3 The following shall be used with respect to branch circuit (20 Amp, 120 VAC) wire sizing for voltage drop from the circuits associated panel board.

.1 #12 AWG to be used from 0 to 70 ft, maximum length of branch circuit run from panel board.

.2 #10 AWG to be used from 70 to 100 ft, maximum length of branch circuit run from panel board.

.3 #8 AWG to be used circuits longer than 100 ft, maximum length of branch circuit run from panel board.

.4 The Electrical Contractor shall up-size feeder and branch circuit wiring and associated conduit as required to meet the requirements of the code with respect to acceptable voltage drop.

.5 Insulation:

.1 Wiring in dry locations shall be: R90 or RW90 installed in EMT conduit (unless noted otherwise).

.2 Wiring in damp locations shall be: RW90 in conduit (conduit type as noted on drawings).

.3 Underground service entrance wiring shall be RWU90 in PVC duct or conduit.

.6 Colour Coding:

.1 All conductors shall be colour coded consistent with the Ontario Electric Safety Code.

.7 Manufacturers: Acceptable manufacturers approved as a basis of design:

.1 Canada Wire and Cable Limited

.2 Prysmian Group

.3 Phillips Cables Limited

.4 Pirelli

.5 Nexans

2.2 TECK 90 CABLE

.1 Conductors

.1 Copper conductors shall be of the sizes indicated in the Contract Documents, having a minimum conductivity of 98 percent.

.2 Each cable shall have a grounding conductor.

.2 Insulation:

.1 Chemically cross-linked thermosetting polyethylene insulation rated at a minimum of 1000V, type RW 90.

.3 Inner jacket: polyvinyl chloride material

.4 Armour: aluminum interlocked armour

.5 Overall covering: thermoplastic polyvinyl chloride, compliant to applicable Building Code classification for this project. Conform to FT4.

.6 Fastenings

.1 One hole malleable iron straps to secure surface mounted cables.

.2 12-gauge galvanized steel channel type supports for two or more cables at 1500 mm centres.

.3 1/4" diameter threaded rods to support the suspended channels.

.7 Connectors

.1 Watertight TECK connectors, T & B series 10464 and 10470.

.8 Manufacturers: Acceptable manufacturers approved as a basis of design

.1 Canada Wire and Cable Limited

.2 Prysmian Group

.3 Phillips Cables Limited

.4 Pirelli

.5 Nexans

2.3 ARMOURED CABLES

.1 AC90 Cable

.1 Shall be permitted in ceiling spaces for interconnection of lighting fixtures. Maximum length per location shall not exceed 3m; utilize EMT conduit for longer lengths.

.2 Conductors: Copper conductors, of the sizes as indicated in the Contract Documents, having a minimum conductivity of 98%.

.3 Insulation: Chemically cross-linked thermosetting polyethylene insulation rated at a minimum of 600 V.

.4 Armour: Interlocking armour fabricated from aluminum strip.

.5 Connectors: anti short connectors

.6 Shall be provided with an integral insulated ground wire.

2.4 MINERAL-INSULATED CABLE

.1 Conductors: Solid bare soft-annealed copper conductors, of the sizes as indicated in the Contract Documents.

.2 Insulation Compressed powered magnesium oxide insulation to form a compact homogeneous mass throughout the entire length of the cable.

.3 Sheath:

.1 An annealed seamless copper sheath, Type MI, rated 600 V, 250 C.

.2 Termination Kits: Provide copper termination kits at each end of each cable.

.4 Manufacturers: Acceptable manufacturers approved as a basis of design for MI cable are:

.1 Pyrotenax of Canada Limited.

3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify existing conditions are acceptable for installation of work of this section, in accordance with manufacturer's written instructions and reviewed shop drawings.

.1 Inform Consultant of unacceptable conditions immediately upon discovery.

.2 Proceed with installation only after unacceptable conditions have been remedied.

3.2 PREPARATION

.1 Prepare surface to receive work in this section in accordance with manufactures recommendations.

3.3 INSTALLATION

.1 Install grounding, grounded and neutral conductors without any fuses, switches or breakers of any kind unless otherwise indicated in the Contract Documents.

.2 Ground the grounded or neutral conductor at the source of supply as indicated in the Contract Documents and isolate the grounded or neutral conductor at all other locations.

.3 Do not use any grounded or neutral conductors as a grounding conductor.

.4 Do not use any grounding conductor as a grounded or neutral conductor.

.5 Do not splice any wiring in any raceway. Make splices only at junction boxes.

.6 Provide sufficient slack at the connection points of conductors to permit proper connections to be made.

.7 Do not install any conductors in any raceway until the raceway is complete and cleared of all obstructions.

.8 Install all conductors in any one conduit at the same time taking care not to twist the conductors.

.9 Use wire pulling lubricants that will not shorten the life of the insulation.

.10 Do not install any wires or cables at temperatures above or below those which will cause damage to the wires or cables.

.11 Systems of different voltages shall be installed in separate raceways.

3.4 INSTALLATION OF BUILDING WIRES

.1 Install wiring as follows:

.1 In conduit systems in accordance with Section 26 05 05 – Basic Materials and Methods.

.2 In wireways and auxiliary gutters in accordance with Section 26 05 05 – Basic Materials and Methods.

3.5 INSTALLATION OF TECK 90 1000 V

.1 Install cables as indicated.

.2 Group cables wherever possible on channels.

.3 Terminate cables in accordance with Section 26 05 05 – Basic Materials and Methods.

3.6 INSTALLATION OF ARMOURED CABLE

.1 Group cables wherever possible.

.2 Terminate cables in accordance with Section 26 05 05 – Basic Materials and Methods.

.3 Shall only be permitted for the final connection to light fixtures and the length of the drop shall not exceed 3 meters. Armoured Cable commonly known as BX shall not be permitted for any other use on this Contract.

3.7 INSTALLATION OF MINERAL INSULATED CABLE

.1 Install cable exposed, as indicated in the Contract Documents and securely supported by stainless steel straps. Strap cable every 4 feet along the length of the cable with stainless steel straps.

.2 Make cable terminations by using factory-made kits.

.3 At cable terminations use thermoplastic sleeving over bare conductors.

.4 Where cables are embedded in cast concrete or masonry, provide a sleeve for the entry or exit of cables.

.5 Do not splice the cables.

3.8 CLEANING

.1 Progress Cleaning: clean in accordance with Division 01 General Requirements section.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Division 01 General Requirements section.

3.9 PROTECTION

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

END OF SECTION

1 General

1.1 SUMMARY

.1 This section specifies the requirements for electrical grounding for the project.

1.2 RELATED REQUIREMENTS

.1 Section 26 05 05 – Basic Materials and Methods

.2 Division 26 – Electrical

.3 Division 27 – Communications

.4 Division 28 – Electronic Safety and Security

1.3 REFERENCE STANDARDS

.1 American National Standards Institute /Institute of Electrical and Electronics Engineers (ANSI/IEEE)

.1 ANSI/IEEE 837-02, IEEE Standard for Qualifying Permanent Connections Used in Substation Grounding.

1.4 ACTION SUBMITTALS

.1 Submit in accordance with Division 01 General Requirements section.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for grounding equipment and include product characteristics, performance criteria, physical size, finish and limitations.

1.5 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Division 01 General Requirements section.

.2 Operation and Maintenance Data: submit operation and maintenance data for grounding equipment for incorporation into manual.

1.6 STORAGE, DELIVERY, HANDLING AND PROTECTION

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

.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 grounding equipment from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

2 Products

2.1 EQUIPMENT

.1 Clamps for grounding of conductor: Size as required to electrically conductive underground water pipe.

.2 Copper conductor: minimum 6 m long for each concrete encased electrode, bare, stranded, tinned, soft annealed, size as required.

.3 Rod electrodes: Copper clad steel 19 mm diameter by minimum 3 m long.

.4 Grounding conductors: Bare stranded copper, tinned, soft annealed, size as indicated.

.5 Insulated grounding conductors: Green, copper conductors, size as indicated.

.6 Ground bus: Copper, size as indicated, complete with insulated supports, fastenings, connectors.

.7 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.

.4 Compression type conductor connectors.

.5 Thermit welded type conductor connectors.

.6 Bonding jumpers, straps.

.7 Pressure wire connectors.

3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: Verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for grounding equipment installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Owner.

.2 Inform Owner of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Owner.

3.2 INSTALLATION GENERAL

.1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories. Where EMT is used, run 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. Alternate compression type connection by Burndy is acceptable.

.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 one end 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 or approved mechanical connector.

.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 provide non-metallic entry plate at load end.

.13 Ground secondary service pedestals.

3.3 ELECTRODES

.1 Make ground connections to continuously conductive underground water pipe on street side of water meter.

.2 Install water metre shunt.

.3 Install concrete encased electrodes in building foundation footings, with terminal connected to grounding network.

.4 Install rod electrodes and make grounding connections as indicated.

.5 Bond separate, multiple electrodes together.

.6 Use size 4/0 AWG copper conductors for connections to electrodes.

3.4 SYSTEM AND CIRCUIT GROUNDING

.1 Install system and circuit grounding connections to neutral of secondary Three (3) phase, Four (4) wire 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, , distribution panels, outdoor lighting, cable trays.

3.6 GROUNDING BUS

.1 Install copper grounding bus mounted on insulated supports on wall of electrical room and communication equipment room.

.2 Ground items of electrical equipment in electrical room and IT equipment in communication equipment room to ground bus with individual bare stranded copper connections size 2/0AWG.

3.7 COMMUNICATION SYSTEMS

.1 Install grounding connections for telephone, sound, fire alarm, security systems, intercommunication systems as follows:

.1 Telephones: make telephone grounding system in accordance with telephone company's requirements.

.2 Sound, fire alarm, security systems, intercommunication systems as indicated.

3.8 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 – General Electrical Requirements.

.2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Owner and local authority having jurisdiction over installation.

.3 Perform tests before energizing electrical system.

.4 Disconnect ground fault indicator during tests.

3.9 CLEANING

.1 Progress Cleaning: clean in accordance with Division 01 General Requirements section.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Division 01 General Requirements section.

END OF SECTION

1 General

1.1 GENERAL

.1 All conditions of the Contract apply to the work of this Section.

1.2 REFERENCES

.1 The following standards are applicable to the collection of data, modeling, calculation, and evaluation methodology required for the analysis. The Engineering Contractor is expected to know and utilize the best practices and methods outlined in these standards.

.1 OESC, Ontario Electrical Safety Code

.2 CSA Z462 – 18 and NFPA 70E – Standard for Electrical Safety in Workplace.

.3 CAN/CSA-Z460 - Control of Hazardous Energy - Lockout and Other Methods

.4 IEEE 1584 - IEEE Guide for Performing Arc Flash Hazard Calculations.

.5 NETA International Electrical Testing Association Standards for Power System Studies for requirement specified under the specification.

.2 Where references to Codes and Standards are made, the latest version shall be applicable for the purposes of this specification.

1.3 SCOPE

.1 This specification defines the minimum technical requirements governing the performance of a complete Electrical Systems Analysis for the existing building and new construction.

.2 Construct a comprehensive and up-to-date electrical distribution system Single Line Diagram (SLD) using AutoCAD for area of work within facility. The SLD shall include all major electrical equipment.

.3 A Short Circuit and Protective Device Coordination study for the electrical distribution system shall be performed before performing the Arc Flash Risk Assessment. The intent of the Short Circuit Study is to identify underrated equipment and to increase facility reliability, equipment protection and personnel safety. The intent of the Protective Device Coordination Study is to increase facility reliability by limiting the effects of a fault to the smallest portion of the distribution system.

.4 Device Short Circuit ratings identified on the drawings and specifications shall be the minimum acceptable ratings and it is the responsibility of the power system provider to indicate required Short Circuit ratings for all distribution equipment.

.5 Perform an Arc Flash Risk Assessment for the area of work within facility electrical distribution system based on the up-to-date Single Line Diagram. The intent of the Arc Flash Risk Assessment is to determine the level of hazard that exists at each major piece of electrical equipment shown on the Single Line Diagram and/or information collected on site. This includes distribution panels, panelboards, disconnects, cables and transformers. It is the responsibility of the contractor to collect data, model, and recommend components of the power system not included in the area of work deemed significant to the results of the power study.

.6 The Arc Flash Risk Assessment shall consider all expected operating scenarios during normal conditions, alternate operations, emergency power conditions, and any other operations, which could result in maximum arc flash hazard. The Arc Flash warning labels shall list the maximum incidental energy calculated and the scenario from which it is derived shall be documented in the final report. The following is a sample list of common operating scenarios:

.1 Maximum and Minimum Utility Fault Conditions

.7 Coordinate with the Local Power Utility Company and obtain required information such as available short circuit current, design fault level, etc. (from supply authority) and equipment (service transformer, cabling and protective devices) installed by the utility for completing study.

.8 Any available documented information pertaining to existing equipment shall be provided by the Owner. Any outstanding data shall be collected on site by the Electrical Contractor (or his representative who is undertaking the analysis).

.9 It is the Contractor's responsibility to obtain qualified and competent personnel to safely perform on-site data collection without hindering the Owner's normal operations.

.10 A detailed report shall be provided to the Owner at the completion of the study. The report shall contain and list all electrical equipment modeled in the study and the results of the Short Circuit study, Protective Device Coordination, and Arc Flash study.

.11 Recommendations shall be included in the report to mitigate any hazard above an incident energy of 12 cal/cm^2 at the specified working distance. Solutions shall be cost-effective, and mindful of the operating and maintenance requirements. For new construction projects, these recommendations shall be documented in sufficient time for changes to be made in the power system design to avoid creating a location of high hazard.

.12 The study will include the creation of Arc Flash Hazard and Shock Warning Labels. These labels serve as a guide to assist technicians and others in the selection of proper Personal Protective Equipment when working on and around exposed and energized conductors and equipment.

.13 The Labels will be produced and installed by the Contractor as required by applicable regulatory standards and specifications identified herein.

1.4 SUBMITTALS

.1 Submit shop drawings in accordance with Section 26 05 00 – General Electrical Requirements and the requirements of Division 01.

.2 Reports shall be submitted as Shop Drawing submissions and shall include:

- .1 Short Circuit Study.
- .2 Protective Device Coordination Study.
- .3 Arc Flash Hazard Study (including Arc Flash Hazard Labels)

.3 Final reports shall be submitted with close out documents as hard copies and pdf file.

1.5 QUALITY ASSURANCE

.1 The electrical system analysis shall be performed using SKM Power Tools, ETAP, Paladin, or an equivalent commercially available Arc Flash Software package. The use of single point software or CSA Z462 Task Tables to determine Arc Flash Hazard Classification is not acceptable.

.2 The analysis shall be completed by one of the following Companies:

- .1 G.T.Wood Company Limited
- .2 Spark Power Corp.
- .3 Brosz Technical Services Inc.
- .4 K-Tek Electro Services
- .5 Alternates: not allowed

.3 The Study shall be prepared and/or reviewed by a Professional Electrical Engineer (licensed in the province of Ontario) who has relevant work experience and academic background in the power systems industry. Relevant work experience shall be at least five years of experience in power system analysis.

2 Products

2.1 SHORT CIRCUIT STUDY

.1 A Short Circuit Study shall be performed on the equipment as per the up-to-date Single Line Diagram.

.2 The short circuit current available at each bus in the system shall be calculated per the applicable standards. The results shall be compared with the equipment short circuit ratings as per IEEE Standard 1015 and IEEE Standard 242 to ensure that all equipment is compliant with rule 14-012 of the Ontario Electrical Safety Code. Verify that the equipment is properly rated for the available bolted three phase short circuit current.

.3 The short circuit study shall consider all potential fault current sources. Motors less than 50HP will not be considered a significant source.

.4 The study will be continued downward into the system until a 100A bus is reached at the 208 volt level. Only the largest or slowest protective device on each bus needs to be represented in the study.

.5 Short circuit calculations shall be based on transient and sub-transient impedances of fault sources. X/R ratio analysis shall be used where asymmetric fault current may be an issue.

.6 Where actual equipment data is not available, the IEEE Gray Book shall be used as an alternate source. This shall be documented in the report.

.7 Recommendations from the Short Circuit Study shall be provided.

2.2 PROTECTIVE DEVICE STUDY

.1 A Protective Device Coordination Study shall be performed for the equipment as per the up-to-date Single Line Diagram.

.2 The study shall include the main service and secondary switchgear for the facility. Utility protective devices and short circuit levels shall be included in the study. The results of this analysis will be documented in a log-log TCC (time current curve) representation including all cables, transformation, cables, circuit breakers and fuses. Where grounding protection is applicable, it shall also be included. This information shall be included in the final report.

.3 For each TCC graph, a complete title and single line diagram with legend identifying the specific portion of the system covered.

.4 Identify the device associated with each curve by type, function, and if applicable, tap, time delay, and instantaneous settings recommended.

.5 The study will be continued downward into the system until a 100A bus is reached at the 208 volt level. Only the largest or slowest protective device on each bus needs to be represented in the study.

.6 All protective devices settings and ratings shall be documented in the report.

.7 Any miss-coordination uncovered shall be depicted in a log-log TCC plot showing the details of the miss-coordination and description of the situation along with a recommended solution and anticipated improvement.

.8 Recommended settings for the protective devices shall be provided to improve the situation.

2.3 ARC FLASH HAZARD STUDY

.1 The Arc Flash Hazard Study shall be performed once the Short Circuit Study and the Protective Device Coordination Study have been completed.

.2 Pertinent data, rationale employed, and assumptions in developing the calculations shall be incorporated in the final report.

.3 The analysis shall be in accordance with latest applicable IEEE 1584 and CSA-Z462 Standards.

.4 Best practices and guidelines identified in IEEE 1584 shall be utilized to provide accurate and usable results.

.5 The Engineering Contractor shall analyze and make practical and cost-effective recommendations to reduce the hazard potential for any location above an incident energy of 12 cal/cm2.

.6 Design and print Arc Flash Warning Labels.

2.4 STUDY ANALYSIS

.1 Submit preliminary report of short circuit analysis to verify short circuit withstand ratings specified for electrical equipment provided under this Contract. Submit report before starting manufacturing or placing purchase orders with suppliers.

.2 Final report to include written summary of:

.1 Scope of studies performed.

.2 Explanation of bus and branch numbering system.

.3 Prevailing conditions.

.4 Selected equipment deficiencies.

.5 Results of short circuit and co-ordination studies.

.6 Comments or suggestions.

.3 Suggest changes and additions to equipment rating and/or characteristics.

.4 Notify the Consultant in writing of circuit protective devices improperly rated for new fault conditions.

2.5 ARC FLASH HAZARD LABELS

.1 Labels are required on:

.1 Power distribution equipment

.2 Control cabinets

.3 Distribution and lighting panels

.4 Equipment disconnects

.5 Equipment where access to energized electrics is required

.2 Labels are not required on:

.1 Enclosed equipment not required to be serviced while energized

.2 Motor terminal boxes

.3 120 volt receptacles

.4 Conduit fittings or pull boxes

.5 Lighting fixtures

.3 Where equipment is composed of multiple sections, cubicles or doors, warning labels shall be installed such that the hazard is readily observed upon opening of any enclosure door or panel.

.4 All equipment shall have a label containing information from the worst case scenario analysis.

.5 Units on label will be in millimeters and calories per centimeters squared. Distances shall be rounded to the nearest whole number. Incident energy level shall have decimals rounded to the nearest tenth.

.6 Arc Flash and Shock Hazard Labels shall be printed in a format to that shown in Figure 1. Labels will contain information including:

.1 The heading “ARC FLASH and SHOCK HAZARD”

.2 Incident Energy

.3 Working Distance

.4 Arc Flash Boundary

.5 Shock Hazard Potential

.6 Shock Insulation Class

.7 Limited Approach Boundary

.8 Restricted Approach Boundary

.9 Method of Arc Flash calculation

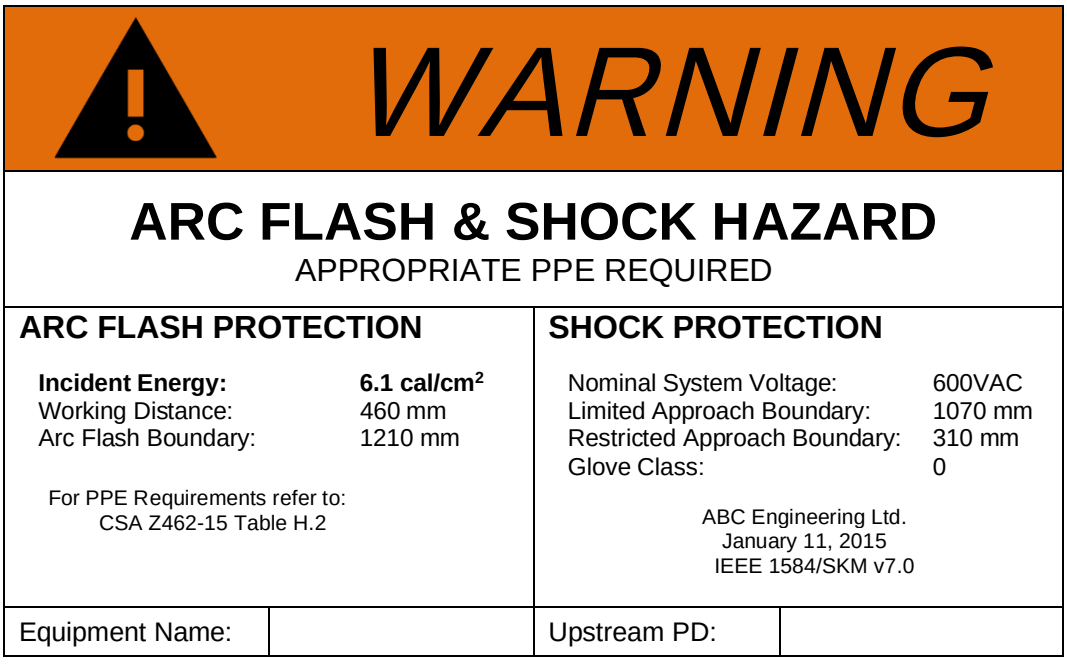
.10 Date of Study

.11 Firm Preparing the Study

.12 Name of Panel/Bus/Equipment

.13 Name of Upstream Protective Device

FIGURE 1: Arc Flash and Shock Hazard Label Standard



3 Execution

3.1 SITE ACCESS

.1 All site access will be coordinated through a designated representative of Owner and confirmed in advance. The Contractor shall take reasonable care to minimize disruption to the building occupants and operation. All inquiries, direct communication for all approvals, concerns and general management issues of the projects will also be directed to the Board's representative. Contact information will be given to the successful contractor upon award of the Contract.

.2 Program all protective relays according to values established by the co-ordination study. Provide list of parameter settings to the Engineer for review.

.3 Make modifications to equipment as required to accomplish conformance with the short circuit and protective device co-ordination studies.

.4 Notify the Consultant in writing of any required major equipment modifications.

.5 post arc flash labels on the electrical equipment.

3.2 ARC FLASH HAZARD LABEL INSTALLATION

.1 After the report, including a copy of the Arc Flash Hazard and Shock Warning Labels, is approved by the Consultant, the labels shall be installed.

.2 The Contractor shall arrange with the Owner for access and install labels as indicated in the Arc Flash Risk Hazard report. They shall be installed prominently where personnel has to access the energized equipment. Bus or panel names on the label shall be the same as on the bus or panel enclosure and consistent with the bus or panel name on the Single Line Diagram.

.3 The label installer shall clean and otherwise prepare the surface for effective and permanent installation. The label installer shall be issued with a concise Arc Flash summary sheet outlining the panel names and the calculated incident energy level.

3.3 FIELD QUALITY CONTROL

.1 The Analysis Engineer (or his designate) will inspect the work when complete to ensure that;

.1 All equipment modeled in the analysis has a correct label as indicated in the report.

.2 Warning Labels have been installed as per applicable standards.

.3 All required equipment has been included in the analysis.

END OF SECTION

1 General

1.1 SCOPE

.1 Provide commissioning of electrical systems provided under Division 26 and 28.

.2 The Contractor shall perform electrical system installation, start-up, testing, preparation of O&M manuals and operator training, and the coordination of the commissioning process the responsibility of the General contractor

.3 Include all labor and material as required to participate in the commissioning process, as outlined in this section, for equipment installed under Division 26 and responsibilities prescribed for the electrical contractor in Division 01 General Requirements section.

1.2 RELATED WORK

.1 Commission electrical equipment and systems in conjunction with: Specification Section of Division 1 - General Commissioning Requirements and Commissioning for LEED requirements.

.2 This Section of the specification shall be read in conjunction with all other Sections of the Division 26, and 28 - Electrical Specifications, which include details of specific tests / inspections to be performed on various equipment /systems in addition to those specified in this Section.

1.3 COORDINATION

.1 Coordinate the work of this Section with all other Divisions to ensure complete and operational electrical systems at completion of this work.

.2 Review the design intent of the project and the intended operation of systems with Police Training Facility representative and the Consultant before proceeding with commissioning.

1.4 COMMISSIONING PROCESS

.1 Commissioning Mandate for Electrical Systems: to ensure that all project systems perform interactively and in strict accordance with the design intent and latest OESC requirements for life safety equipment and owner’s operational needs as set forth in the Contract Documents.

.2 Commissioning procedures are in accordance with this Section.

.3 The Commissioning process develops, coordinates, and documents the following:

- .1 Shop drawings and record drawings
- .2 Start up, installation inspection and equipment verification and/or system and calibration
- .3 Check sheets and testing forms
- .4 Testing of equipment and systems
- .5 Functional and Performance Testing
- .6 Commissioning meetings and reporting
- .7 Operation documentation
- .8 Operator training
- .9 Warranties

.4 The Commissioning Program is divided into the following parts:

- .1 Part 1: Shop drawings and record drawings
- .2 Part 2: Factory Testing

.3 Part 3: Pre-Start and Start-Up testing

.4 Part 4: Installation Verification testing

.5 Part 5: Functional testing

.6 Part 6: Systems Operating Manuals

.7 Part 7: Operator Training

.8 Part 8: Warranties

1.5 WORK INCLUDED

.1 Commissioning work of Division 26 includes, but is not limited to:

.1 Shop drawing review for Mechanical and Electrical coordination.

.2 Participation in regular construction meetings as well as separate Commissioning Meetings during the construction period associated with the scheduling, coordination, and implementation of the various commissioning activities within the overall construction program.

.3 Factory Testing of equipment as described under various equipment specifications.

.4 Site Testing and start-up of equipment.

.5 Detailed acceptance testing as described under various equipment specifications including supplementary testing required by Commissioning Authority

.6 Cooperation with the Commissioning Authority in developing and implementation of the commissioning plan.

.7 Providing qualified personnel for participation in implementing commissioning test procedures.

.8 Providing equipment, materials, and labor as necessary to correct construction and/or equipment deficiencies found during the commissioning process.

.9 Providing operation and maintenance manuals and as-built drawings to the Commissioning Authority for verification in a timely manner.

.10 Providing training and demonstrations for the systems specified in this Division prior to turnover to Owner.

.2 Conduct complete and thorough evaluation and documentation of the operation and performance of all components, systems, and sub-systems, including the following equipment and systems:

.1 Low Voltage Switchboards

.2 Dry Type Transformers primary up to 600V

.3 Fire Alarm System

.4 Power and lighting panels

.5 Lighting System

.6 Emergency Lighting System

.7 Lighting Control System

.8 Power Monitoring System

.3 Commission all equipment supplied under the Contract by the Contractor, as well as any equipment, pre-purchased, or pre-ordered by the Owner. Provide skilled trades people to operate various related electrical equipment in support of the commissioning program.

.4 Commission services to equipment, but not the equipment itself, where the supply of the equipment does not form part of the electrical Work. Provide skilled trades people to operate various related electrical equipment in support of the commissioning activities of other trades.

.5 Provide the following commissioning documentation:

.1 recording completed Pre-start and Start-up procedures test results,

.2 record completed Installation Verification and Performance Validation, as well as Functional test results, and Certificates

.3 As-built records.

.4 Operation and maintenance manuals

.6 The final commissioning report will be prepared by the Commissioning Consultant.

1.6 EXCLUDED WORK

.1 Unless otherwise specified, equipment which is not supplied by the electrical contractor or their sub-trades, where the value for the supply of equipment is not included as part of the Work, such as:

.1 Supplied by Owner (SBO) equipment,

.2 Equipment marked Not in Contract (NIC) or Not in Electrical Contract (NIEC).

1.7 REQUIRED INFORMATION AND COMMISSIONING PREREQUISITES INFORMATION

.1 A complete shop drawing submission schedule shall be submitted to the Commissioning Authority.

.2 Approved construction administration shop drawing shall be submitted to the Commissioning Authority two weeks before the production release of each item.

.3 A complete set of accurate "as built" drawings must be transmitted to commissioning consultant/authority a minimum of 31 Days prior to the anticipated date of Substantial Performance of the Work.

.4 A copy of all equipment specifications must be transmitted to commissioning consultant a minimum of 31 Days prior to the anticipated date of Substantial Performance of the Work.

.5 All "sequence of operation" narratives must be submitted to the commissioning consultant a minimum of 31 Days prior to the anticipated date of Substantial Performance of the Work.

.6 A copy of all Factory Acceptance Test (FAT) reports must be completed, reviewed by the Consultant, and transmitted to commissioning consultant a minimum of 31 Days prior to the anticipated date of Substantial Performance of the Work.

.7 A copy of all site startup reports must be transmitted to the commissioning consultant a minimum of 5 Working Days prior to the anticipated date of Substantial Performance of the Work.

1.8 DEFINITIONS

.1 Major deficiency – an item which if not corrected renders the equipment or system unsuitable or un-safe for use by the Owner. Major deficiencies must be corrected as a condition for achieving Substantial Performance of the Work.

.2 Minor deficiency – an item which does not impact on the operation of the equipment or system and will allow the Owner to use the system safely. Minor deficiencies may be corrected before or after Substantial Performance but will not prevent certification of Substantial Performance of the Work.

1.9 COMMISSIONING SCHEDULE

.1 Provide a detailed commissioning schedule for consolidation into the main construction schedule.

.2 Include:

.1 equipment and systems start-up predecessors

.2 Time periods for pre-start and start up testing, verification and validation testing for each equipment and system.

1.10 DOCUMENTATION DELIVERABLES

.1 Identify documents including test documents, binder covers, etc. using equipment ID numbers provided on equipment schedules.

.2 Scan original signed test reports, including verification and performance and / or functional test reports, manufacturers service reports, etc. in Adobe Acrobat *.pdf version 8 format. For original document chapters, provide Adobe chapter referencing.

.3 Submit three (3) copies of each completed and accepted Verification and Functional Performance Test reports, both preliminary and final issues.

.4 Collate final, accepted and signed test results in separate binders as follows:

.1 Electrical Systems

.2 Fire Alarm Systems

.5 Provide PDF copies of commissioning documentation.

1.11 SUBSTANTIAL PERFORMANCE

.1 Refer to project commissioning requirements specified in the Contract Documents.

.2 Application for Substantial Performance of the Work is contingent on the Work being ready for Owner's use which includes completion of the following commissioning elements:

.1 Start-Up and testing

.1 Commissioning Verification testing including submission of completed records,

.2 Commissioning Performance Validation testing including submission of completed records, except for alternate season tests,

.3 Commissioning Controls Validation testing,

.4 Training of Owner's operations personnel,

.5 As-built documentation issued for Consultant's review,

.6 Operations and Maintenance manuals which have been reviewed by the Consultant and accepted by the Owner.

1.12 TEST EQUIPMENT

.1 The Contractor shall provide all labour and materials, tools and equipment required during the various stages of pretesting, startup, and commissioning processes.

.2 Provide any test equipment and software required for pretesting and start-up, whether specified or not.

.3 Ensure that the manufacturer provides test equipment and personnel as required for the startup and testing of their equipment and assists in the commissioning process as needed.

.4 Ensure that Manufacturer provides test equipment, demonstrates its use, and assists in the commissioning process as needed.

2 Organization

2.1 GENERAL

.1 Complete all phases of work so that the systems can be started, tested, and verified for alarm or status monitoring by the Building Automation System (BAS) and fire alarm systems as applicable, and the Commissioning procedures can be undertaken in a timely manner such that only one acceptance test is conducted at any one time. Provide supplementary testing as required to ensure all BAS and fire alarm system monitoring of electrical equipment status points are verified to demonstrate all operating status and alarm conditions.

.2 Participate and assist in the development of the Commissioning Schedule by the Construction Manager, by providing necessary information pertaining to the equipment and installation. Provide commissioning schedule information to be incorporated into the overall Construction Plan Schedule.

.3 Acceptance procedures may begin prior to completion of a system and/or sub-system. Start of acceptance procedures before system completion does not relieve the Contractor from completing those systems in accordance with the commissioning and construction schedule.

2.2 PARTICIPANTS

.1 Commissioning Team consists of multiple parties with separate responsibilities.

.2 Owner:

.1 establishes acceptance criteria,

.2 provides operations staff to receive training, and to witness any or all tests at their discretion,

.3 Final acceptance of commissioning results.

.3 Consultant:

.1 Responsible for the construction review activities in accordance with local building code requirements,

.2 May participate in development and / or review of commissioning procedures,

.3 reviews pre-startup, testing, and commissioning test results,

.4 General Contractor and the Consultant

.1 Develops and/or approves the commissioning plan and procedures,

.2 Coordinates Owner's commissioning team members who witnesses tests,

.3 Witnesses commissioning tests to confirm compliance by the Contractor to the Commissioning Plan,

.4 Reviews commissioning test results and makes recommendations to the Owner and/or Acceptance Authority for acceptance,

.5 Monitors the progress of the commissioning work and reports to the Owner.

.6 Accepts the commissioning test results on behalf of the Owner.

.5 General Contractor:

.1 Coordinates and manages commissioning activities,

.2 Develops and integrates commissioning activities into the construction schedule,

.3 Ensures commissioning procedures are completed and documented, and commissioning records including any required attachments are submitted.

.6 Contractor:

.1 Provides the services of qualified technician(s) who are familiar with the construction and operation of the system, to start-up and debug equipment and systems within the Division 26 scope of Work. Include work of Independent testing contractors, ITC. Include for labour, materials, and subsistence costs for these same technicians to assist the Commissioning Authority in completing the commissioning program.

.2 Provide access to the contract plans, shop drawings, and equipment cut sheets of all installed equipment.

.3 Ensures the qualified technician(s) are available and present during commissioning testing to complete the tests, make adjustments and to assist in problem resolutions.

.4 Should any equipment or system experience performance problems and/or reconstruction or replacement is required, include for additional technician time for subsequent retesting of systems until required system performance is achieved.

.5 The Commissioning Authority reserves the right to approve proposed technicians with regard to the technical skill level required for each type of equipment and/or system, and willingness by the individual(s) to work within the Commissioning Group.

.6 Provides a foreman electrician familiar with the electrical interlocks, interfaces with emergency power supply, and interfaces with BAS, alarm, and life-safety systems. Provide access to the contract plans, and all as-built schematics of sub-systems, interfaces and interlocks.

.7 Independent Testing Contractor

.1 The Independent Testing Contractor (ITC) shall be hired by the Electrical Contractor to provide the coordination study, the Arc Flash study, testing, verification and calibration of the electrical system, and to issue reports to the Design Consultant and Commissioning Authority.

.2 The ITC shall conduct, as detailed in the specification 26 05 10, the Arc Flash study, and a coordination study and issue a report as a shop drawing submission and also provide testing, verification and calibration of the electrical system and issue reports to the Design Consultant and Commissioning Authority.

.8 Equipment suppliers:

.1 Provide the services of manufacturers' service personnel to provide assistance with pre-start and initial start-up of the equipment, and to undertake operation of equipment as part of the acceptance and commissioning testing program as required.

3 Execution

3.1 COMMISSIONING MEETINGS

.1 Participate in periodic commissioning team meetings, and trade commissioning meetings.

.2 Construction and Post-Construction:

.1 Participate in commissioning meetings as scheduled by the Construction Manager.

.2 participate in trade commissioning meetings as required, in addition to the regular commissioning team meetings,

.3 Identify to the commissioning group problems relating to the commissioning schedule, identification of start-up issues, etc, and participate in the resolution of these problems.

3.2 COMMISSIONING PROCEDURES

.1 The commissioning process shall meet the requirements of ANSI/NETA ATS – 2009 Standards for Acceptance Testing of Electrical Systems except as specifically modified by this specification.

.2 The Contractor shall prepare a detailed Commissioning Schedule for commissioning of all electrical systems and equipment in coordination with the Construction Manager's schedule and to the approval of Commissioning Authority. Update the schedule as appropriate through the construction period.

.3 Shop Drawings and Record Drawings

.1 Prepare record documentation for each equipment installation covering:

.1 Equipment identification and supplier.

.2 Shop Drawing submittal, review, production release coordination, and delivery dates.

.3 Dates for completion of all work required preparing for equipment installation.

.4 Dates for equipment installation, supplier prestart checkout, and system availability for start-up.

.5 Dates for equipment start-up, performance testing, proposal for temporary use, acceptance testing, demonstration, turnover and warranty start / finish.

.2 Submit proposed record sheets and procedures to Commissioning Authority for review and approval.

.3 List all specialist personnel and equipment required for the tests, and ensure that these are available by the test dates.

.4 Provide documentation of the commissioning process and include in maintenance manuals. These are to include check sheets, equipment data sheets, start-up certificates from suppliers involved in start-up, and documentation concerning demonstration to the Owner's O&M Personnel. Include all record and result sheets from commissioning tests.

.5 Maintain a log of key operating parameters, problems encountered, solutions employed and verification of effectiveness of solutions. Include log in maintenance manuals.

.6 Submit templates for all documentation including record sheets, check sheets, commissioning reports etc. to Commissioning Authority for approval. Meet Commissioning Authority's requirements for level of reporting.

.4 Check sheets and Testing Forms

.1 The Contractor and manufacturers shall fill out the check sheets and test forms listed in this section or provide other forms. The Consultant and the Region must approve the forms before they are used.

.2 The Commissioning Authority will randomly confirm that check sheets are complete and accurate. In the event that false or incomplete check sheets are submitted, ALL check sheets will be rejected. The contractor will be required to resubmit new check sheets for all similar systems. All cost incurred by the contractor with processing and rechecking false or incomplete check sheets will be to the contractors account.

.5 The Owner's designated Commissioning Authority provides the approved commissioning procedures (checklists, etc) for use by the contractor.

.6 Each commissioning procedure tests the equipment and systems, and consists of the following elements:

.1 Document sign-off

.2 Pre-start and Initial test

.3 Installation Verification - Equipment

.4 Installation Verification - Systems

.5 Performance Validation

.6 Appendices

.7 Document Sign-Off:

.1 each completed procedure is signed off by the following parties:

.1 Contractor, for testing,

.2 Independent testing organization for review of factory test report, witness the factory testing and testing.

.3 Commissioning Authority/Consultant, for review and witnessing,

.4 Owner, for test acceptance.

.8 Pre-Start and Initial Test:

.1 Checklists included: confirmation of authorities inspections, pre-start safety checks (where applicable), system cleaning and pressure testing, and confirmation of availability of supporting systems.

.9 Installation Verification - Equipment

.1 Checklists to verify the installation of equipment, including: design specification requirements, drawing requirements, manufacturer installation requirements, and other experience-related items.

.2 Use of pre-printed manufacturer installation and start-up checklists are permitted and encouraged; however, the commissioning procedure checklists may contain supplemental items.

.10 Installation Verification - System:

.1 Checklists to verify the installation of the system associated with the equipment.

.11 Functional Test Plans:

.1 Specific test procedures and record documentation requirements for performance measurements of the various systems.

.12 Appendices:

.1 Collate test reports from authorities having jurisdiction, manufacturer start-up and test reports, balancing reports, etc.

3.3 COMMISSIONING TEST METHODOLOGY

.1 Step 1: Notify the required attendees in accordance with an agreed schedule and notification period when testing will begin on each procedure type. The Commissioning Consultant will witness the testing on an audit basis, including the first instance, the last instance, and at random during other times.

.2 Step 2: complete the commissioning procedures including recording results, and sign-off and date separately the completion of Part “A” Verification, and Part “B” Validation. Any deficiencies discovered during this testing are to be corrected prior to sign-off of the test.

.3 Step 3: on completion of systems which do not require witness demonstration, finalize the report and submit to the General Contractor for review.

.4 Step 4: on completion of systems which have been witnessed by the required reviewers the General Contractor is to sign-off the completed procedure document as being witnessed.

3.4 COMMISSIONING IMPLEMENTATION

.1 Conduct operating tests and checks to verify that all components, equipment, systems, and interfaces between systems, operate in accordance with contract documents.

.2 Demonstrate and verify operating modes, interlocks, specified control sequences, specific responses to abnormal or emergency conditions, and verification of the proper response to the Building Automation System, security system, and fire alarm system as applicable.

.3 Roles and Responsibilities:

Organized by:	**Construction Manager**
Approved Test sheets provided by:	Commissioning Authority
Testing Conducted by:	Contractor Equipment Suppliers Technical Personnel as appropriate Independent Testing Organization as specified
Testing recorded by:	Contractor Equipment Suppliers Technical Personnel as appropriate Independent Testing Organization as specified Commissioning Authority
Tests witnessed by:	Commissioning Consultant/Authority Owner (selected tests)
Reports reviewed by:	Construction Manager Commissioning Consultant/Authority

Organized by:	**Construction Manager** Design Consultant
Reports Accepted by:	Owner

3.5 OPERATING CHECKS

.1 The Commissioning Consultant witnesses equipment and system tests.

.2 Set the system equipment into operating mode to be tested including but not limited to:

.1 Normal start up, operation, and shut-down

.2 Normal auto position

.3 Normal manual position

.4 Unoccupied cycle

.5 Emergency power operation, including transition states.

.6 Status and Alarm conditions

.3 Inspect and verify the position of each device and interlock identified on the checklist.

.4 Repeat the above tests for each operating mode that applies to the system being tested.

.5 For failed test items, provide appropriate comments to the checklist data sheet and classify whether it is a “Major” or “Minor” deficiency.

.1 The Consultant retains the right to make the final decision regarding classifications of deficiencies.

.6 Test failure is defined as:

.1 Refer to relevant specification sections.

.7 Acceptance

.1 The final reports will be reviewed by the Commissioning Consultant and the Consultant, to determine if verification is complete and the operating systems are functioning in accordance with the contract documents.

.2 The Commissioning Consultant, in conjunction with the Consultant, reviews and makes final classification of all noted deficiencies. Correct deficiencies classified as “Major” before acceptance of the Verification stage.

.3 The Owner will make the final acceptance of test results.

3.6 FUNCTIONAL VALIDATION TESTING

.1 Conduct performance / functional tests and checks to validate that equipment and system components are providing the required functionality (capacity) for each equipment and system.

3.7 PROBLEM RESOLUTION

.1 In the event that additional work is required to correct either systems, misapplied or improperly installed equipment, and/or deficient performance under varying load conditions, assist the Owner and Commissioning Consultant in developing an acceptable resolution to the problem, including the resources of equipment suppliers.

.2 The Owner has final approval over any additional work required to achieve the required level of performance.

.3 Complete corrective work in a timely fashion to permit the completion of the commissioning process.

3.8 ACCEPTANCE

.1 Any identified deficiencies will be reviewed by the Consultant in conjunction with the Construction Manager to determine if correction of the deficiency is as a result of a defect in the equipment or installation.

.2 If it is determined the performance deficiency is as a result of a defect in the equipment or its installation, rectify the deficiency and repeat the functional test until the required performance levels are functionality is achieved.

.3 If it is determined the equipment or system has been constructed in accordance with the contract documents, the Owner will decide whether to accept the functionality as is, or, direct the installation contractor to make changes to the system as required to obtain performance levels which meet the design intent, and retest the system.

3.9 POST-SUBSTANTIAL COMMISSIONING

.1 Provide commissioning after Substantial Performance of the Work:

.1 Functional testing which is weather or live-load dependent;

.2 For out-of-season system functional testing, conduct initial functional tests to demonstrate off-peak load performance. Schedule peak load performance testing over the succeeding nine (9) months to ensure all equipment is tested at peak load prior to the expiry of the warranty period.

.3 Infra-red thermal imaging of equipment under peak building live-load conditions,

.4 Alternatively, provide temporary equipment (load banks, etc) to simulate full load conditions. Submit proposed methodology for review by the Commissioning Authority and Consultant.

3.10 ADDITIONAL COMMISSIONING

.1 Additional commissioning activities may be required after completion of system functional testing. Include in the tender cost a reasonable reserve to complete this work, including assistance from manufacturers' service technicians.

3.11 SYSTEMS OPERATING MANUALS

.1 Provide Operating and Maintenance Manuals in accordance with the requirements of Division 1.

.2 The Systems Operating Manuals (SOM) are in addition to the Operating and Maintenance Manuals (OMM) required under Section 26 05 00.

.3 Conform to the specification Section 26 05 00 for the requirements of the O&M manuals. Documents such as system description, sequence of operation (including start-up and shut-down procedures) shall be compiled by the Contractor from the specification, drawings and approved shop drawings and included in the manuals after Consultant's approval.

.4 Included a list of spare parts, special tools, lubricants, etc. for each item of equipment, which has been purchased as part of the Contract.

.5 Provide a list of recommended spare parts for all equipment installed under Divisions 26, 27 and 28 to cover a period from Substantial Performance of the Work to Warranty end.

.6 Provide at minimum, the following information for recommended spare parts:

.1 Manufacturer's name, address, phone and fax numbers.

.2 Manufacturer's part name, part number, unit price, lead time, shelf life.

.3 Quantity recommended for one (1) year.

.4 Alternative suppliers of compatible parts, including local supplier name, address, phone and fax numbers.

.7 Submit preliminary list of spare parts and tools to Owner to a minimum of 30 Days prior to intended system handover to Owner. The Owner reserves the right to add to, reduce, or omit entirely, the recommendations contained on these lists.

END OF SECTION

1 General

1.1 SUMMARY

.1 All conditions of the Contract apply to the work of this Section.

1.2 RELATED WORK

.1 Section 26 05 00 – General Electrical Requirements

.2 Section 26 05 05 – Basic Materials and Methods

.3 Section 26 50 00 – Lighting

.4 Contractor shall be responsible for co-ordinating this section with all related sections.

1.3 REFERENCE STANDARDS

.1 American National Standards / Institute/Institute of Electrical and Electronic Engineers (ANSI/IEEE)

.2 Underwriter Laboratories of Canada (ULC)

.3 International Electro-technical Commission

.4 International Organization for Standardization (ISO)

.5 National Electrical Manufacturers Association (NEMA)

.6 WD1 (R2005) - General Color Requirements for Wiring Devices.

.7 Underwriters Laboratories, Inc. (UL):

.1 916 – Energy Management Equipment.

.2 924 – Emergency Lighting

1.4 SYSTEM DESCRIPTION

.1 The Lighting Control and Automation system as defined under this section covers the following equipment:

.1 Digital Room Controllers – Self-configuring, digitally addressable one, two or three relays controllers with 0-10 volt control for ballasts (if applicable) and single relay application-specific plug load controllers.

.2 Digital Occupancy Sensors – Self-configuring, digitally addressable and calibrated occupancy sensors with LCD display and two-way active infrared (IR) communications.

.3 Digital Switches – Self-configuring, digitally addressable pushbutton switches, dimmers, and scene switches with two-way active infrared (IR) communications.

.4 Digital Photosensors – Single-zone closed loop and multi-zone open loop daylighting sensors with two-way active infrared (IR) communications can provide switching or dimming control for daylight harvesting.

.5 Digital Plug Load Controllers – Self-Configuring, digitally addressable one relay controllers, specifically designed and cUL listed for use as a plug load control device.

.6 Isolated Relay Interface- A component of the Digital Lighting Management system that allows for seamless integration with third party devices such as HVAC systems of exhaust fans.

.7 Configuration Tools – Handheld remote for room configuration provides two way infrared (IR) communications to digital devices and allows complete configuration and reconfiguration of the device / room from up to 30 feet away. Unit to have Organic LED

display, simple pushbutton interface, and allow send and receive of room variables and store of occupancy sensor settings. Computer software also customizes room settings.

.8 Handheld remotes for personal control – One-button dimming, two-button on/off, or five-button scene remotes provide control using infrared communications. Remote may be configured in the field to control selected loads or scenes without special tools.

.9 Digital Lighting Management (DLM) local network – Free topology, plug-in wiring system (Cat 5e) for power and data to room devices.

1.5 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 26 05 00 – General Electrical Requirements and the requirements of Division 1.

.2 Shop drawing submission shall include:

.1 Composite wiring and/or schematic diagram of each control circuit as proposed to be installed (standard diagrams will not be accepted).

.2 Scale drawing for each area showing exact location of each sensor, room controller, and digital switch.

.3 Product Data: Catalog sheets, specifications, and installation instructions.

.4 Include data for each device which:

.1 Indicates where sensor is proposed to be installed.

.2 Prove that the sensor is suitable for the proposed application.

1.6 WARRANTY

.1 Provide a five-year complete manufacturer's warranty on all products to be free of manufacturers' defects.

2 Products

2.1 MANUFACTURERS

.1 The basis of design for the lighting controls is as indicated on drawings.

.2 Alternate Manufacturers

.1 Lutron

.2 Acuity Brands nLight

.3 Leviton

.4 Cooper iLumin Plus

.5 Or approved equivalent

.1 Any proposed substitutions shall be submitted in writing a minimum of 5 working days prior to the tender closing date for review by the consultant. Proposed alternate products must be accompanied by a review of the specification noting compliance on a line-by-line basis. Alternate systems shall not be supplied and/or installed without written acceptance by the Consultant.

.2 The Contractor shall accept responsibility and associated costs for all required modifications to circuitry, devices, and wiring. The Contractor shall provide complete engineered shop drawings (including power and control wiring) with deviations from the original design highlighted in an alternate color to the Consultant for review and approval prior to rough-in.

2.2 SINGLE/DUAL RELAY WALL SWITCH OCCUPANCY SENSORS

.1 Type DW: Manual-ON, Automatic-OFF dual technology (passive infrared and ultrasonic) wall switch occupancy sensor Furnish the Company's model which suits the electrical system parameters, and accommodates the square-foot coverage and wattage requirement for each area (and type of lighting) controlled.

2.3 DIGITAL WALL OR CEILING MOUNTED OCCUPANCY SENSOR SYSTEM

.1 Wall or ceiling mounted (to suit installation) dual technology digital (passive infrared and ultrasonic) occupancy sensor. Furnish the Company's system which accommodates the square-foot coverage requirements for each area controlled, utilizing room controllers, digital occupancy sensors and accessories which suit the lighting and electrical system parameters.

.2 Digital Occupancy Sensors shall provide graphic LCD display for digital calibration and electronic documentation. Features include the following:

.1 Digital calibration and pushbutton programming for the following variables:

.1 Sensitivity – 0-100% in 10% increments

.2 Time delay – 1-30 minutes in 1 minute increments

.3 Test mode – Five second time delay

.4 Detection technology – PIR, Ultrasonic or Dual Technology activation and/or re-activation.

.5 Walk-through mode

.6 Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the DLM local network.

.2 One or two RJ-45 port(s) for connection to DLM local network.

.3 Two-way infrared (IR) transceiver to allow remote programming through handheld commissioning tool and control by remote personal controls.

.4 Device Status LEDs including:

.1 PIR Detection

.2 Ultrasonic detection

.3 Configuration mode

.4 Load binding

.5 Assignment of occupancy sensor to a specific load within the room without wiring or special tools.

.6 Manual override of controlled loads.

.3 Units shall not have any dip switches or potentiometers for field settings.

.4 Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required.

2.4 DIGITAL WALL SWITCHES

.1 Low voltage momentary pushbutton switches in 1, 2, 3, 4, 5 and 8 button configuration; available in white, light almond, ivory, grey and black; compatible with wall plates with decorator opening. Wall switches shall include the following features:

.1 Two-way infrared (IR) transceiver for use with personal and configuration remote controls.

.2 Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall.

.3 Red configuration LED on each switch that blinks to indicate data transmission.

.4 Blue Load/Scene Status LED on each switch button with the following characteristics:

.1 Bi-level LED

.2 Dim locator level indicates power to switch

.3 Bright status level indicates that load or scene is active

.5 Dimming switches shall include seven bi-level LEDs to indicate load levels using 14 steps.

.2 Two RJ-45 ports for connection to DLM local network.

.3 Multiple digital wall switches may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required to achieve multi-way switching.

.4 The following switch attributes may be changed or selected using a wireless configuration tool:

.1 Load and Scene button function may be reconfigured for individual buttons (from Load to Scene, and vice versa).

.2 Individual button function may be configured to Toggle, On only or Off only.

.3 Individual scenes may be locked to prevent unauthorized change.

.4 Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.

.5 Ramp rate may be adjusted for each dimmer switch.

.6 Switch buttons may be bound to any load on a room controller and are not load type dependant; each button may be bound to multiple loads.

2.5 ROOM CONTROLLERS

.1 Room Controllers automatically bind the room loads to the connected devices in the space without commissioning or the use of any tools. Room Controllers shall be provided to match the room lighting load and control requirements. The controllers will be simple to install and will not have, dip switches, potentiometers or require special configuration. The control units will include the following features:

.1 Automatic room configuration to the most energy-efficient sequence of operation based upon the devices in the room.

.2 Simple replacement – Using the default automatic configuration capabilities, a room controller may be replaced with an off-the-shelf unit without requiring any configuration or setup.

.3 Device Status LEDs to indicate:

.1 Data transmission

.2 Device has power

.3 Status for each load

.4 Configuration status

.4 Quick installation features including:

.1 Standard junction box mounting

.2 Quick low voltage connections using standard RJ-45 patch cable

.5 Plenum rated

.6 Manual override and LED indication for each load

.7 Dual voltage (120/277 VAC, 60 Hz) capable or 347VAC, 60 Hz

.8 Zero cross circuitry for each load.

.2 On/Off Room Controllers shall include:

.1 One or two relay configuration

.2 Efficient 150 mA switching power supply

.3 Three RJ-45 DLM local network ports

.4 Discrete model listed for connection to receptacles, for occupancy-based control of plug loads within the space.

.1 One relay configuration only

.2 Automatic-ON/OFF configuration

.3 On/Off/Dimming enhanced Room Controllers shall include:

.1 Real time current monitoring

.2 One, two or three relay configuration

.3 Efficient 250 mA switching power supply

.4 Four RJ-45 DLM local network ports.

.5 One 0-10 volt analog output per relay for control of compatible ballasts and LED drivers.

.6 Optional Network Bridge for BACnet MS/TP communications (LMRC-3xx).

.7 The following dimming attributes may be changed or selected using a wireless configuration tool:

.1 Establish pre-set level for each load from 0-100%

.2 Set high and low trim for each load

.3 Set lamp burn in time for each load up to 100 hours

.8 Discrete model listed for connection to receptacles, for occupancy-based control of plug loads within the space.

.1 One relay configuration only

.2 Automatic-ON/OFF configuration

2.6 DIGITAL PHOTOSENSORS

.1 Digital photosensors work with room controllers to provide automatic switching or dimming daylight harvesting capabilities for any load type connected to a room controller. Closed loop photosensors measure the ambient light in the space and control a single lighting zone. Open loop photosensors measure incoming daylight in the space and are capable of controlling up to three lighting zones. Photosensors shall be interchangeable without the need for rewiring.

.2 Digital photosensors include the following features:

.1 An internal photodiode that measures only within the visible spectrum and has a response curve that closely matches the photopic curve. The photodiode shall not

measure energy in either the ultraviolet or infrared spectrums. The photocell shall have a sensitivity of less than 5% for any wavelengths less than 400 nanometers or greater than 700 nanometers.

.2 Sensor light level range shall be from 1-10,000 footcandles (fc).

.3 The capability of switching one-third, one-half or all lighting ON and OFF, or raising or lowering lighting levels, for each controlled zone, depending on the selection of room controller(s) and load binding to room controller(s).

.4 For switching daylight harvesting, the photosensor shall provide a deadband or a separation between the “ON Setpoint” and the “OFF Setpoint” that will prevent the lights from cycling after they turn off.

.5 For dimming daylight harvesting, the photosensor shall provide the option, when the daylight contribution is sufficient, of turning lights off or dimming lights to a user-selectable minimum level.

.6 Optional programmable wall switch override to allow occupants to reduce lighting level to increase energy savings or, if permitted by system administrator, raise and lower lighting levels for a selected period of time or cycle of occupancy.

.7 Infrared (IR) transceiver for configuration and/or commissioning with a handheld configuration tool, to transmit detected light level to wireless configuration tool, and for communication with personal remote controls.

.8 Red configuration LED that blinks to indicate data transmission.

.9 Blue status LED indicates test mode, override mode and load binding.

.10 Recessed switch to turn controlled load(s) ON and OFF.

.11 One RJ-45 port for connection to DLM local network.

.12 An adjustable head and a mounting bracket to accommodate multiple mounting methods and building materials. The photosensor may be mounted on a ceiling tile, skylight light well, suspended lighting fixture or backbox.

.3 Closed loop digital photosensors include the following additional features:

.1 An internal photodiode that measures light in a 100 degree angle, cutting off the unwanted light from bright sources outside of this cone.

.2 Automatic self-calibration, initiated from the photosensor, a wireless configuration tool or a PC with appropriate software.

.3 Automatically establishes setpoints following self-calibration.

.4 A sliding setpoint control algorithm for dimming daylight harvesting with a “Day Setpoint” and the “Night Setpoint” to prevent the lights from cycling.

.4 Open loop digital photosensors include the following additional features:

.1 An internal photodiode that measures light in a 60 degree angle cutting off the unwanted light from the interior of the room.

.2 Automatically establishes setpoints following calibration using a wireless configuration tool or a PC with appropriate software.

.3 A proportional control algorithm for dimming daylight harvesting with a “Setpoint” to be maintained during operation.

2.7 DIGITAL PLUG LOAD CONTROLLERS

.1 Single Relay Digital Plug Load Controllers shall include the following features:

.1 One 20 Amp relay for on/off control of connected plug loads.

.2 High efficiency 150mA power supply.

.3 cUL Listing for use with plug loads.

.4 Three RJ-45 DLM local network ports.

.1 Single relay configuration only

.2 Automatic ON/OFF configuration.

2.8 ISOLATED RELAY INTERFACE

.1 Isolated relay interface module shall include the following features:

.1 One single pole, double throw isolated relay with normally open, normally closed, and common outputs.

.2 Two RJ-45 DLM local network ports.

.3 Ability to control HVAC systems or exhaust fans using the occupancy signal of any digital occupancy sensor in the local DLM network.

2.9 ROOM NETWORK (DLM LOCAL NETWORK)

.1 The DLM local network is a free topology lighting control physical connection and communication protocol designed to control a small area of a building. Digital room devices connect to the network using CAT 5e cables with RJ-45 connectors which provide both data and power to room devices. Features of the DLM local network include:

.1 Plug n' Go automatic configuration and binding of occupancy sensors, switches and lighting loads to the most energy-efficient sequence of operation based upon the device attached.

.2 Simple replacement of any device in the network with a standard off the shelf unit without requiring commissioning, configuration or setup.

.3 Push n' Learn configuration to change the automatic configuration, including binding and load parameters without tools, using only the buttons on the digital devices in the local network.

.4 Two-way infrared communications for control by handheld remotes, and configuration by a handheld tool including adjusting load parameters, sensor configuration and binding, within a line of sight of up to 30 feet from a sensor, wall switch or IR receiver.

2.10 CONFIGURATION TOOLS

.1 A configuration tool facilitates optional customization of DLM local networks, and is used to set up open loop daylighting sensors. A wireless configuration tool features infrared communications, while PC software connects to each local network via a USB interface.

.2 Features and functionality of the wireless configuration tool shall include:

.1 Two-way infrared (IR) communication with DLM IR-enabled devices within a range of approximately 30 feet.

.2 High visibility organic LED (OLED) display, pushbutton user interface and menu-driven operation.

.3 Read, modify and send parameters for occupancy sensors, daylighting sensors, room controllers and buttons on digital wall switches.

.4 Save up to nine occupancy sensor setting profiles, and apply profiles to selected sensors.

.5 Temporarily adjust light level of any load(s)on the local network, and incorporate those levels in scene setting.

.6 Adjust or fine-tune daylighting settings established during auto-commissioning, and input light level data to complete commissioning of open loop daylighting controls.

3 Execution

3.1 INSTALLATION

.1 Do not install equipment until the following conditions can be maintained in spaces to receive equipment:

.1 Ambient temperature: 0° to 40° C (32° to 104° F).

.2 Relative humidity: Maximum 90 percent, non-condensing.

.2 When using wire for connections other than the DLM local network (Cat 5e with RJ-45 connectors), provide detailed point to point wiring diagrams for every termination. Provide wire specifications and wire colors to simplify contactor termination requirements.

.3 Install the work of this Section in accordance with manufacturer's printed instructions unless otherwise indicated.

.4 Calibrate all sensor time delays and sensitivity to guarantee proper detection of occupants and energy savings.

.1 Adjust time delay so that controlled area remains lighted for 5 minutes after occupant leaves area.

.5 Provide written or computer-generated documentation on the commissioning of the system including room by room description including:

.1 Sensor parameters, time delays, sensitivities, and daylighting setpoints.

.2 Sequence of operation, (e.g. manual ON, Auto OFF. etc.)

.3 Load Parameters (e.g. blink warning, etc.)

.6 Re-commissioning – After 30 days from occupancy re-calibrate all sensor time delays and sensitivities to meet the Owner's Project Requirements. Provide a detailed report to the Consultant / Owner of re-commissioning activity.

3.2 FACTORY COMMISSIONING

.1 Upon completion of the installation, the system shall be commissioned by the manufacturer's factory authorized representative who will verify a complete fully functional system.

.2 The electrical contractor shall provide both the manufacturer and the electrical engineer with ten working days written notice of the system startup and adjustment date.

.3 Upon completion of the system commissioning the factory-authorized technician shall provide the proper training to the owner's personnel on the adjustment and maintenance of the system.

END OF SECTION

1 General

1.1 GENERAL

.1 All conditions of the Contract apply to the work of this Section.

1.2 RELATED WORK

.1 Section 26 05 00 – General Electrical Requirements

1.3 REFERENCES

.1 CAN/CSA-C22.2 No.47 - Air-Cooled Transformers (Dry Type).

.2 CSA C9 - Dry-Type Transformers.

1.4 SCOPE

.1 Provide dry type distribution transformers as detailed herein and on drawings.

1.5 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 26 05 00 – General Electrical Requirements and the requirements of Division 1.

2 Products

2.1 MATERIAL

.1 All transformers shall meet Natural Resources Canada (NRCan) 2019 energy efficiency regulation requirements.

.2 All transformers shall be of one manufacturer. Acceptable Manufacturers: Schneider Electric, Eaton, Hammond, Rex, Delta, Bemag.

.3 All material shall be specification grade, new and carry CSA approval or special inspection approval in accordance with Electrical Safety Authority requirements.

2.2 TRANSFORMERS

.1 Type: ANN.

.2 Three (3) phase, 480 V input, 120/208 V output, 60 Hz. kVA rating as detailed on drawings.

.3 Voltage taps: standard, 2 x ±2.5% (2 FCAN, 2 FCBN).

.4 Coil Windings: Copper

.5 Insulation: Class H (220°C),

.6 Basic impulse level: Standard.

.7 Winding temperature rise 150°C .

.8 Maximum sound level: 55dB or less

.9 Enclosure: CSA Type 2 (drip proof), removable metal front panel.

.10 Mounting: wall or floor, as indicated on drawings. Transformer shall be supplied with c/w all required mounting accessories.

.11 Finish: ASA 61 baked grey powder coating.

3 Execution

3.1 INSTALLATION

.1 Mount dry type transformers up to 75 kVA floor or wall mounted as indicated on drawings. Coordinate installation with Consultant and structural trades with regards to proper load bearing.

.2 Mount dry type transformers above 75 kVA on floor. Provide 100mm (4") high concrete housekeeping pads under all floor mounted transformers

.3 Ensure adequate clearance (150mm (6”) minimum to adjacent walls) is provided around transformers for ventilation.

.4 Install transformers in level upright position.

.5 Remove shipping supports only after transformer is installed and just before putting into service.

.6 Loosen isolation pad bolts until no compression is visible.

.7 Make primary and secondary connections in accordance with wiring diagram.

.8 Energize transformers after installation is complete.

END OF SECTION

1 General

1.1 REFERENCES AND RELATED WORK

.1 Section 26 05 00 – Common Work Results – Electrical

.2 Section 26 05 27 – Substation Grounding

.3 Section 26 05 28 – Building Grounding

.4 Section 26 24 13 – Secondary Switchboard

.5 Section 26 24 16 – Distribution Panel

.6 Section 26 24 17 – Panelboards Breaker Type

.7 Section 26 24 18 – Panelboards Switch and Fuse Type

.8 Section 26 24 19 – Motor Control Centres

.9 Section 26 27 19 – Multi-Outlet Assemblies

.10 Conform to relevant sections of specifications for Division 26 and other Divisions.

1.2 SYSTEM

.1 The specifications in this section describe the electrical and mechanical requirements for a protection system provided by high-energy transient voltage surge suppressors.

.2 The specified system shall provide effective, high-energy surge current diversion and be suitable for application in ANSI/IEEE C62.41 Category B environment (as tested by ANSI/IEEE C62).

.3 The Surge Protective Device (SPD) shall consist of a high performance filter designed to provide transient voltage surge suppression and high-frequency electrical noise filtering.

.4 The specified unit shall be compatible with non-linear loads and provide high energy transient voltage suppression, surge current diversion and high-frequency electrical line noise attenuation.

.5 The unit shall be connected in parallel with the electrical distribution system.

.6 The operation of the unit shall not be affected by or interact with any other filter or harmonic reduction device installed on the electrical distribution system.

.7 The SPD unit shall be remote of panelboards and shall be manufactured by the same manufacturer. The SPD unit shall be connected to the equipment via a circuit breaker from within the equipment in order that the SPD unit can be serviced. The SPD shall be of modular design.

1.3 STANDARDS

.1 The specified system shall be designed, manufactured, tested and installed in compliance with the following codes and standards:

.1 Institute of Electrical and Electronic Engineers (ANSI/IEEE C62.11, C62.41, C62.45)

.2 American National Standards Institute.

.3 Federal Information Processing Standards Publication 94 (FIPS PUB 94).

.4 National Electrical Manufacturer Association (NEMA LS-1 1992 All Tests).

.5 MIL Standard 220A Method of Insertion Loss Measurement.

.6 Underwriters Laboratories UL 1283 and UL 1449 (most recent edition).

.7 Canadian Standards (CUL).

.8 Canadian Standards Association (CSA) CSAC22.2-Latest Edition.

.9 Ontario Hydro Electrical Safety Code Latest Edition.

1.4 PRODUCT SHOP DRAWING DATA

.1 Product data shall be submitted in accordance with Section 26 05 00 – Common Work Results - Electrical. This shall include schematic diagram and all options including indicating lights and dry contacts.

.2 Evidence of compliance to the certifications as per CSA and UL 1449 must be submitted. Manufacturer shall submit the NEMA LS-11992 test results. This will show actual test data as certified by UL and ANSI standard. Documentation must include copy of UL Listing Report. Manufacturer shall certify stating that tested product (UL tests) and delivered product both had same suppliers for raw materials and same processes to manufacture.

1.5 SUBMITTALS

.1 Product Data: Provide catalogue sheets showing voltage, physical size, Measured Limited Voltage for each waveform listed, UL1449 latest revision, latest edition, suppressed voltage ratings, dimensions showing construction, lifting and support points, enclosure details, per mode and per phase peak surge current, modes of discrete suppression circuitry, warranty period and replacement terms, conductor size, conductor type and lead length.

.2 Submit product data for all components and accessories.

.3 Manufacturer's Installation Instructions: use stipulated by product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product. Indicate maximum size of circuit breaker or fuse to be connected for each unit.

.4 List and detail all protection systems such as fuses, disconnecting means and protective features.

.5 Provide verification that the SPD device complies with the required UL1449 latest edition, latest revision, and CSA approvals.

.6 Provide actual let through voltage test data in the form of oscillograph results for the ANSI/IEEE C62.41 Category C3 & C1 (combination wave) and A1 (ringwave) tested in accordance with ANSI/IEEE C62.45.

.7 Provide spectrum analysis of each unit based on MIL-STD-220A test procedures between 10 khz and 100 khz verifying the devices noise attenuation equals or exceeds 50 db at 100 khz.

.8 Provide test report in compliance with NEMA LS1 from a recognized independent testing laboratory verifying the suppressor components can survive published surge current rating on both per mode and per phase basis using the IEEE C 62.41, 8x20 microsecond current wave. Test data must be on a complete SPD with internal fusing in place. Test data on an individual module is not acceptable.

1.6 ENVIRONMENTAL REQUIREMENTS

.1 The operating temperature range shall be -40° to 70° C (-40° to 160° F).

.2 The unit shall be capable of operation up to 13,000 feet above sea level.

.3 No appreciable magnetic fields shall be generated. Unit shall be capable of use in computer rooms without danger to data storage systems or devices.

.4 Operation shall be reliable in an environment with 5% to 95% non-condensing relative humidity.

.5 The unit shall not generate any audible noise during normal operation.

1.7 QUALITY ASSURANCE

.1 The manufacturer shall provide a full 10-year parts and labour warranty from date of shipment against failure when installed in compliance with manufacturer's written instructions, ULC listing requirements, and any applicable national or local electrical codes. Manufacturer shall make available for consultation, (local, national) engineering service support. Where direct factory employed service engineers are not locally available, travel time from the factory or the nearest dispatch centre shall be stated in the Bid form.

.2 An SPD that shows evidence of failure or incorrect operation during the warranty period shall be replaced free of charge. Since "Acts of Nature" or similar statements typically include the threat of lightning to which the SPD's shall be exposed, any such clause limiting warranty responsibility in the general conditions of this specification shall not apply to this section. That is, the warranty must specifically provide for unlimited free replacements in the event of failure caused by the effects of lightning and all other electrical anomalies. The warranty shall cover the entire device, not just various components, such as modules only.

.3 The installation of SPD's in or on electrical distribution equipment shall in no way compromise or violate equipment listing, labeling, or warranty of the distribution equipment.

1.8 MANUFACTURERS

.1 Acceptable manufacturers:

.1 Schneider Electric

.2 Eaton

.3 International Innovative Systems-Total Protection Solutions

1.9 QUALIFICATIONS

.1 The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.

.2 For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.

.3 The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Consultant, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

1.10 DELIVERY, STORAGE AND HANDLING

.1 Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of manufacturer's instructions shall be included with the equipment at time of shipment.

1.11 OPERATION AND MAINTENANCE MANUALS

.1 Equipment operation and maintenance manuals shall be provided with each assembly shipped, and shall include instruction leaflets and instruction bulletins for the complete assembly and each major component.

2 Products

2.1 PERFORMANCE

.1 General

.1 Electrical Requirements

.2 The SPD device shall be suited for operation in the following configurations; 480V VAC, 3 pole, wye, 3 wire, electrical configuration. The operating environment is classified by IEEE C62.41 as follows:

.1 Panelboards, 480V: Category B.

.2 Maximum Continuous Operating Voltage (MCOV) – The MCOV shall be 125% of the nominal system operating voltage.

.3 The suppression system shall incorporate a hybrid designed Metal-Oxide Varistors (MOV) surge suppressor at the distribution level. The system shall not utilize silicon avalanche diodes, selenium cell, air gaps or other components that may crowbar the system voltage leading to system upset or create any environmental hazards.

.4 Protection Modes – For a wye configured system, the device must have directly connected suppression elements between line-neutral (L-N), lineground (L-G), and neutral-ground (N-G). For a delta-configured system, the device must have suppression elements between line to line (L-L) and line to ground (L-G).

.4

.3 The unit shall be listed by ETL, UL, or other nationally recognized test laboratory to UL's 1283 and UL's 1449 standards (latest edition, latest revision, and not merely the components or modules.

.4 The SPD shall protect all modes L-G, L-N, L-L, and N-G, have discrete suppression circuitry in L-G, L-N and N-G, and have bidirectional, positive and negative impulse protection. Line-to-neutral-to-ground protection is not acceptable where line-to-ground is specified, and accordingly reduced mode units with suppression circuitry built into only 4 modes are not acceptable. In delta systems, line-to-ground-to-line protection is not acceptable where line-to-line is specified.

.5 Obtain all surge suppression devices through one source from a single manufacturer.

.6 No unit will be accepted unless it meets the warranty, strength, safety features, IEEE let-through levels, modes of discrete suppression circuitry, fusing, independent NEMA LS-1 per mode surge testing, and all other requirements of this specification.

.7 In compliance with NEMA LS-1-1992, each design configuration shall have the maximum single pulse surge current capacity per mode verified through testing at an independent, nationally recognized test laboratory. To be considered for approval, the manufacturer must submit a test report on a unit which was tested with internal over current fusing in place. The test shall include a UL1449 Second Edition surge defined as a 1.2 X 50 µsec 6000V open circuit voltage waveform and an 8 X 20 µsec 500A short circuit current waveform to benchmark the unit's suppression voltage, followed by a single pulse surge of maximum rated surge current magnitude with an approximated 8 X 20 µsec waveform. To complete the test, another UL1449 surge shall be applied to verify the unit's survival. Compliance is achieved if the suppression voltage found from the two UL1449 surges does not vary by more than +10%. Test data on an individual module is not acceptable.

.2 SPD Design

.1 Balanced Suppression Platform – The surge current shall be equally distributed to all MOV components to ensure equal stressing and maximum performance. The surge suppression platform must provide equal impedance paths to each matched MOV. Designs incorporating SPD modules shall not be acceptable.

.2 Electrical Noise Filter – Each unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric line noise shall be 50 dB at 100 kHz using the MIL-STD-220A insertion loss test method. Products not able to demonstrate noise attenuation of 50 dB @ 100 kHz shall be rejected.

.3 Extended Range Filter –The Surge Protective Device shall have a High Frequency Extended Range Tracking filter in each Line to Neutral mode with compliance to UL 1283 and NEMA LS1. The filter shall have published high frequency attenuation rating in the attenuation frequencies.

Attenuation Frequencys	50 kHz	100 kHz	500 kHz	1 MHz	10 MHz	100 MHz
Insertion Loss (ratio)	40	316	316	89	200	79
Insertion Loss (dB)	32	50	50	39	46	38

.4 Internal Connections – No plug-in component modules or printed circuit boards shall be used as surge current conductors. All internal components shall be hardwired with connections utilizing low impedance conductors and compression fittings.

.5 Monitoring Diagnostics – Each SPD shall provide integral monitoring options:

.6 Each unit shall provide a green / red solid-state indicator light shall be provided on each phase. The absence of a green light and the presence of a red light, shall indicate which phase(s) have been damaged.

.7 Remote Status Monitor – The SPD device must include Form C dry contacts (one normaly opened and one normally closed for remote annunciation of unit status. The remote alarm shall change state if any of the three phases detect a fault condition.

.8 Audible Alarm – The SPD shall provide an audible alarm with a reset pushbutton that will be activated under any fault condition.

.9 Push to Test – The SPD shall be equipped with push-to-test feature designed to provide users with real time testing of the suppressor's monitoring and diagnostic system. A test button shall be provided to initiate a self test procedure. If the system is fully operational, the self test will activate all indicator lights.

.10 Event Counter – The SPD shall be equipped with an LCD display system designed to indicate to the user how many surges, sags, swells and outages have occurred at the location. The events counter triggers each time under each respective category after significant event occurs. A reset pushbutton shall also be standard allowing all counters to be zeroed.

.11 Overcurrent Protection Fusing: In order to isolate the SPD under any fault condition, the manufacturer shall provide:

.12 Individual Fusing: MOVs shall be individually fused via Copper Fuse Trace. The Copper Fuse shall allow protection during high surge (kA) events.

.13 Thermal Protection: MOVs shall be equipped with Thermal Fuse Spring (TFS) Technology which allows disconnection of the suppression component at the overheated stage common during temporary over voltage condition. For small fault currents between 100 mA to 30 Amp, or if the occurrence is over a longer period of time, the TFS will

disconnect first. Manufacturers that utilize fuse trace only shall not be approved since there is no fault current protection between 100 mA to 30 A.

.14 All overcurrent protection components shall be tested in compliance with UL 1449-Limited Current Test and AIC rating test.

.15 Minimum Repetitive Surge Current Capability as per ANSI/IEEE C62.41 and ANSI/IEEE C62.45 – 1992.

.16 The suppression filter system shall be repetitive surge tested in every mode utilizing a 1.2 x 50µsec, 20 kV open circuit voltage. 8 x 20µsec, 10 kA short circuit current Category C3 bi-wave at one minute intervals without suffering either performance degradation or more than 10% deviation of clamping voltage at a specified surge current. The minimum repetitive surge current capability as per ANSI/IEEE C62.41 and ANSI/IEEE C62.45 – 1992 shall be:

.1 Branch Location Panelboard: 9000 impulse per mode.

2.2 SYSTEM APPLICATION

.1 The branch panel located SPD shall be tested and demonstrate to be suitable for ANSI/IEEE C62.41 Category C1 environments.

.2 Surge Current Capacity - The minimum total surge current 8 x 20 microsecond waveform that the device is capable of withstanding shall be as shown in the following table:

Minimum total surge current and withstand capability with compliance to ANSI/IEEE C62.41 & NEMA LS1

Application	Per Phase	Per Mode	Surge Withstand Capabilities ANSI/IEEE C3 Wave (10 kA)
Branch Locations (Panelboards)	120 kA	60 kA	9000

.3 The SPD shall not limit the use of Through-feed lugs, Sub-feed lugs and Sub-feed breaker options.

.4 The SPD shall be immediately installed on the load side of the main breaker.

.5 The panelboard shall be capable of re-energizing upon removal of the SPD.

.6 A direct bus bar connection shall be used to mount the SPD component to the panelboard bus bar to reduce the impedance of the shunt path.

.7 The SPD panelboard shall be constructed using a direct bus bar connection (cable connection between bus bar and SPD device is not acceptable). SPD units that use a cable connection do not meet the intent of this specification.

.8 The SPD shall be included and mounted within the panelboard by the manufacturer of the panelboard.

.9 The SPD shall be of the same manufacturer as the panelboard.

.10 The complete panelboard including the SPD shall be UL67 listed.

.11 Retrofit Installation (externally mounted suppressor). Maximum conductor lead length between breaker and suppressor shall not exceed 14 inches. Comply with the manufacturer's recommended installation and wiring practices.

3 Execution

3.1 EXAMINATION

.1 Factory Testing

.1 Standard factory tests shall be performed on the equipment under this section. All tests shall be in accordance with the latest version of NEMA and UL standards.

3.2 INSTALLATION

.1 The SPD shall be remote mounted to the Panelboard and shall be installed by the Contractor. Connect SPD units to circuit breaker within the equipment noted on drawings. Conductors are to be as short and straight as possible as, no greater than 18” in length. Input conductors to the SPD/filter shall be twisted to reduce impedance during high frequency filtering. Cable size shall be minimum #6 AWG.

.2 The SPD should be installed following the manufacturer's recommended practices and in compliance with all applicable codes.

3.3 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification nameplate in accordance with Section 26 05 00 – Nameplates.

END OF SECTION

1 General

1.1 SUMMARY

.1 All conditions of the Contract apply to the work of this Section.

1.2 RELATED REQUIREMENTS

.1 Section 26 05 00 – General Electrical Requirements

1.3 SUBMITTALS

.1 Shop Drawings

.1 Submit shop drawings in accordance with Section 26 05 00 – General Electrical Requirements and the requirements of Division 1.

.2 Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

1.4 QUALITY ASSURANCE

.1 Panelboards and circuit breakers shall comply with the following standards:

.1 CSA-C22.2 No. 5 - Moulded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures.

.2 CSA C22.2 No. 29 - Panelboards and Enclosed Panelboards.

1.5 SCOPE

.1 Provide circuit breaker type panelboards at locations detailed on drawings.

2 Products

2.1 GENERAL

.1 All panelboards, distribution panels and moulded case circuit breakers shall be of one manufacturer. Acceptable Manufacturers: Eaton, Schneider Electric, Siemens.

2.2 PANELBOARDS

.1 Refer to drawings for specific details pertaining to panelboards: mains rating, voltage, main lug or main breaker, flush or surface mounting, number of circuits, and number and size of branch circuit breakers. Panelboard cabinet assemble to comply with NEMA enclosure type 2 with drip shield for indoor areas, unless otherwise indicated on the Contract Drawings.

.2 All power panelboards to contain six spare circuit breakers.

.3 Install circuit breakers in panelboards and distribution panels before shipment.

.4 277/480V or 347/600V Panelboards with tin plated copper buses and bus bracing rated for a minimum 22kA (rms symmetrical) interrupting capacity. Final kA rating shall be as per short circuit and co-ordination analysis.

.5 120/208VAC panelboards: bus and circuit breakers rated for a minimum 10kA (rms symmetrical) interrupting capacity. Final kA rating shall be as per short circuit and co-ordination analysis.

.6 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.

.7 Provide two keys for each panelboard and key panelboards alike.

.8 Copper bus with neutral of same ampere rating as mains.

.9 Mains: suitable for bolt-on circuit breakers.

.10 Trim with concealed front bolts and hinges.

.11 Trim and door finish: baked grey enamel.

.12 All new panel boards that supply exterior and roof equipment are to come complete with surge protection devices.

.13 All panelboard should be equipped with main circuit breaker unless noted otherwise.

2.3 MOULDED CASE CIRCUIT BREAKERS

.1 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.

.2 Common-trip breakers: with single handle for multi-pole applications.

.3 Circuit breakers for 277/480V or 347/600V panelboards to have minimum 22kA symmetrical rms interrupting capacity rating. Final kA rating shall be as per short circuit and co-ordination analysis.

.4 Circuit breakers for 120/208V panelboards to have minimum 10kA symmetrical rms interrupting capacity rating. Final kA rating shall be as per short circuit and co-ordination analysis.

.5 Circuit breakers shall have thermal and magnetic tripping unless indicated otherwise.

.6 Main circuit breaker:

.1 Separately mounted on top or bottom of panel to suit cable entry.

.2 When mounted vertically, down position should open breaker.

.3 Provide shunt trip on main circuit breaker for panelboards serving laboratory equipment.

.7 Provide ground fault circuit breaker with 30 mA sensitivity as shown on Contract Documents. Ground fault circuit–breaker with minimum 10 kAIC at 208 V, 480 V or 600 V or in accordance with short circuit and co-ordination study.

3 Execution

3.1 INSTALLATION

.1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.

.2 Mount panelboards to height specified in Section 26 05 00 – General Electrical Requirements or as indicated.

.3 Provide a spare 32mm (1¼") EMT raceway into accessible ceiling space from each recessed panel. Provide nylon pull string in raceway and cap open end.

.4 Connect loads to circuit breakers.

.5 Connect neutral conductors to common neutral bus.

.6 Panelboards shall not be located on interior building columns within the warehouse area.

.7 All panelboards are to be located in designated electrical rooms or along dock wall (coordinated with fire sprinkler risers).

3.2 CIRCUIT BREAKERS

.1 Ensure all circuit breakers mounted in panelboard have the specified interrupting capacity required for that piece of equipment.

3.3 IDENTIFICATION

.1 Provide lamacoid nameplate on all panelboards.

.2 Provide circuit directory cards for all panelboards with typewritten directories indicating loads controlled by each circuit. Install circuit directory under plastic protective cover on front of panel.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 26 05 00 – Common Work Results - Electrical

.2 Section 26 05 00 – Nameplates

.3 Section 26 05 24 – Wiring Methods

.4 Section 26 05 32 – Outlet Boxes, Conduit Boxes and Fittings

.5 Section 26 05 39 – Under Floor Duct

.6 Conform to relevant sections of specifications for Division 26 and other Divisions.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Division 01 General Requirements section.

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Indicate type of multi-outlet assemblies with similar terminology to these documents.

1.3 1.3 QUALITY ASSURANCE

.1 Quality assurance submittals: submit following in accordance with Division 01 General Requirements section.

.1 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, cleaning procedures or any other specialty instruction.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store and handle in accordance with Division 01 General Requirements section.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

2 Products

2.1 SURFACE RACEWAY FOR WIRING DEVICES

.1 Two-piece assembly manufactured for mounting wiring devices and associated wiring.

.2 Raceway with base channel and snap on cover plate. Cross-section dimensions: as indicated.

.3 Finish: Standard to be selected by architect.

.4 Internal barrier for raceway having power and communication.

2.2 WIRING DEVICES

.1 Wiring devices: as indicated.

.2 Communication devices: as indicated.

.3 Cover plate: to match raceway manufacturer's standard snap-on cover.

2.3 PREWIRED RECEPTACLE HARNESS

.1 Receptacle harness factory assembled with single receptacles at 1525 mm centres on 2 circuits.

2.4 VINYL PLASTIC STRIP

.1 Extruded rigid vinyl plastic with 2- [No. 12 AWG] [3] mm² copper wires and continuous ground strip.

.2 Unfused "U" ground lock-in receptacle [for each 1.5 m of strip] [as indicated].

2.5 FITTINGS

.1 Elbows, tees, supports, connectors, couplings and fittings to make a complete installation.

3 Execution

3.1 INSTALLATION

.1 Install multi-outlet assemblies and raceway system in accordance with manufacturer's instructions.

.2 Install supports, elbows, tees, connectors, fittings.

.3 Keep number of elbows, offsets and connections to minimum.

.4 Install barriers where required.

.5 Install surface raceway continuous around corners. Provide corner and vertical sections as required.

3.2 WIRING

.1 Install wiring after installation of raceway system is complete.

.2 Install receptacle harness as indicated.

.3 Fasten wiring with wire clips inside raceway.

.4 Install ground wire as required.

3.3 WIRING DEVICES

.1 Install wiring devices and cover plates as indicated

.2 Install vinyl strip receptacles as indicated.

.3 Install identification labels for all electrical outlets.

3.4 CLEANING

.1 Clean in accordance with Division 01 General Requirements section.

.2 Clean installed products in accordance to manufacturer's recommendation.

.3 Waste Management: separate waste materials for [reuse] [and] [recycling] in accordance with Division 01 General Requirements sections.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results - Electrical

.2 Section 26 05 10 – Short Circuit, System Coordination and ARC Flash Study

.3 Section 26 24 16 – Distribution Panel

.4 Section 26 24 18 – Panelboards Switch and Fuse Type

.5 Section 26 28 23 – Disconnect Switches Fused and Non-Fused

.6 Conform to relevant sections of specifications for Division 26 and all other Divisions.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Division 01 General Requirements section.

.2 Submit fuse performance data characteristics for each fuse type and size above 60A. Performance data to include: average melting time-current characteristics, (for fuse coordination), and peak let-through current.

1.3 MAINTENANCE MANUALS

.1 Six spare fuses of each type and size installed up to and including 600 A.

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 and moisture free location.

2 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.

2.2 FUSE TYPES

.1 HRC-L fuses (formerly Class L).

.1 Type L1, time delay, capable of carrying 500% of its rated current for 10 second minimum.

.2 Type L2, fast acting.

.2 HRCI-J fuses (formerly Class J).

.1 Type J1, time delay, capable of carrying 500% of its rated current for 10second minimum.

.2 Type J2, fast acting.

.3 HRCI-R fuses (formerly Class R). For UL Class RK1 fuses, peak let-through current and 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 HRCII-C fuses (formerly Class C).

3 Execution

3.1 INSTALLATION

.1 Install fuses in mounting devices immediately before energizing circuit.

.2 Ensure correct fuses fitted to physically matched mounting devices.

.1 Install Class R rejection clips for HRCI-R fuses.

.3 Ensure correct fuses fitted to assigned electrical circuit.

.4 Where UL Class RK1 fuses are specified, install warning label "Use only UL Class RK1 fuses for replacement" on equipment.

.5 Fuses protecting motor loads, and transformers to be type J1 for up to and including 600 A and L1 for ratings above 600 A.

.6 Fuses protecting service entrance and feeder circuits to be type J2 for up to and including 600 A, and type L2 for ratings above 600 A.

.7 Fuses protecting other services or equipment shall be of the type required for that purpose.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results - Electrical

.2 Section 26 05 03 – Nameplates

.3 Section 26 05 10 – Short Circuit, System Coordination and Arc Flash Study

.4 Section 26 24 13 – Secondary Switchboard

.5 Section 26 24 16.01 – Panelboards and Circuit Breakers

.6 Section 26 24 17 – Panelboards Breaker Type

.7 Conform to relevant sections of the specifications for Division 26 and all other Divisions.

1.2 STANDARDS

.1 CAN/CSA-C22.2 No. 144-M91 (R2001): Ground Fault Circuit Interrupters.

.2 CSA C22.2 No. 5-02: Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures.

.3 CSA C22.1-02-Canadian Electrical Code.

.4 UL 489 (2002) Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures.

.5 ANSI C37.17 (latest) American National Standard for trip devices for AC and general purpose DC low voltage power circuit breakers.

.6 NEMA-AB1-1993 Molded case circuit breakers and molded case switches.

.7 ANSI C37.50 American National Standard for Switchgear – test procedures for low voltage AC power circuit breakers used in enclosures.

.8 IEEE Standard 1015, specifically acceptance practice.

.9 NETA –ATS Section 7.

.10 Ontario Electrical Safety Code.

.11 Section 26 05 73 – Short Circuit, System Coordination & Arc Flash Study.

1.3 PRODUCT DOCUMENTATION

.1 Submit shop drawings in accordance with Section 26 05 00. There will be details such as dimensions, clearances required, cable entries, tabulation of all devices including tags, wiring diagrams (power ,signals, control wiring). The notes will identify field wiring and factory installed wiring).

.2 Include time-current characteristic curves for breakers with ampacity of 150A and over. In some cases due to critical nature of the equipment smaller size breaker may have to be verified for Time Current coordination as well.

2 Products

2.1 BREAKERS GENERAL

.1 Provide bolt-on molded case circuit breaker, quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient as indicated in the Contract Documents.

.2 Circuit breakers that are 400 amps and higher that are part of the emergency distribution system shall be 100% rated.

.3 The purpose of selecting right type of circuit breaker is to comply with Section 26 05 10. The contractor shall ensure that a necessary study is carried out or professional judgment is sought before offering the breakers. The coordination study must be submitted at the same time as all panelboards, switchboards and any other equipment that is being supplied with molded case circuit breakers. No equipment shall be released for manufacturing prior to the coordination study being approved by the consulting engineer.

.4 Provide multi-pole breakers with a common-trip device and a single handle.

.5 Provide magnetic instantaneous trip elements in circuit breakers, to operate only when the value of the current reaches the setting, as indicated. For breakers with adjustable trips, provide a trip range of 3 to 10 times the rated current or as indicated in the Contract Documents.

.6 Provide circuit breakers with interchangeable trips as indicated in the Contract Documents.

.7 Provide pad locking devices on all breakers to lock the handle of a breaker in the "on" or "off" position with the trip units to remain free to function and protect the circuit from both overload and short circuit conditions.

2.2 THERMAL MAGNETIC BREAKERS (TMB)

.1 Provide molded case circuit breakers to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping characteristic.

2.3 FUSED THERMAL MAGNETIC BREAKERS (FTMB)

.1 Provide fused thermal magnetic breakers with current limiting fuses internally mounted. Coordinate the time vs current characteristics and the time current limiting characteristics of the fuses with the time vs current tripping characteristics of the circuit breakers resulting in the circuit interruption by the breaker of currents up to the interrupting capacity of the breaker and the circuit interruption by the fuses above the interrupting capacity of the breaker. Provide individually removable fuses interlocked with the breaker such that the removal of the fuse cover, the blowing of a fuse or the removal of a fuse will trip the breaker.

2.4 SOLID STATE TRIP BREAKERS DESIGN (LSI, LSIG AS INDICATED IN THE CONTRACT DOCUMENTS)

.1 Provide molded case circuit breakers to operate by means of a solid-state trip unit with associated current monitors and self-powered shunt trip devices to provide an inverse time vs current trip characteristic under overload conditions, and long time short time instantaneous tripping for phase ground fault short circuit protection. The trip unit shall be fully adjustable current and time characteristics. All breakers 400 A and above shall be solid state type (LSIG) unless otherwise shown on Drawings.

2.5 MAGNETIC BREAKERS

.1 Moulded case circuit breaker to operate automatically by means of magnetic tripping devices to provide instantaneous tripping for short circuit protection.

2.6 OPTIONAL FEATURES

.1 Provide shunt trip devices, with 120 V AC coils unless otherwise indicated in the Contract Documents, to provide remote tripping where indicated.

.2 Provide closing coils, with 120 V AC coils unless otherwise indicated, to provide remote/automatic closing where indicated in the Contract Documents.

.3 Provide auxiliary switches, rated at 5 A and 120 V unless otherwise indicated in the Contract Documents, to operate remote devices where indicated. Circuit breakers rated 800A or larger shall have contacts rated 10A at 240V where indicated.

.4 Provide motor operated mechanisms, with 120 V motors unless otherwise indicated, to provide remote operation where indicated. This will be provided with electrical closing mechanism where indicated.

.5 Provide NEMA and UL rated enclosures for individual breakers as required.

2.7 MANUFACTURERS

.1 Provide circuit breakers of one manufacturer. Acceptable manufacturers are:

.1 Schneider Electric

.2 Eaton Electric.

.3 Siemens

3 Execution

3.1 EXAMINATION

.1 Examine the circuit breakers for compliance with installation tolerances and other conditions affecting performance. Proceed with installation only after satisfactory compliance has been confirmed.

3.2 INSTALLATION

.1 Circuit breakers in panelboards shall be factory installed.

.2 Install other individual breakers where indicated in the Contract Documents.

3.3 IDENTIFICATION

.1 Identify all field installed conductors, wiring and components; provide warning signs as required by manufacturer and also CEC and Ontario Electrical Safety Code. Install engraved nameplates and lamacoid nameplates on enclosures.

3.4 CONNECTION

.1 Install grounding connections, power wiring and indication devices. Verify the torque recommended by manufacturer.

3.5 TESTS

.1 Test for continuity of phase and ground connections and insulation resistance (Megger) for each phase to phase and phase to ground.

.2 Verify all acceptance tests as per NETA test procedure.

.3 Any malfunctioning of the units shall be corrected and retested to demonstrate compliance.

3.6 SUBMITTALS

.1 Field test reports: Include the test procedures and instruments used. Record test results for formal submission to Consultant and Owner.

.2 Final maintenance manual shall include all the routine maintenance requirements and complete information about each circuit breaker settings.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results - Electrical

.2 Section 26 05 00 – Nameplates

.3 Section 26 05 10 – Short Circuit, System Coordination and Arc Flash Study

.4 Section 26 24 16 – Distribution Panel

.5 Section 26 24 18 – Panelboards Switch and Fuse Type

.6 Conform to relevant sections of the specifications for Division 26 and all other Divisions.

1.2 PRODUCT DATA

.1 Submit product data in accordance with Section 26 05 00 – Common Work Results - Electrical.

.2 Standards: Design, manufacture and test all disconnect switches in accordance with good industry practice and in accordance with the following Standards and Codes:

.3 CSA Standard C22.2 No. 4 Enclosed switches;

.4 CSA Standard C22.2 No. 39 Fuseholder assemblies.

2 Products

2.1 DISCONNECT SWITCHES

.1 Provide fusible and non-fusible disconnect switches in CSA Enclosure to suit the environment where the switch is located.

.2 Provide the provision for padlocking the switch in the ON and OFF switch position by using one lock via a multi-lock hasp.

.3 Mechanically interlocked door to prevent opening when handle in ON position.

.4 Fuses: size as indicated, to Section 26 28 14 – Fuses - Low Voltage.

.5 Fuseholders: suitable without adaptors, for type and size of fuse indicated.

.6 Provide a type A quick-make, quick-break switching action with arc chutes or arc snuffers.

.7 Provide a vertically moving handle with an ON-OFF switch position indication on the switch enclosure cover with the ON position being the upper handle position.

.8 Provide solderless neutral terminals where indicated.

.9 Disconnect switches integrated rating must be rated to handle the design interrupting capacity for this project.

.10 Ensure system coordination per Section 26 05 73 prior to ordering of the equipment.

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 nameplate.

.3 If part of the emergency distribution system, it shall be finished in Sherwin Williams #F65E37.

2.3 ACCEPTABLE MANUFACTURERS

.1 Provide disconnect switches which are the product of one manufacturer. Acceptable manufacturers are:

.1 Schneider Electric

.2 Eaton Canada.

.3 Siemens Canada.

2.4 ENCLOSURE

.1 Individually mounted disconnect switch shall be installed in Sprinkler proof enclosure c/w drip shield.

3 Execution

3.1 INSTALLATION

.1 Install disconnect switches complete with fuses if applicable.

END OF SECTION

1 General

1.1 REFERENCES & RELATED WORK

.1 Section 26 05 00 – Common Work Results - Electrical

.2 Section 26 05 03 – Nameplates

.3 Section 26 05 00 – Short Circuit, System Coordination and Arc Flash Study

.4 Section 26 05 28 – Building Grounding

.5 Section 26 22 18 – Surge Protection Device (SPD)

.6 Section 26 24 19 – Motor Control Centres

.7 Section 26 28 14 – Fuses – Low Voltage

.8 Section 26 29 12 – Control Devices

.9 Conform to relevant sections of specification for this and other Divisions.

1.2 SHOP DRAWINGS & PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 26 05 00 – Common Work Results - Electrical.

.2 Indicate:

.1 Mounting method and dimensions.

.2 Starter size and type.

.3 Layout of identified internal and front panel components.

.4 Enclosure types.

.5 Wiring diagram for each type of starter.

.6 Interconnection diagrams.

.3 Upon approval of the shop drawings, CAD files are to be submitted to the Consultant such that diagrams for each motor load can be developed. The Consultant will develop motor wiring diagrams for submission to Sanofi Pasteur Ltd. – C&Q Team.

.4 The CAD files shall be submitted to the Consultant in the same format as Record Drawings in Section 26 05 00 – Common Work Results - Electrical. The CAD files CAD files are to be provided for:

.5 Interconnection diagrams.

.6 Wiring Diagram for each type of starter. The following information shall be included on the diagrams:

.1 Starter size and over-current protection.

.2 All components of the starter.

.3 Terminal numbers for all connections within starter. Terminals shall be labeled for the following interfaces:

.1 Fire Alarm start-up and shutdown.

.2 Safeties and permissive signals from field devices.

.3 Start/Stop signal

.4 Motor and overload connections.

.5 All spare terminals shall be labeled in diagrams.

2 Products

2.1 MATERIALS

.1 Starters in accordance with CSA Standard C22.2 No. 14: Industrial Control Equipment for Use in Ordinary (Non- Hazardous) Locations.

.1 Half size starters are not acceptable.

.2 Minimum starter size: Size 1

.3 All starters shall be provided with the following indicting LED Pilot Lights:

.1 Red LED Pilot Light Denotes – Running.

.2 Green LED Pilot Light Denotes – Stopped.

.3 Amber LED Pilot Denotes – Tripped.

.4 All starters shall be EEMAC / NEMA rated. IEC rated starters are not acceptable.

.5 All starters shall be complete with indicating lights for run and off indication and 'Push To Test' lamp test push button.

2.2 MANUAL MOTOR STARTERS

.1 Single phase manual motor starters of size, type, rating, and enclosure type as indicated, with components as follows:

.1 Switching mechanism, quick make and break.

.2 Solid state overloads.

.3 Manual resets with a trip indicating handle.

.2 Accessories:

.1 Toggle switch, standard duty labelled as indicated.

.2 Indicating light: standard duty and colour as indicated.

.3 Locking tab to permit padlocking in ON or OFF position.

2.3 COMBINATION MAGNETIC STARTERS (CMS)

.1 All magnetic starters to be the combination, fusible, magnetic type unless otherwise indicated.

.2 Combination type starters to include disconnect switch with a vertically moving operating lever on the outside of enclosure to control disconnect switch and provision for:

.1 Locking in OFF position with up to 3 padlocks.

.2 Locking in ON position.

.3 Independent locking of enclosure door.

.4 A voidable interlock to prevent the starter door from being open when the disconnect switch is in the ON position and to prevent switching the disconnect switch to the ON position when the starter door is open.

.5 Provide as part of CMS type starter all items as specified in 2.4 Full Voltage Magnetic Starter. (FVNR).

.6 Provide control transformer.

2.4 FULL VOLTAGE MAGNETIC STARTERS (FVMS)

.1 Full voltage magnetic starters of the size, type, rating and enclosure type as indicated with the following components:

.1 Rapid action solenoid operated contactor.

.2 Motor overload solid state protective device in each phase, manually reset from outside enclosure.

.3 Power and control terminals.

.4 Wiring and schematic diagram inside starter enclosure in visible location.

.5 Identify each wire and terminal for the internal and external connections within starter, with permanent number markings identical to the wiring and schematic diagram.

.2 Accessories:

.1 Hand-off-auto selector switches: heavy duty, labelled as indicated.

.2 Indicating lights: heavy duty and colour as indicated.

.3 2 normally open and 2 normally closed spare auxiliary contacts unless otherwise indicated.

2.5 CONTROL TRANSFORMER

.1 Single phase, dry type, control transformer installed in with starter enclosure as indicated in accordance with Section 26 29 12: Control Devices.

2.6 THERMISTOR RELAY

.1 Thermistor overload protection relay for starters Size 2 and larger, supplied under Division 26, shall be Siemens Electric Limited Cat. #3UN21 or equivalent, complete with door mounted reset button and amber pilot light on door to indicate thermistor trip unit trip condition.

2.7 FINISHES

.1 For all painted surfaces, acid etch, prime coat and apply two finish coats of the manufacturer's standard finish.

2.8 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 03 – Nameplates.

2.9 MANUFACTURERS

.1 Provide starters of one manufacturer. Acceptable manufacturers are:

.1 Schneider Electric SquareD

.2 Eaton Canada

.3 Siemens Canada

.4 Allen-Bradley

3 Execution

3.1 INSTALLATION

.1 Install the starters and connect the power and control wiring as indicated.

.2 Ensure that the correct fuses and overload devices and elements are installed.

3.2 TESTS

.1 Perform tests in accordance with Section 26 05 00 – Common Work Results - Electrical and manufacturer's instructions.

.2 Operate all switches and contactors to verify correct functioning.

.3 Perform starting and stopping sequences of the contactors and relays.

.4 Check that the sequence controls, interlocking with other separate related starters, equipment and control devices operate as indicated.

END OF SECTION

1 General

1.1 REFERENCES & RELATED WORK

.1 Section 26 05 00 – Common Work Results - Electrical

.2 Section 26 29 11 – Motor Starters Up To 600 V

.3 Section 26 24 19 – Motor Control Centres

1.2 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 26 05 00 – Common Work Results - Electrical, and Division 01 General Requirements section.

.2 Include schematic, wiring, and interconnection diagrams.

2 Products

2.1 STANDARDS

.1 Provide control relays designed, manufactured and tested in accordance with CSA Standard C22.2 No. 14: Industrial Control Equipment for Use in Ordinary (Non- Hazardous) Locations.

2.2 MANUFACTURERS

.1 Provide control devices of one manufacturer (except thermostats). Allen-Bradley catalogue numbers are indicated to indicate the quality of the control devices required. Equivalent products of other acceptable vendors may be used. Acceptable manufacturers are:

.1 Allen-Bradley

.2 Schneider Electric

.3 Eaton Electric

.4 Siemens Canada

2.3 AC CONTROL RELAYS

.1 Electrically held with field convertible contact cartridges and the following characteristics:

.1 Coil rating: 120 V

.2 Contact rating: EEMAC A600 & P300.

.3 4 contacts

.4 Allen-Bradley 700-P Series or equivalent.

.2 Double voltage, electrically held with a sliding barrier to permit access to the only the contact compartment or the coil compartment at any one time, field convertible contact cartridges and the following characteristics:

.1 Coil rating: 120 V

.2 Contact rating: EEMAC A600 & P300

.3 4 contacts in the contact compartment and 2 contacts in the coil compartment.

.4 Allen-Bradley 700-BRD Series or equivalent.

2.4 DC CONTROL RELAYS

.1 Electronically held with field convertible contact cartridges, economizing coil and the following characteristics:

.1 Coil Rating: 24 V DC

.2 Contact Rating: EEMAC A300 & P300

.3 4 Contacts

.4 Allen-Bradley 700DC-N Series or equivalent.

.2 Selector switches:

.1 Type A:

.1 Duty: Standard

.2 Operator type: Standard

.3 Operator colour: black as indicated

.4 Nameplate type: metal, engraved with contrasting letters as indicated.

.5 Two position, maintained

.6 Three position, maintained

.7 One normally open and one normally closed contact rating: EEMAC A600.

.8 Enclosure: CSA enclosure 1

.9 Allen-Bradley 800S Series or equivalent.

.3 Pilot Lights:

.1 Type A:

.1 Heavy duty

.2 Push to test full voltage type for operation in a 120 V circuit.

.3 Lens colours: Red, green, amber, as indicated.

.4 Nameplate: Metal, engraved with contrasting letters, as indicated.

.5 Enclosure: CSA enclosure

.6 Allen-Bradley 800 Series or equivalent.

2.5 RELAY ACCESSORIES

.1 Standard contact cartridges field convertible between normally-open and normally closed.

.2 Sealed contact cartridges, normally open and normally closed as indicated.

.3 Overlap contact cartridges supplied in pairs having a normally open contact that closes before the normally closed contact opens and vice versa (Make before Break).

.4 Indexed mounting strips easily cut to the required length and bolted or rivetted in place. The relays are installed in rows on the strips with captive mounting screws.

.5 Adder contact decks to add contacts in multiples of 4 contacts to the maximum of 12 contacts.

.6 Mechanical latch attachment to convert an electrically held relay to a mechanically held relay.

2.6 CONTROL & RELAY PANELS

.1 Sheet steel CSA enclosure 1 with hinged pad-lockable access door to accommodate all relays timers, terminals labels, wiring and all other components as indicated to the factory installed and wired to identified terminals.

.2 Provide sprinkler protection complete with rain tight fittings.

2.7 SOLID STATE TIMING RELAYS

.1 Construction: AC operated electronic timing relay with a solid-state timing circuit to operate output contact. The timing circuit and output contact to be completely encapsulated for protection 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 V, 60 Hz.

.5 Operating temperature range: -20 °C to 60 °C.

.6 Contact rating: EEMAC B300 and P300.

.7 Timing ranges: Continuously adjustable over the range 0.1 s. to 30 s. or as required.

.8 Components shall be DIM railed mounted.

2.8 CONTROL CIRCUIT TRANSFORMERS

.1 Single phase, dry type.

.2 Primary voltage: to match the equipment line voltage.

.3 Secondary voltage: 120 V unless otherwise indicated.

.4 Rating: 50 VA or the actual load plus 20%, whichever is the greater unless otherwise indicated.

.5 Secondary fuse: size for the actual load x 2.5 or the next largest standard size unless otherwise indicated. Provide an integrally mounted fuse holder.

.6 Close voltage regulations as required by magnet coils and solenoid valves.

.7 Components shall be DIM railed mounted.

2.9 OPERATOR CONTROL STATIONS

.1 Pushbuttons:

.1 Type A

.1 Duty: Standard

.2 Operator type: recessed

.3 Operator colour: red and green as indicated

.4 Nameplate type: metal, engraved with contrasting letters as indicated

.5 Provision for padlocking in the depressed position

.6 1 normally open and 1 normally closed contacts

.7 Contact rating: EEMAC A600

.8 Enclosure: CSA enclosure 1

.9 Allen-Bradley 800S Series or equivalent.

.10 Provide Red Mushroom Head for E-Stop.

3 Execution

3.1 INSTALLATION

.1 Install the pushbutton stations and control devices as indicated and interconnect them as indicated.

3.2 TESTS

.1 Perform tests in accordance with Section 26 05 00 – Common Work Results - Electrical.

.2 Depending upon the magnitude and complexity, divide the control system into convenient sections, energize one section at a time and check out the operation of the section.

.3 Undertake the group testing upon completion of the sectional tests.

.4 Check out the complete system for operational sequencing.

.5 Submit one copy of the test results to the Consultant and the Owner.

END OF SECTION

1 General

1.1 SUMMARY

.1 All conditions of the Contract apply to the work of this Section.

1.2 RELATED REQUIREMENTS

.1 Section 26 05 00 – General Electrical Requirements

.2 Section 26 09 24 – Lighting Control Devices

.3 Section 26 53 00 – Emergency Lighting and Exit Signs

.4 Contractor shall be responsible for co-ordinating this section with all related sections

1.3 REFERENCE STANDARDS

.1 CAN/CSA C22.2 No. 250.0 – Luminaires.

.2 CAN/CSA C22.2 No. 9.0 - General Requirements for Luminaires.

.3 ASHRAE/IESNA 90.1 – Energy Standard for Building except Low-Rise Residential Buildings.

.4 CAN/CSA-C22.2 No.250.13-14 – Lighting Emitting Diode (LED) Equipment for Lighting Applications.

.5 CAN/CSA-C239.02 – Performance Standard for Dusk to Down Luminaires.

.6 CSDA C22.2 No.206 – Lighting Poles.

1.4 SCOPE

.1 Provide lighting fixtures (luminaires) complete with LEDs, drivers and accessories as detailed herein and in the lighting fixture schedule (on drawings).

.2 Operation and Maintenance Data: Provide operations and maintenance information in accordance with Division 01 General Requirements section.

.3 Spare Parts and Tools: Submit unique parts and tools for maintaining system in accordance with Division 01 General Requirements section.

1.5 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 26 05 00 – General Electrical Requirements and the requirements of Division 01.

1.6 WARRANTY

.1 All LED lighting fixtures shall be supplied with a minimum of ten (10) years' warranty.

2 Products

2.1 MATERIAL

.1 All material shall be specification grade, where applicable, new and carry CSA approval or special certification as per Electrical Safety Authority requirements.

.2 Similar devices and items shall be from one manufacturer throughout the project.

.3 LED light sources and integrated electronic drivers detailed in this specification are based on manufacturers listed in the fixture schedule. Alternate products will also be acceptable subject to equivalent performance and conformance with the specifications.

.4 Refer to Lighting Fixture Schedule on drawings for details of fixtures to be supplied. Where alternate fixtures are proposed, provide submission prior to tender close in accordance with Section 26 05 00 – General Electrical Requirements.

2.2 LED LAMPS

.1 Long-life rated: Based on IESNA LM-80-20.

.2 Warehouse fixtures L70 of ≥ 50,000 hours and Office fixtures L85 of ≥ 60,000 hours.

.3 LED drivers shall provide 0-10V dimming where required; refer to fixture schedule on drawings for fixtures to be dimmed.

.4 Warranty: 10 years

2.3 FIXTURE CONSTRUCTION

.1 All interior fixtures shall comply with CSA Standard C22.2 No.9, latest edition, complete with accessories and components, complying with relevant CSA standards applicable to accessory or component.

.2 Fixture lens, where specified, shall be flat and in hinged metal frame unless otherwise specified, made from clear acrylic lenses and shall be 100% virgin acrylic minimum 3.2mm (.125") thick.

.3 Standard fixture colour shall be baked white enamel unless noted otherwise, which shall resist chipping, corrosion and discolouration. Before finishing all metal shall be chemically degreased and neutralized. Where custom fixture colours are required, colour shall be confirmed via shop drawing submission.

.4 All fixtures shall be CSA approved and/or carry certification by a certifying organization recognized by the Electrical Safety Authority.

3 Execution

3.1 INSTALLATION

.1 Co-ordinate fixture locations with other trades on site prior to rough in.

.2 Install fixtures complete with all mounting hardware and trims for a neat, finished appearance.

.3 Ensure that all fixtures installed in built-in enclosures can be serviced.

3.2 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 (unless indicated otherwise on drawings).

3.3 LUMINAIRE SUPPORTS

.1 General:

.1 Support fixtures as shown on the drawings, level, plumb and true with the structure and other equipment, and in a horizontal or vertical position as intended.

.2 Wall or side bracket mounted fixture housings shall be rigidly installed and adjusted to give a neat flush fit to the surface on which it is mounted.

.3 All hangers, supports, fastenings or accessory fittings shall be protected against corrosion. Care shall be taken during the installation to assure that insulation and corrosion protection is not damaged.

.2 Supports:

.1 Self-alignment ball joint hangers shall be used for rod suspended fixtures, and ceiling canopies shall be fitted tightly to the ceiling without restricting the alignment of the hanger.

.2 Support fixtures by hangers and mounting arrangements which will not cause the fixture frame, housing, sides or lens frame to be distorted, or prevent complete alignment of several fixtures in a row.

.3 Mounting methods for fixtures on or in suspended ceilings are to be as follows:

.1 Secure surface mounted equipment with twist clip fasteners to inverted 'T' bar ceilings and independently support clips using jack chain to structure above.

.2 Where cross member supports are required above the ceiling to provide support points, these are to be steel channels or angles.

.3 Toggle bolts of the Snap-On or spring-in type are not to be used through drywall, tile or similar type ceilings.

.4 Lay-in or recessed luminaires (or luminaires mounted to the lower surface of suspended ceilings) shall be secured to the building structure. Each fixture shall be secured at opposite ends by a minimum of No. 12 AWG (2.70mm) galvanized soft annealed, mild steel wire (pencil rod) or fixture chain of adequate strength.

.3 Suspension Length:

.1 The suspension length for all ceiling-mounted, suspended types of lighting fixtures, as listed in the Fixture Schedule, shall be the overall length from the ceiling to the lowest point of the fixture body, reflector, or glassware in its hanging position.

.2 The length of the stems or chain hangers of suspended fluorescent lighting fixtures shall be adjusted to hang all fixture bodies in the same room level and in the same horizontal plane, unless specifically required to be otherwise on the electrical drawings.

.4 Chain Hangers:

.1 Where fixtures are specified to be chain hung, the chain used shall be No. 4 Tensile bright zinc coated with a strength of 181 kg. Attachments shall be made using No. 105 'S' hooks. Wires running down chain to fixture shall be run in flexible conduit and shall be attached to chain with cable clips.

3.4 WIRING

.1 Connect luminaires to lighting circuits as detailed on drawings.

.2 Refer to Section 26 05 05 – Basic Materials and Methods for acceptable wiring methods.

.3 Refer to Section 26 09 24 – Lighting Control Devices and drawings for lighting controls.

3.5 CLEANING

.1 Immediately prior to completion of project, provide a final cleaning of fixtures in accordance with Section 26 05 00 – General Electrical Requirements and Division 1.

END OF SECTION

1 General

1.1 SUMMARY

.1 All conditions of the Contract apply to the work of this Section.

1.2 RELATED REQUIREMENTS

.1 Section 26 05 00 – General Electrical Requirements

.2 Contractor shall be responsible for co-ordinating this section with all related sections.

1.3 REFERENCE STANDARDS

.1 CSA C22.2 No.141 - Emergency Lighting Equipment.

.2 CAN/CSA C860 - Performance of Internally Lighted Exit Signs.

.3 OESC Section 46 - Emergency Power Supply, Unit Equipment, Exit Signs and Life Safety Systems.

.4 NFPA 101-2015, Life Safety Code.

1.4 SCOPE

.1 Provide a complete and operational exit sign system capable of operating (upon loss of normal power) for a minimum of 30 minutes under full load conditions.

1.5 WARRANTY

.1 Exit signs and combination exit sign/emergency lighting units shall be fully warranted to be free of defects in material and workmanship under normal use for a period of one (1) year.

.2 Exit sign unit equipment batteries shall be warranted to be free of defects in material and workmanship under normal use for a period of one (1) year full and nine (9) years Pro Rata.

.3 LED lamps used in Exit signs shall be warranted to be free of defects in material and workmanship under normal use for a period of ten (10) years.

.4 The full warranty period shall begin on the date of substantial completion of the project.

1.6 MATERIAL

.1 All material shall be specification grade, where applicable, new and carry CSA approval or special inspection approval (in accordance with OESC).

.2 Similar devices and items shall be from one manufacturer throughout the project.

.3 Equipment detailed in this specification is based on AimLite. Alternate equipment supplied by one of the following manufacturers (equivalent to that specified) will also be acceptable: Emergi-Lite or Lumacell.

2 Products

2.1 EXIT SIGNS

.1 General:

.1 Exit signs to comply with the latest editions of CSA 22.2 No. 141 and CSA C860.

.2 LED, less than 2.5W.

.3 Universal mounting directly on junction box and c/w knockouts for conduit, single or double face as required (refer to drawings).

.4 Faceplate(s): multiple legend films for pictogram and direction selection.

.5 Voltage: 120VAC, with self-powered option for emergency operation.

.2 Public Areas

.1 Refer to lighting schedule on drawings.

.2 Extruded aluminum housing, white finish.

2.2 COMBINATION EMERGENCY LIGHTING AND EXIT SIGN

.1 General

.1 Where a combination emergency lighting unit & exit sign is to be provided, units shall be in accordance with above.

.2 Public areas:

.1 Refer to lighting schedule on drawings.

.2 Extruded aluminum housing, white finish.

3 Execution

3.1 GENERAL

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

3.2 INSTALLATION

.1 Install exit lights to manufacturer's recommendations, listing requirements, and local regulatory requirements.

.2 Emergency and exit lighting shall be fed from the central battery inverter system.

.3 Ensure that exit light circuit breaker is locked in on position.

3.3 CLEANING

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

END OF SECTION

1 General

1.1 GENERAL

.1 All conditions of the Contract apply to the work of this Section.

1.2 RELATED WORK

.1 Section 26 05 00 – General Electrical Requirements

1.3 REFERENCES

.1 Ontario Electrical Safety Code

.2 Ontario Building Code

.3 Ontario Fire Code

.4 CAN/ULC-S524-14, Installation of Fire Alarm Systems

.5 CAN/ULC-S536-04, Inspection and Testing of Fire Alarm Systems

.6 CAN/ULC-S537-04, Verification of Fire Alarm Systems

.7 CAN/ULC-S561-20, Installation and Services for Fire Signal Receiving Centres and Systems

.8 CAN/ULC-S1001-11, Integrated Systems Testing of Fire Protection and Life Safety Systems

1.4 SCOPE

.1 Provide new fully addressable single stage fire alarm signaling devices to suit existing system with interior notification devices in specific areas as indicated in the drawings.

.2 Provide testing and verification of fire alarm system in accordance with the requirements of CAN/ULC-S537.

.3 Provide integrated systems testing of fire alarm and fire protection systems in accordance with the requirements of CAN/ULC-S1001-11.

.4 Provide new fully addressable initiating fire alarm devices to suit existing system in select few areas as noted in drawings.

1.5 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 26 05 00 – General Electrical Requirements and the requirements of Division 1.

.2 A complete description of system architecture and operation.

.3 Detailed riser diagrams identifying all devices including but not limited to locations of isolation modules required by code, conductors, raceways, initiating zones, signaling circuits and terminations. A complete listing of all devices to be annunciate on the LCD display. Listing shall include device address, type and descriptive label.

.4 Step-by-step operating sequence, cross referenced to logic flow diagram.

.5 Calculation showing battery capacity for the require operation to meet code requirements.

.6 Integrated Systems Testing Plan and Report as per latest issue of CAN/ULC-S1001-11.

1.6 WARRANTY

.1 The Fire Alarm / Life Safety System manufacturer shall supply a one (1) year warranty from date of verification for all control system, field devices, and appliances. Contractor shall warrant the installed system to be free from any defects of material and installation for a period of one (1) year from acceptance by the engineer.

.2 Any deficiencies shall be immediately corrected at no additional cost to the owner.

.3 The Fire Alarm Manufacturer's authorized service organization shall provide a separate maintenance contract for a period of two years from the date of system commissioning. As part of the systems maintenance, the service company will provide printed reports which detail the sensitivity of each smoke detector installed in the system, and the date of the report.

2 Products

2.1 GENERAL

.1 Section Includes:

.1 The minimum requirements for the Integrated Life Safety System. The system shall include, but not limited to, all equipment, materials, labour, documentation and services necessary to furnish and install a complete, operational system to include, but not limited to, the following functions:

.1 Smoke and fire detection & off-premise notification

.2 Interconnection with other building systems (elevator, air handling unit, air circulating fans, etc.)

.2 Manufacturer

.1 All equipment and components shall be the manufacturer's current model. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approvals agency for use as part of a protected premises protective signaling (fire alarm) system. The authorized representative of the manufacturer of the major equipment, such as control panels, shall be responsible for the satisfactory installation of the complete system. The contractor shall provide, from the acceptable manufacturer's current product lines, equipment and components, which comply, with the requirements of these specifications.Existing fire alarm control panel is Edwards model.

.3 General

.1 The Contractor shall furnish all labor, services and materials necessary to install new initiating and signalling devices to suit existing fire alarm control panel. The System shall comply in all respects with all pertinent codes, rules, regulations and laws of the local jurisdiction. The System shall comply in all respects with the requirements of the specifications, manufacturer's recommendations and Underwriters Laboratories of Canada (ULC) listings.

.2 It is further intended that upon completion of this work, the Owner be provided with:

.1 Complete information and drawings describing and depicting the entire system(s) as installed, including all information necessary for maintaining, troubleshooting, and/or expanding the system(s) at a future date.

.2 Complete documentation of system(s) testing.

.3 Certification that the entire system(s) has/have been inspected and tested, is/are installed entirely in accordance with the applicable codes, standards, manufacturer's recommendations and ULC listings, and is/are in proper working order.

2.2 WIRING

.1 Power Wires: solid copper conductors, type RW90, rated 600 volt XLPE insulation in approved metal raceways. Minimum #12 AWG.

.2 Fire Alarm Wires and Cables:

.1 Audible/Visual Signal Circuit Wiring - solid copper conductors, type FAS105, rated 600Volt XLPE insulation in approved metal raceways. Minimum #14 AWG.

.2 Addressable loops and Initiation Circuit Wiring – solid copper conductors, type FAS105, 300V PVC flame retardant jacket, shielded. Canada Wire - Securex. Minimum wire size shall be #18 AWG.

.3 Coordinate and confirm fire alarm system wiring requirements with fire alarm system representative prior to start of work.

2.3 GRAPHIC (PASSIVE TYPE)

.1 Full colour mylar film of building indicating street, building floor plan and fire alarm zones corresponding to the fire alarm annunciator.

.2 All text shall be black with red “YOU ARE HERE” text and directional arrow.

.3 Provide a solid backing and enclose in an extruded aluminum metal frame with a minimum 3mm (1/8") plexiglas cover.

.4 Graphic is to bolted or screwed securely to the wall using tamperproof mounting hardware. One graphic shall be supplied for the main control panel and each remote annunciator location.

.5 Graphic must be approved by Consultant and local fire authorities prior to manufacture; submit shop drawings in accordance with the requirements of Section 26 05 00 – General Electrical Requirements and Division 1.

2.4 ANNUNCIATION

.1 Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, monitor, trouble and component status messages and control menu.

.2 The LED Annunciator rows shall contain the following format:

.1 Provide one row of red (alarm) and yellow (trouble) LED's. LED's in each row shall be arranged in columns, one column per type of alarm initiating device, and shall illuminate upon receipt of an alarm signal from the associated device(s) (i.e., electrical room smoke detector).

.2 Provide one row of red (alarm) LED's. LED's in each row shall be arranged in columns, one column per type of alarm initiating device, and shall illuminate upon receipt of an alarm signal from the associated device(s) (i.e., electrical room smoke detector).

.3 Provide one row of yellow (supervisory) LED's. LED's in each row shall be arranged in columns, one column per type of supervisory type device, and shall illuminate upon receipt of an supervisory signal from the associated device(s) (i.e., 2nd floor sprinkler valve supervisory switch)

.3 The LED annunciator shall be provided with 25% spare LED's minimum. Each pair of LED's shall be labeled "Spare".

.4 The LED Annunciator shall contain the following switches:

.1 Provide eight (8) two position switches for system by-pass functions. Actual switch function shall be determined by the owner.

.5 Provide 1 pair of #14 AWG twisted wire for data network.

.6

2.5 POWER SUPPLY

.1 System power supply(s) shall provide multiple power limited 24 VDC output circuits as required by the panel. Upon failure of normal (AC) power, the affected portion(s) of the system shall automatically switch over to secondary power without losing any system functions. Each system power supply shall be individually supervised. Power supply trouble signals shall identify the specific supply and the nature of the trouble condition. All standby batteries shall be continuously monitored by the power supply. Low battery and disconnection of battery power supply conditions shall immediately annunciated as battery trouble and identify the specific power supply affected.

.2 All system power supplies shall be capable of recharging their associated batteries, from a fully discharged condition to a capacity sufficient to allow the system to perform consistent with the requirements of this section as per ULC. All AC power connections shall be to the building's designated emergency electrical power circuit and shall meet the requirements of OESC. The AC power circuit shall be installed in conduit raceway. The power circuit disconnect means shall be clearly labeled FIRE ALARM CIRCUIT CONTROL and shall have a red marking. The location of the circuit disconnect shall be labeled permanently inside the each control panel the disconnect serves.

.3 Provide sufficient battery capacity for standby operation of entire system for 24 hours followed by 30 minutes in alarm condition (full load). Batteries shall only be utilized to a maximum of 70 % of their rated capacity. Provide battery calculations to verify this requirement is met.

2.6 INITIATION DEVICES (ADDRESSABLE)

.1 Manual Pull Stations

.1 Fire Alarm / Life Safety System shall incorporate single stage microprocessor-based addressable Manual Pull Stations connected over a 2 wire electronic communications loop, using both broadcast and serial polling protocols. All Manual Pull Stations shall display communications and alarm status via LED’s mounted on their integral, factory assembled module.

.2 All addressing of the Manual Pull Stations shall be done electronically, and the electrical location of each station shall be automatically reported to the Fire Alarm Control Panel, where it may be downloaded into a PC, or printed out. The addressing of the Manual Pull Station will not be dependent on their electrical location on the circuit.

.3 All Manual Fire Alarm station shall be suitable for operation in the following environment:

.1 Temperature: 32°F to 120°F (0°C to 49°C)

.2 Humidity: 0-93% RH, non-condensing

.2 Smoke/Heat Detectors

.1 Provide intelligent multi-sensor smoke and heat detectors. The multi-sensor analog detector shall gather analog information from each of its two sensors: an optical type smoke sensor and a rate-of-rise heat sensor. The integral microprocessor measures and analyzes smoke and heat sensor readings to make an alarm decision based on historical data.

.2 Each detector shall be capable of adapting to ambient environmental conditions and the integral heat sensor shall be capable of causing an alarm when it reaches its rate-of-rise and fixed temperature alarm set point.

.3 The detector shall have a ULC Smoke Sensitivity Range of 0.53-3.94% obscuration/ft. The alarm smoke obscuration per foot setting shall be field selectable to any one of five sensitivity settings.

.4 The detector shall be protected by a ULC listed protective guard in areas where subjected to mechanical damage or abuse. The design must be 100% compatible with

the detector and must not affect the detector sensitivity or reduce detector spacing. The guard shall be low profile and suitable for flush or surface mounted detectors.

.5 The multi-sensor detector shall be suitable for operation in the following environment:

.1 Temperature: 32°F to 100°F (0°C to 38°C)

.2 Humidity: 0-93% RH, non-condensing

.3 Elevation: no limit

.3 Duct Smoke Detectors

.1 Photoelectric Smoke Detector

.1 Photoelectric detector shall utilize a light scattering type photoelectric smoke sensor to detect visible particulates produced by combustion. The integral microprocessor shall dynamically examine values from the sensor and initiate a system alarm based on the analysis of data.

.2 The alarm set point shall be field selectable to any of five sensitivity settings ranging from 1.0% to 3.5% smoke obscuration per foot. The photo detector shall be suitable for operation in the following environment:

.1 Temperature: 32°F to 120°F (0°C to 49°C)

.2 Humidity: 0-93% RH, non-condensing

.3 Elevation: no limit

.2 Duct Detector Housing:

.1 The Analytical Microprocessor-based photoelectric smoke detector shall be readily adaptable for use in air duct smoke detection applications, using a housing that mounts to the outside of the duct. When used for duct smoke detection, the smoke detectors will not forfeit any of the system functionality that they have when used as area smoke detectors.

.2 The duct smoke detection housing shall allow the detector to sample and compensate for, variations in duct air velocity between 300 and 4,000 feet per minute.

.3 Remote Alarm LED and Test Station

.1 Provide a Remote Alarm LED and Remote Test Station; to be located in the vicinity of the duct detector.

.4 Detector Bases

.1 Detector Base - Standard

.1 Mounting bases shall support all microprocessor-based detector types detailed in this specification

.2 Removal of the respective detector shall not affect communications with other addressable devices.

.3 Field wiring connections shall be made to the room side of the base, so that wiring connections can be made or disconnected by the contractor without the need for remove the mounting base from the electrical box. Bases will have the option of external LED operation, Relay Base or Data Line Isolator Base.

.2 Detector Base - Isolator

.1 The isolator base shall support all Addressable Detector types and have the following requirements:

.2 The isolator shall operate within a minimum of 23msec of a short circuit condition on the analog communication wiring.

.3 An analog addressable detector mounted with an isolator base shall only use 1 address on the loop. It shall be possible to provide one isolator for every detector to achieve the highest level of survivability possible. The analog loop controller shall support up to 250 devices including 125 modules and 125 detectors with 125 isolator bases.

.4 In a Class A configuration, the analog loop controller shall identify an isolated circuit condition and provide communications to all non-isolated analog devices.

.5 Isolators are required between all Floor Areas as defined in the OBC.

2.7 NOTIFICATION DEVICES

.1 General

.1 All appliances which are supplied for the requirements of this specification shall be ULC Listed.

.2 All appliances shall be of the same manufacturer as the Fire Alarm Control Panel specified to ensure absolute compatibility between the appliances and the control panels, and to ensure that the application of the appliances are done in accordance with the single manufacturer's instructions.

.3 Any appliances that do not meet the above requirements, and are submitted for use must show written proof of their compatibility for the purpose intended. Such proof shall be in the form of documentation from all manufacturers that clearly states that their equipment (as submitted) is 100% compatible with each other for the purpose intended.

.2 Self-Synchronized Horns and Strobes

.1 Provide electronic horns, strobes and combination horn/strobes to match existing.

.2 Voltage and wiring to match existing horn/strobe circuit.

.3 The horn shall be selectable for continuous or synchronized temporal operation. The horn shall provide an output of 94 dB peak (measured at 3m) using a low frequency tone for superior wall penetration.

.4 The strobe shall be selectable for a continuous or temporal synchronized flash rate to match the horn and meet the intent of the Ontario Building Code, Appendix Clause 3.2.4.20 (1). The strobe output shall be synchronized and selectable (15, 30, 75 or 110 candela (cd)). The light output shall be an even "Full Light" pattern throughout the strobes protected area. Strobes utilizing a traditional specular reflector with uneven light distribution are not acceptable.

.5 The horn/strobe shall be an ultra-low profile single gang design, finished in UV stable textured red and shall not protrude more than 1" from the wall.

.6 All mounting hardware shall be captive and there shall be no mounting screws visible after the device is installed. The devices shall mount to a standard single gang electrical box and have an optional trim ring for 2-gang, octagonal or 4" square boxes. The signalling device series shall share a common appearance and be available in a horn, strobe or combination horn/strobe unit as listed on the plans.

2.8 INTELLIGENT MODULES

.1 General

.1 Fire Alarm System shall incorporate microprocessor-based addressable modules for the monitoring and control of system Input and Output functions over a 2 wire electronic communications loop, using both broadcast and serial polling protocols.

.2 All modules shall display communications and alarm status via LED indicators. The function of each connected module shall be determined by the module type, and shall be defined in the system software through the application of a personality code. All addressing of the Microprocessor-based Addressable Modules shall be done electronically, and the electrical location of each module shall be automatically reported to the Fire Alarm Control Panel, where it may be downloaded into a PC, or printed out.

.3 The addressing of the modules will not be dependent on their electrical location on the circuit. All field wiring to the Microprocessor-based Addressable Modules shall be supervised for opens and ground faults and shall be location identified to the module of incidence. Diagnostic circuitry, and their associated indicators, with reviewable Trouble Codes, shall be integral to the Microprocessor-based Addressable Modules to assist in troubleshooting system faults.

.4 Each module shall be suitable for operation in the following environment:

.1 Temperature: 32°F to 120°F (0°C to 49°C)

.2 Humidity: 0-93% RH, non-condensing

.2 Single Input Module:

.1 Microprocessor-based Addressable Modules shall be used to provide one (1) supervised Class B (style B) input circuit capable of latching operation for use with contact devices, non-damped water flow switches, non-latching supervisory sprinkler switches.

.3 Dual Input Module:

.1 Microprocessor-based Addressable Modules shall be used to provide two (2) independent supervised Class B (style B) input circuits capable of operation with contact devices. Both of the input circuits shall be terminated to, and operated from, the same microprocessor-based addressable module.

.2 Modules configured for water flow operation shall have an automatic delay of 15 seconds before reporting the water flow alarm condition to the Fire Alarm Control Panel. The module shall monitor sprinkler supervisory switches and shall automatically report the supervisory function to the Fire Alarm Control Panel each time the associated dry contact closes.

.4 Monitor Module:

.1 The Microprocessor-based Addressable Monitor Module shall be factory set to support one (1) supervised Class B Normally-Open Active Non-Latching Monitor circuit. The module shall automatically report the monitor function to the Fire Alarm Control Panel each time the associated dry contact closes.

.5 Control Relay Module:

.1 Microprocessor-based Addressable Control Relay Modules shall provide one form “C” dry relay contact rated at 2 amps @ 24 Vdc or 0.5 amps at 120 VAC to, control external appliances or equipment processes. The control relay module shall be rated for pilot duty applications. The position of the relay contact shall be confirmed by the system firmware.

.6 Universal Class A/B Module,

.1 The Microprocessor-based Addressable Module Universal Class A/B Module shall be capable of a minimum of fifteen (15) distinct operations. The universal class A/B module shall support one of the following circuit types:

.1 Supervised Class A/B Normally-Open Alarm (Active) (Delayed) (Non-) (Latching).

.2 Form “C” dry relay contact rated at 2 amps @ 24 Vdc.

.3 Supervised Class A/B 2-wire Smoke Alarm (Verified)

.4 Supervised Class A/B Signal Circuit, 24Vdc @ 2A.

.7 Universal Input/Output Module Support

.1 Enclosure to provide mounting and wiring terminations for up to six addressable modules. The motherboard design shall provide two riser inputs that are common to all modules.

2.9 ACCESSORIES

.1 Remote Annunciator

.1 LCD annunciator, complete with the following features:

.1 80 character (2 lines x 40 characters) Alphanumeric, back lit, liquid crystal display.

.2 Remote annunciation (audible and visual) and control functions as per control panel capabilities.

.3 Dedicated LED's to indicated System Alarm, Supervisory Service, System Trouble, and Power On.

.4 Panel mounted switches providing Alarm Silence, System Reset, and Acknowledgement of Alarm, Supervisory and Trouble conditions.

.5 Indication of "System Normal" status and time and date.

.2 Weatherproof Covers

.1 Where noted on drawings, provide protective covers for devices located in wet or damp locations.

.2 STI Stopper or as recommended by fire alarm system manufacturer.

.3 Fire Alarm Passive Graphic

.1 Full colour mylar film of building indicating street, building floors and fire alarm zones corresponding to the fire alarm annunciator. Provide a solid backing and enclose in an extruded aluminum metal frame with a minimum 1/8" (3mm) Plexiglas cover. Graphic is to bolted or screwed securely to the wall in location(s) as indicated on drawings. Graphic must be approved by Consultant and local fire authorities before manufacture.

.2 Provide a graphic adjacent to the control panel and remote annunciator.

3 Execution

3.1 SEQUENCE OF OPERATION

.1 Operation: alarm signal operation to activate following the operation of the initiating devices as shown on drawings, including: Manual station; Fire detector; Flow Switch.

.2 Alarm initiating devices shall be grouped in zones. The zone of the fire shall be indicated by an LED and LCD on the control panel, remote annunciators and the control panel.

.3 The audible signals shall sound continuously at the rate of 3-3-3 pattern for the alarm.

.4 The alarm shall sound for at least one minute after which it may be manually silenced at the alarm control panel. An “alarm silenced” LED shall turn on while the signals are in the silence mode. Should a new alarm occur on a different zone after signals are silenced the alarm devices shall resound.

.5 An automatic alarm signal silence timer to silence the evacuation audible alarms 20 minutes after the last alarm event starts. This timer shall recycle for each alarm event.

.6 The visual signals shall activate on alarm.

.7 The auxiliary relay panel shall cause the following to happen:

.1 Signal central station / Security system.

.2 All designated fans and air handling equipment to shutdown as per smoke control sequence events.

.8 Alarm initiating devices shall be grouped in zones. The zone of the fire shall be indicated by the electrically supervised lamp annunciator on the control unit and on the remote annunciators.

.9 Operation of an alarm input device shall flash the alarm queue LED, sound a momentary audible signal, and annunciate on the alphanumeric LCD display. Display the type, condition, and a location message for the first alarm immediately without the need for operator response. Capture the display to annunciate an alarm in the event the shared display is annunciating events of a lower priority or is in the site programming mode. Turn on a respective red zone alarm LED at the control panel and at the remote annunciator.

.10 Sort new (subsequent) events by type and log into type queues for display by emergency user selection. Sound a momentary audible signal for each event occurrence. Flash a queue LED when an unseen event exists in a queue. Update the display to annunciate the total by type and the chorological number of the event on display i.e. 3 alarm reports - #2 displayed.

.11 Display the operational status of each signal circuit to inform the emergency user of the system signal programming.

.12 The system manufacturer shall allow for one change to the software programming to revise the sequence of operation as directed by the Consultant.

3.2 INSTALLATION

.1 The entire system shall be installed in accordance with the latest edition of CAN/ULC-S524 and the approved manufacturer's manuals and wiring diagrams.

.2 The contractor shall furnish all labour, conduit, wiring, outlet boxes, junction boxes, cabinets and similar devices necessary for a complete, functional life safety fire alarm system.

.3 Provide all necessary power supply, interconnecting and remote signal wire in dedicated conduit throughout and installed in accordance with the manufacturer's wiring diagrams and the requirements of the Ontario Electrical Safety Code and the Electrical Safety Authority.

.4 All penetration of floor slabs and fire walls shall be fire stopped in accordance with all local fire codes.

.5 Wiring for fire alarm system shall be installed in metallic raceways (EMT conduit unless noted otherwise). Flexible metallic raceways may be utilized for drops to devices installed in drop ceilings (length not to exceed 3000mm).

.6 Install wiring for alarm initiating circuits in separate raceway system from the alarm signal circuits.

.7 Splicing of conductors is not permitted under any circumstances.

.8 Wire all alarm signals in accordance with requirements by manufacturer and operation. Install resistor for signal circuit in suitable box adjacent to last signal device. If diodes are used, install in outlet box of last signal device of signal circuit and indicate on signal.

.9 Isolation modules shall be furnished as required for site specific conditions.

.10 Provide required number of signal circuits and wire alternatively. Meaning that signals on same circuit shall not be horizontally adjacent to each other.

.11 Ensure continuity of ground through all raceways from ground buss in control panel to each device junction box.

.12 Clear all wiring of shorts, opens and grounds on completion of work.

.13 Mount detectors on ceiling as per latest edition of CAN/ULC-S524 standard unless otherwise specified herein with minimum and maximum distances as required for respective type of detector, at highest point where variations in ceiling height exist. Do not mount detectors on sides, undersides, or less than 450 mm from walls, beams, joints, ducts, open web steel joists or any obstruction (projecting more than 100mm below actual ceiling height). Do not mount detectors less than 450 mm from air handling outlets or air exhaust inlets.

.14 Should interference from obstruction, lamp positions, air outlets or heat radiating surfaces be encountered in locating any detector where shown, locate detector as near as possible to shown position, clear of obstacles, but maintain a clear space of 450 mm on ceiling, below and around.

.15 Identify signal circuit, alarm initiating circuit, auxiliary circuit and all other wiring at fire alarm control panel, annunciator, terminal boxes or elsewhere on completion of work with appropriate marking labels. Mark single conductors with suitable self-adhesive type, indelible numbered markers, identify cables with a clear polyester tag, attaches with a self-locking TY-RAP.

.16 Provide, install and connect wiring and interconnecting wires and cables as specified herein, as required by control panel manufacturer and as shown on Drawings.

3.3 FIELD QUALITY CONTROL

.1 Only directly prior to verification, all smoke detector protection shall be removed, and all smoke detectors shall be thoroughly cleaned.

.2 The manufacturer's representative shall make an inspection of the fire alarm equipment, including those components necessary to the direct operation of the system such as manual stations, thermal and smoke actuated detectors and controls, whether or not manufactured by the manufacturer. The inspection shall comprise an examination and test of such equipment for the following:

.1 That the type of equipment installed is that designated by the specifications.

.2 That the wiring connections to all equipment components show that the installer undertook to have observed ULC requirements.

.3 That all products of combustion (smoke) detectors have been properly calibrated and adjustments set correctly.

.4 That the representatives equipment has been installed in accordance with the manufacturer's recommendations.

.5 That the supervisory wiring of all devices connected to a supervised circuit is operating and that the wiring, having been met to the satisfaction of the inspecting officials.

.3 Testing to be done in the presence of the local building inspector and the local fire Marshall. Fire alarm system shall be verified as per the latest issue of CAN-ULCS537 Verification of Fire Alarm Systems standard.

.4 Integration testing shall be completed in the presence of local building inspector and the local fire Marshall with a resulting report produced as per the latest issue of CAN/ULC-S1001-11 Integrated Systems Testing of Fire Protection and Life Safety System. Coordinate with Fire Protection system provider as required.

.5 Arrange with Consultant, manufacturer of control equipment and all other installers of related and connected equipment to have a final functional acceptance test, giving ample notice to all parties concerned to be present.

.6 Provide two - 2.0 hour (4 hours total) familiarization and instruction period, to familiarize user and/or appointed representatives, with working and function of system and equipment.

.7 All testing methods are to be ULC approved. Do not use open flame or methods which will damage detectors. All testing methods are to be approved by the engineer prior to actual testing.

3.4 DEMONSTRATION AND TRAINING

.1 Provide two (2), two (2) hour (4 hours total) familiarization and instruction sessions, to familiarize user and/or appointed representatives, with working and function of system and equipment. Sessions shall be scheduled on separate days.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 General Conditions, Supplementary Conditions and Division 01 apply to this section.

1.2 SUMMARY

.1 This Section includes requirements for the supply, outdoor installation, testing and commissioning of a cartridge filter type recirculating dust collection system.

.1 Dusts from abrasive blast cleaning of various road and railway vehicles and components in preparation for body work and coating operations.

.2 Return of filtered air into blast room

.2 Work includes but is not limited to all materials and resources for supply, installation, testing, commissioning and approvals for the following:

.1 Cartridge type dust collector complete with air movement fan(s).

.2 Explosion protection devices.

.3 Equipment platforms and access ladders/stairs and fall protection.

.4 Dust collection containers – forklift movable.

.5 Compressed air filter pulsing system.

.6 All electrical and controls including overall safety provisions and controls.

.7 Any required heaters required for operation in the installed location's outdoor climate.

.8 Ducting systems.

.9 All ductwork interconnections required between the main dust collection/filtering unit and any remotely located fan(s) and / or other related devices shall be provided as part of the general mechanical ductwork contract.

.10 Connections to all required utilities. (Utilities provided by Owner)

.11 Prestart safety review.

.3 The dust collection system will be used with the following operations:

.1 Dry blasting.

.1 Compressed air driven pressure pot systems.

.2 Estimated usage: 16 hours per week

.1 Dusts :

.3 Media and by-products (steel particles, paints, potential aluminum, etc.)

.1 Media including but not limited to sand, aluminum oxide based, other non-ferrite based

.2 Assumed NFPA 484 dust category:

.1 50 <= Kst <= 200 bar/m-sec.

.4 General process:

.1 The facility will use both dry blasting and wet (vapour) blasting systems.

.2 Wet and dry blasting will not normally occur on the same day.

.3 The dust collector will only be activated during dry blasting operations.

.4 Estimated dry blasting conveyed product generated:

.1 Particles and by-products: 350 lbs/ hr.

1.3 RELATED REQUIREMENTS

.1 Not used

1.4 DEFINITIONS

.1 Not used.

1.5 REFERENCE STANDARDS

.1 Refer to the latest version of the following documents:

.1 Air Movement and Control Association International

.1 AMCA Publications 99, Standards Handbook.

.2 AMCA Standard 220, Laboratory Methods of Testing Air Curtains for Aerodynamic Performance Ratings.

.3 AMCA Standard 300, Reverberant Room Method for Sound Testing of Fans.

.4 ANSI/AMCA Standard 301, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

.2 American Society for Testing and Materials International, (ASTM)

.1 ASTM A653/A653M-02a, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 American National Standards Institute/National Fire Prevention Association (ANSI/NFPA)

.3 ANSI/ASHRAE 51, Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.

.4 ANSI/ASHRAE Standard 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size

.5 ANSI/NFPA 91: Standard for Exhaust Systems for Air Conveying of Materials

.6 ANSI/AMCA Standard 210, Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB 1.181, Ready-Mixed Organic Zinc-Rich Coating.

.4 Canadian Standards Association

.1 CSA Standard C22.1, Canadian Electrical Code.

.2 CSA CAN3-G40.21M – Structural Quality Steels.

.5 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S102-1988 (R2000), Surface Burning Characteristics of Building Materials and Assemblies.

.6 International Organisation for Standardization:

.1 ISO-5801, Industrial Fans - Performance Testing Using Standardized Airways.

1.6 SUBMITTALS

.1 Submit the following information in electronic document format (pdf, etc.) with the additional requirements as specified for each:

.1 Total Weight

.2 Shipping breakdowns

.3 Foundation loads (forces) and layout indicating placement of all electrical conduits, anchor bolts, and any equipment that must be installed in the concrete work of the foundations.

.4 Accessories shipped loose by packaged equipment supplier, showing their final location in field assembly.

.5 Control equipment shipped loose, by packaged equipment supplier, showing final location in field assembly.

.6 Unit dimensions.

.2 Submit manufacturer's detailed composite wiring diagrams for power and control systems showing factory installed wiring, field wiring, sequences of operation and all control devices. Interconnection lists, schematic diagrams with cross-referenced components lists and sequence of operations.

.3 Type of lubricants used.

.4 Lifting plan for unloading and placing of equipment, including mass distribution drawings showing point loads and total unit weight.

.5 Elevations, sections and details of support and operating components.

.6 Overall Assembly / Installation drawings and related documents.

1.7 CLOSEOUT SUBMITTALS/MANUALS

.1 Submit the following in Operations and Maintenance Manuals.

.1 Identification: Manufacturing name, type, year, serial number, number of units, capacity, and identification of related systems.

.2 Safety precautions.

.3 Functional description detailing operation and control.

.4 Performance criteria and maintenance data.

.5 Operating instructions and precautions.

.6 Component parts availability including names and addresses of spare part

.7 Suppliers.

.8 Consumables.

.9 Lubrication schedule indicating lubrication points and type of lubricant recommended.

.10 Maintenance and troubleshooting guidelines/protocol, and recommended equipment for analysis and repair.

.11 Detailed dis-assembly and re-assembly instructions for major components complete with photographs.

.12 Final tests and commissioning reports.

.13 Items submitted to Owner's Representative: keys, tools, special devices, maintenance manuals.

.14 Record Drawings.

1.8 QUALITY ASSURANCE

.1 Designer Qualifications:

.2 The design shall be prepared by persons with, or under continued direct supervision by a qualified technical person, with at least ten (10) years of experience in design of industrial dust collectors of this type and scope.

.3 In addition, the following system designs shall be approved and stamped by a qualified Professional Engineer licenced to practice in the state or province where the system is designed and built:

.1 Structural design

1.9 MANUFACTURER QUALIFICATIONS:

.1 The Manufacturer(s) of the system shall:

.2 Demonstrate at least ten (10) years of experience designing, manufacturing, supervising installation, and providing product support for this type of equipment.

.3 Be capable of providing product support in the areas of operation, installation, engineering and product development, repair departments, and spare parts.

1.10 MANUFACTURER'S REPRESENTATIVE:

.1 A qualified manufacturer's representative shall be available to:

.1 Provide technical support to the installer, by telephone throughout the installation period, between 7am and 5pm Eastern Time, Monday through Friday throughout the installation period.

.2 Be on site for a minimum of 8 hours per day at each of the following milestones (1 site day in total):

.1 Initial start-up and ongoing testing. Include for 1 site day.

.2 Training: Provide technical representative to train Owner’s Representative’s maintenance personnel in operation and maintenance of specified equipment as indicated in Section 1.14 - Training.

1.11 DELIVERY, STORAGE AND HANDLING

.1 The system shall be assembled, tested, and painted, and dismantled only sufficiently for proper shipment.

.2 Pack the system components in such a way as to adequately protect them against damage during transportation, unloading, setting in place, and assembly.

.3 Pay all charges, fees, insurance, import/export duties, custom fees and all expenses related to transportation of the system and accessories to the site.

.4 Provide all necessary labor, materials, hoisting equipment, tools and all incidentals required to unload the equipment to a designated laydown area at site.

.5 Provide all necessary labor, materials, hoisting equipment, tools and all incidentals required to move equipment from laydown area and placement at final location.

.6 Vendor shall familiarize himself or herself with the limitations of delivering the equipment to the site. Delivery shall be by truck.

.7 All miscellaneous materials, tools and spare parts shall be delivered to the site in sealed containers adequately protected against the intrusion of moisture or foreign matter.

.8 Special precautions shall be taken to prevent damage to electrical components such as motors, controls and conductors.

.9 All materials shall be delivered to the site with their original manufacturer's markings and identification intact.

.10 The Owner's Representative reserves the right to reject materials that are damaged, improperly identified or not in conformance with reviewed shop drawings and catalog

1.12 SITE CONDITIONS

.1 The Manufacturer is responsible for providing all necessary information to the Owner's Representative for coordination and proper relation of all work to the site.

.2 The Manufacturer shall verify all existing dimensions of the site and of the rail equipment that relate to fabrication of the system including connecting ductwork, and notify the Owner's Representative of any discrepancy before ordering equipment and material, and starting fabrication or installation.

1.13 WARRANTY

.1 Provide complete parts and labour warranty, with no cost to the customer, for a period of a minimum of 12 months from the date of entry into service.

.2 Refer to Supplementary Conditions.

1.14 TRAINING

.1 Provide training as noted below.

.1 On site, to train in all aspects of equipment and system(s) operation(s), repair and maintenance.

.2 Each of the groups listed below shall be trained on separate days as follows:

.1 System Operators: 2 groups of 4 persons: 1 hour session per group.

.1 General familiarization.

.2 Hands-on operation

.3 Basic troubleshooting.

.2 Maintenance Mechanics and Electricians: 2 groups of 4 persons. (1 hour per session)

.1 General electrical and mechanical maintenance.

.2 Hands on.

.3 Troubleshooting – basic and control system functions, including for any PLC.

1.15 SPARE PARTS INFORMATION AND TECHNICAL SUPPORT

.1 Provide:

.1 Recommended list of spare parts for the complete system.

.2 Spare parts list shall show the original equipment manufacturer part numbers.

.3 Closest source of spare parts, preferably within Northern Ontario, and Canada.

.4 Contact number for future technical support.

.5 Records of unit design, fabrication and testing: maintained on file by the manufacturer for the life of the equipment (minimum of 30 years).

2 Products

2.1 RECIRCULATING CARTRIDGE FILTER TYPE

.1 General

.1 Refer to drawings.

.2 CSA or ETLC approved.

.3 Designed for outdoor installation and operation in temperatures ranging from -30C to +30C as measured in the shade.

.4 Basis of Design:

.1 Camfil Gold Series

.2 Products meeting the specifications will be given consideration as approved equals.

.2 Performance:

.1 Airflow: 56,000 CFM (26,415 Litres per second) @ 8 in. Water Column (3.48 kPA) external static pressure (ESP) .

.2 Minimum ESP does not include:

.1 Dust collector filter unit internal losses

.2 Fan inlet, internal, discharge conditions

.3 Any factory connections between dust collector and fan inlets

.4 Silencer(s)

.5 Explosion and backflow prevention devices supplied as part of this specification.

.3 Maximum available space for the required unit(s), including all unit mounted device, maintenance access requirements as indicated on the drawings.

.3 Construction

.1 All steel construction.

.2 Minimum 10 ga steel enclosure, and as required for explosion rating of unit.

.3 Welded structural steel member framing and enclosure reinforcements, suitable for all imposed loads including installation location seismic, snow and wind loads.

.4 Framing designed for unimpeded removal / insertion of underside dust containers.

.5 Coatings:

.1 Steel to be acid washed or zinc-iron alloy coated (Galvaneal, WipeCoat, etc.) to provide enhanced corrosion protection with good paint adhesion

.2 All exterior surfaces to be factory painted.

.1 Factory standard coating and colours

.2 Baked on powder coat, or industrial urethane coating.

.6 Filter access platform

.1 Structural steel, with fall protection railings, kick plate, and self closing gate.

.1 Extended height guard rail systems as required to suit filter access requirements.

.2 Ladder access from grade level, with personal fall restraint system (cage alone is not acceptable).

.3 Designed and installed to provide ergonomically acceptable access to filters for changeout, including when the filter door is open.

.7 Intake (dirty air) Section

.1 Flanged inlet

.2 Inlet blowback prevention damper (refer to Explosion protection section)

.3 Impaction baffle(s)

.4 Hinged filter access doors for dirty side filter removal, complete with snap lock or rotating handle door latches (threaded knobs are not acceptable)

.8 Filtration:

.1 To provide recirculated air meeting the most stringent of:

.1 Minimum MERV 14 rating.

.2 Expelled dust limit: Maximum 1 milligram / cubic metre (0.45 ppm by weight)

.2 Vertically oriented mechanically clamped cartridge filters.

.3 Tool-less cartridge removal/replacement, without need to enter into the filter chamber.

.4 Polyester open pleated type cartridges, with 100% active media exposure.

.5 Filter air to cloth ratio: less than 3.6 CFM/sq.ft.

.6 Secondary filter system to maintain performance in case of primary filtration system failure/rupture.

.7 Filter cleaning:

.1 Automatic pulse type compressed air.

.1 Dedicated pulse timer board or equivalent controller

.2 Header pipe assemblies and steel spun venturis for optimum cleaning

.3 Compressed air manifold complete with pressure gauge and drain valve

.4 NEMA-4 solenoid valve enclosure pre-piped to mounted diaphragm valves.

.5 Compressed air discharge silencers

.8 Differential pressure purge fitting

.1 For connection to control panel mounted photohelic gauge

.9 Dust Handling:

.1 Twin-sloped bottom hopper(s)

.2 Minimum 250mm diameter discharge.

.3 Flexible connectors to dust container lid.

.4 Dust collection containers

.1 Minimum 2 cubic yard (1.5 cubic meter) capacity steel welded fabrication, for each hopper discharge location.

.2 Self dump, manual lever actuated.

.3 Complete with hinged lids, with flexible connector receiver.

.4 Integral fork lift fork tubes.

.5 Painted finish

.1 Urethane paint applied as per paint manufacturer's preparation and application recommendations.

.2 Standard factory colour.

.10 Clean air side plenum

.1 Flanged air outlet c/w matching flange

.2 Acoustically lined.

.3 Quick opening inspection port.

.4 Fan

.1 Preference will be given to fan(s) mounted on top of the dust collector unit.

.2 Industrial grade design and fabrication,

.3 Centrifugal backward inclined, non overloading wheel

.4 Premium efficiency TEFC motor

.1 S.F. 1.25

.2 Class F insulation

.3 Suitable for Inverter duty.

.5 Explosion Protection

.1 Designed and installed as per NFPA recommendations for the stated dust KSt

.2 Inlet duct:

.1 Inlet explosion isolation system

.2 Flow activated passive type

.3 Dust collector shut down switch (in the event of isolation system activation)

.3 Housing:

.1 316 stainless steel rupture disc type.

.2 Burst detector.

.3 To operate in conjunction with inlet duct system.

.4 Ductwork to release vented air to safe discharge area.

.5 Weather hood / duct design to prevent rain/snow entry in venting ductwork.

.4 Discharge ductwork:

.1 As required by unit configuration and NFPA recommendations for air returning to work space.

.1 Galvanized steel or painted to match dust collector paint specifications.

.6 Electrical:

.1 CSA approved components and panel(s).

.2 480 volt, 3 phase power connection.

.3 Single point power connection.

.4 May be integrated with main control panel

.5 NEMA 12 enclosure, suitable for installation in Electrical room (refer to electrical drawings).

.6 Fan Motor starter(s):

.1 Supplied by dust collector manufacturer:

.1 Integral to main control panel, or

.2 Separately mounted in suitable enclosure.

.2 Motor control method:

.1 Soft start, non reversing, or

.2 VFD drive.

.7 Controls

.1 May be integrated into main power panel.

.2 CSA approved components and panel

.3 NEMA 12 enclosure, complete with,

.1 Lockable main disconnect, fused.

.2 Single point power connection.

.3 Control voltage: maximum 120V

.4 Automatic fan speed control adjustment

.1 Ductwork system static pressure monitoring based.

.2 Password protected

.5 Automatic pulse controller

.6 Local Panel / Remote Panels control selector

.7 Fan Mode selection: ON / OFF / AUTO

.8 Pulse cleaning mode selector: DEMAND / OFF/ CONTINUOUS

.9 System Start/stop push buttons

.10 Emergency Stop, non-illuminated mushroom head button

.11 Photohelic filter system differential pressure gauge

.12 Pilot lights (all to be LED):

.1 Local Panel /Remote Panel Control

.2 Fan On

.3 Pulse activity

.4 Filter change indicator

.5 Explosion protection system activation

.1 For each component of the system.

.13 Auxiliary contacts (minimum two input, 2 output)

.14 Fused door disconnect

.8 Remote control panel:

.1 Two panels for Blast Room location

.2 NEMA 4 enclosures

.3 Start/Stop push buttons.

.4 LED indication of:

.1 System Power ON

.2 Fan(s) ON

.3 Filter changeout required

.4 Remote panel control active

.5 General explosion system actuation

.5 Emergency Stop, non-illuminated mushroom head button

2.2 CONTROL SEQUENCES

.1 Main Disconnect Switch to ON

.2 Main Control Panel or Remote Control Panels:

.1 Start button depressed

.1 Fan motor starts

.1 Fan on indicator light confirms fan operation

.2 Dust Collector auto-pulsing module actuated

.1 Pulse indicator light confirms operation

.2 Filter cleaning pulse occurs automatically while air flows

.2 Stop or E-stop button depressed

.1 Fan motor stops

.3 Dust collection duct damper system (by others)

.1 Damper system shut down signal

.1 Fan(s) stop

.2 Damper system restart signal

.1 Fan(s) restart.

3 Execution

3.1 PREPARATION

.1 Provide reviewed Shop Drawings, to trades responsible for installation.

3.2 FACTORY TEST:

.1 At any time during the manufacture of the equipment, subject to reasonable notice, the Owner's Representative or their designers may visit the Manufacturer's facility to inspect manufacturing and quality control processes.

.2 The Manufacturer shall perform a comprehensive operational test of the subassemblies and system specified herein. The test shall test all components, subsystems, systems, software and hardware.

.3 Provide all lubricants, hydraulic oils, cleaning compounds, and similar materials required for the factory test.

.4 Any changes of equipment that can cause an unsafe condition shall be re-tested.

3.3 INSTALLATION

.1 Install in accordance with reviewed shop drawings, and manufacturer's recommendations.

3.4 TESTING AND COMMISSIONING.

.1 Provide all material and resources for testing of systems.

.1 Owner will provide dust generation for testing as required.

.2 Make all necessary adjustments.

.3 Complete final site cleanup.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 General Conditions, Supplementary Conditions and Division 01 apply to this section.

1.2 SUMMARY

This Section includes requirements for the supply, installation, testing and commissioning of a system of stainless steel open trough horizontal screw conveyors (augers) to transport used wet blast cleaning and dry blast cleaning abrasive media, water, and by-products.

The conveying systems will be used with the following operations:

.1 Dry blasting.

- .1 Compressed air driven, pressure pot systems
- .2 Conveyed product: Media and by-products (iron based particles, paints, etc.)
  - .1 Media including but not limited to sand, aluminum oxide based, other non-ferrite based
  - .2 Assumed media and particulate maximum density: 150 lbs/cu.ft. (2400 kg/m3)

.2 Vapour (wet) blasting

- .1 Compressed air driven, water and media mixture, currently using GRACO Ecoquip EQs (skid) system with integral water tank, having the following approximate capacities (as taken from publication “Instructions EcoQuip 2™ EQs, EQc, and EQ Trailer Unit Vapor Abrasive Blast System” GRACO doc # 3A7467E rev. E)
  - .1 Maximum Water Capacity: 115 usg (435 litres)
  - .2 Maximum Abrasive Capacity: 880 lbs (400kg) based on #80 grit Garnet media
- .2 Conveyed product:
  - .1 Soupy-slurry consisting of:
    - .1 Water,
    - .2 Wetted media (as per dry media), and
    - .3 Wetted by-products (as per dry blasting).
  - .2 Assumed water/wetted media and particulate density:
    - .1 100 lbs/ cu.ft.

1.3 GENERAL PROCESS AND RATES:

.1 Blasting is currently operating on one 8 hour shift per day.

.2 Dry and wet blasting will not occur on the same day.

.3 Conveyors will move spent media, liquids and by products to the discharge location into a dewatering/media reclamation system as indicated in another specification section.

.4 Gap between screw and trough will allow media/particulate layer to form, and liquid will tend to accumulate and drain / dry slowly through this layer.

.5 Estimated dry blasting conveyed product generated:

- .1 particles and by-products: 400 lbs/ hr. (185 kg/hr.)

.6 Estimated wet blasting conveyed product generated:

.1 Based on use of only one Ecoquip unit, that is filled twice during an 8 hour blasting shift:

.1 Average of 220 lbs of media in 35 gallons of water per hour (100kg of media in 145 kg (145 litres) of water per hour).

.2 Confirm values with end users.

.2 Water only washdown may occur after wet blasting.

.1 Traces of media or particulates may be present.

.2 Estimated 10 usgpm (380 litres/minute) flow.

.3 Water will flow through blast room conveyors and into the media system dewatering unit as per normal media reclaim.

1.4 RELATED REQUIREMENTS

.1 Not used

1.5 DEFINITIONS

.1 Base Metal Thickness: Thickness dimensions are minimums as defined in referenced ASTM standards for both uncoated steel sheet and the uncoated base metal of metallic coated steel sheets.

1.6 REFERENCE STANDARDS

.1 All references standards specified herein imply the latest edition of the standards.

.1 ABMA American Bearing Manufacturer's Association

.2 AGMA American Gear Manufacturer's Association

.3 AISC American Institute of Steel Construction

.4 ANSI American National Standards Institute

.5 ASME American Society of Mechanical Engineers

.6 ASTM American Society for Testing and Materials

.7 AWS American Welding Society

.8 CEMA Conveyor Equipment Manufacturers Association

.9 CSA Canadian Standards Association

.10 EEMAC Electrical and Electronic Manufacturer's Association of Canada

.11 FM Factory Mutual

.12 IEC International Electrotechnical Commission

.13 IEEE Institute of Electrical & Electronic Engineers

.14 ISA International Society of Automation

.15 ISO International Organization for Standardization

.16 MPTA Mechanical Power Transmission Association

.17 NEMA National Electrical Manufacturer's Association

.18 OHS Ontario Occupational Health and Safety Act and Regulations

.19 OSHA Occupational Safety and Health Administration

.20 SAE Society of Automotive Engineers

.21 SSPC The Society for Protective Coating

.22 ULC Underwriter's Laboratories of Canada

.2 American Society for Testing and Materials (ASTM):

.1 ASTM A53/A53M, Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc Coated, Welded and Seamless

.2 ASTM A276, Standard Specification for Stainless Steel Bars and Shapes

.3 ASTM A325, Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength

.4 ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

.5 ASTM A666, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip Plate, and Flat Bar

.6 ASTM A1011/A1011M, Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with improved Formability, and Ultra-High Strength

.7 ASTM C1107/C1107M, Standard Specification for Packaged Dry, Hydraulic Cement Grout (Nonshrink)

.3 Canadian Standards Association (CSA):

.1 CSA G40.20-04/G40.21, General Requirements for Rolled or Welded Structural Quality Steel / Structural Quality Steel

.2 CAN/CSA-G164-M92, Hot Dip Galvanizing or Irregularly Shaped Articles

.3 CSA-S16, Design of Steel Structures

.4 CSA-S136, North American Specification for the Design of Cold Formed Steel Structural Members

.5 CSA W47.1, Certification of Companies for Fusion Welding of Steel

.6 CSA W55.3, Certification of Companies for Resistance Welding of Steel and Aluminum

.7 CSA W59, Welded Steel Construction (Metal Arc Welding)

.8 CSA Z432 – Safeguarding of Machinery

.4 Canadian General Standards Board (CGSB):

.1 CAN/CGSB-1.181, Ready-Mixed Organic Zinc-Rich Coating

.2 CGSB 31-GP-105Ma, Zinc Phosphate Conversion Coatings for Paint Base

.5 The Society for Protective Coatings (SSPC) and National Association of Corrosion Engineers International (NACE):

.1 SSPC-SP 1, Solvent Cleaning

.2 SSPC-SP 2, Hand Tool Cleaning

.3 SSPC-SP 3, Power Tool Cleaning

.4 SSPC-SP 6/ NACE No. 3, Commercial Blast Cleaning

.6 The latest edition of a code or standard at the time of contract award will govern.

.7 In addition, comply with all Local and Regional Statutory Regulations, Codes and Standards.

.8 In the event of conflict between the drawings, specifications, data sheets and/or the purchase order, obtain clarification before proceeding with the work.

1.7 SUBMITTALS

.1 Submit the following information in electronic document format (pdf, etc.) with the additional requirements as specified for each:

.2 Total Weight

.3 Shipping breakdowns

.4 Foundation loads (forces) and layout indicating placement of all electrical conduits, anchor bolts, and any equipment that must be installed in the concrete work of the foundations.

.5 Accessories shipped loose by packaged equipment supplier, showing their final location in field assembly.

.6 Control equipment shipped loose, by packaged equipment supplier, showing final location in field assembly.

.7 Unit dimensions.

.8 Submit manufacturer's detailed composite wiring diagrams for power and control systems showing factory installed wiring, field wiring, sequences of operation and all control devices. Interconnection lists, schematic diagrams with cross-referenced components lists and sequence of operations.

.9 Type of lubricants used.

.10 Lifting plan for unloading and placing of equipment, including mass distribution drawings showing point loads and total unit weight.

.11 Elevations, sections and details of support and operating components.

.12 Overall Assembly / Installation drawings and related documents.

1.8 CLOSEOUT SUBMITTALS/MANUALS

.1 Submit the following in Operations and Maintenance Manuals.

.1 Identification: Manufacturing name, type, year, serial number, number of units, capacity, and identification of related systems.

.2 Safety precautions.

.3 Functional description detailing operation and control.

.4 Performance criteria and maintenance data.

.5 Operating instructions and precautions.

.6 Component parts availability including names and addresses of spare part

.7 Suppliers.

.8 Consumables.

.9 Lubrication schedule indicating lubrication points and type of lubricant recommended.

.10 Maintenance and troubleshooting guidelines/protocol, and recommended equipment for analysis and repair.

.11 Detailed dis-assembly and re-assembly instructions for major components complete with photographs.

.12 Final tests and commissioning reports.

.13 Items submitted to Owner's Representative: keys, tools, special devices, maintenance manuals.

.14 Record Drawings.

1.9 QUALITY ASSURANCE

.1 Designer Qualifications:

.2 The design shall be prepared by persons with, or under continued direct supervision by a qualified technical person, with at least ten (10) years of experience in design of CEMA type screw conveyors, of this type and scope.

.3 In addition, the following system designs shall be approved and stamped by a qualified Professional Engineer licenced to practice in the state or province of system is designed and built:

.4 Electrical works.

1.10 MANUFACTURER QUALIFICATIONS:

.1 The Manufacturer(s) of the system shall:

.2 Demonstrate at least ten (10) years of experience designing, manufacturing, supervising installation, and providing product support for this type of equipment.

.3 Be capable of providing product support in the areas of operation, installation, engineering and product development, repair departments, and spare parts.

1.11 MANUFACTURER'S REPRESENTATIVE:

.1 A qualified manufacturer's representative shall be available to:

.1 Provide technical support to the installer, by telephone throughout the installation period, between 7am and 5pm Eastern Time, Monday through Friday throughout the installation period.

.2 On site for a minimum of 8 hours per day at each of the following milestones (1 site day in total):

.1 Initial start-up and ongoing testing. Include for 1 site day.

.2 Training: Provide technical representative to train Owner's Representative's maintenance personnel in operation and maintenance of specified equipment as indicated in Section 1.14 - Training.

1.12 DELIVERY, STORAGE AND HANDLING

.1 The system shall be assembled, tested, and painted, and dismantled only sufficiently for proper shipment.

.2 Pack the system components in such a way as to adequately protect them against damage during transportation, unloading, setting in place, and assembly.

.3 Pay all charges, fees, insurance, import/export duties, custom fees and all expenses related to transportation of the system and accessories to the site.

.4 Provide all necessary labor, materials, hoisting equipment, tools and all incidentals required to unload the equipment to a designated laydown area at site.

.5 Provide all necessary labor, materials, hoisting equipment, tools and all incidentals required to move equipment from laydown area and placement at final location.

.6 Vendor shall familiarize himself or herself with the limitations of delivering the equipment to the site. Delivery shall be by truck.

.7 All miscellaneous materials, tools and spare parts shall be delivered to the site in sealed containers adequately protected against the intrusion of moisture or foreign matter.

.8 Special precautions shall be taken to prevent damage to electrical components such as motors, controls and conductors.

.9 All materials shall be delivered to the site with their original manufacturer's markings and identification intact.

.10 The Owner's Representative reserves the right to reject materials that are damaged, improperly identified or not in conformance with reviewed shop drawings and catalog

1.13 SITE CONDITIONS

.1 The Manufacturer is responsible for providing all necessary information to the Owner's Representative for coordination and proper relation of all work to the site.

.2 The Manufacturer shall verify all existing dimensions of the site and of the rail equipment that relate to fabrication of the system including infeed conveying systems and rail transfer table systems and notify the Owner's Representative of any discrepancy before ordering equipment and material, and starting fabrication or installation.

1.14 WARRANTY

.1 Provide complete parts and labour warranty, with no cost to the customer, for a period of 12 months from the date of entry into service.

.2 Refer to Supplementary Conditions.

1.15 TRAINING

.1 Provide training as noted below.

.1 On site, to train in all aspects of equipment and system(s) operation(s), repair and maintenance.

.2 Each of the groups listed below shall be trained on separate days as follows:

.1 System Operators: 2 groups of 4 persons: 1 hour session per group.

.1 General familiarization.

.2 Hands-on operation

.3 Basic troubleshooting.

.2 Maintenance Mechanics and Electricians: 2 groups of 4 persons. (1 hour per session)

.1 General electrical and mechanical maintenance.

.2 Hands on.

.3 Troubleshooting – basic and control system functions, including for any PLC.

1.16 SPARE PARTS INFORMATION AND TECHNICAL SUPPORT

.1 Provide:

.1 Recommended list of spare parts for the complete system.

.2 Spare parts list shall show the original equipment manufacturer part numbers.

.3 Closest source of spare parts, preferably within Northern Ontario, and Canada.

.4 Contact number for future technical support.

.5 Records of unit design, fabrication and testing: maintained on file by the manufacturer for the life of the equipment (minimum of 30 years).

2 Products

2.1 TROUGHED SCREW CONVEYORS

.1 General

.1 Provide complete conveyor systems, complete with control functions, as indicated on the drawings and in this specification.

.2 The equipment operates indoors in a humid, wet and dusty environment. Provide all necessary safeguards and protection for optimal performance of the equipment.

.3 Provide equipment having a minimum design life of thirty (30) years for operation at rated design loading for.

.1 16 hours per day, 5 days per week, 50 weeks per year.

.4 Standardize equipment sizes to the maximum extent possible to keep the cost of spare parts to a minimum.

.5 Ensure screw conveyors and feeders start, operate, and stop smoothly and safely in the fully loaded condition under normal/emergency and all climatic conditions without over-stressing of components, structures, or associated systems.

.6 All warning signs and safety signs shall be in the English language and/or using pictograms.

.7 Provide all assemblies and components with suitable lifting devices to allow for easy off-loading, installation, and removal at site.

.8 Provide lifting lugs or devices for components heavier than 20 kg.

.2 Safety

.1 The design shall conform to all safety and personnel protection requirements of The Occupational Health and Safety Act (OHSA), and of all Authorities Having Jurisdiction.

.2 A pre-start safety review shall be provided.

.3 Provide safety guards around all moving parts in accordance with Occupational Safety and Health Administration (OSHA).

.4 Provide dust-tight covers to protect any exposed parts where dust penetration might be harmful.

.3 Technical Requirements

.1 Design, fabricate, inspect and test screw conveyors to be suitable for site conditions and in accordance with this specification, and the current versions of the following specific standards:

.1 ANSI / CEMA 350 – Screw Conveyors for Bulk Materials;

.2 ANSI / CEMA 300 – Screw Conveyors – Dimensional Standards;

.3 ASME B20.1 – Safety Standard for Conveyors and Related Equipment.

.2 It is not intended for the Vendor to depart this standard specification; however, clearly list and explain any deviation from this specification in the proposal. The lack of such listing will indicate that no such deviation exists.

.4 Materials of Construction

.1 Provide materials of construction in accordance with the specification, equipment data sheets, drawings and the Vendor's recommendation for the duty and service conditions specified.

.2 Ensure no substitution of the materials of construction after the purchase order has been issued. Substitutions require written approval by the Engineer.

.3 Fabricate all equipment using only new materials of first grade quality, free from defects impairing strength, durability and appearance.

.5 Mechanical

.1 General

.1 Design equipment to withstand the loadings exerted by drive, material load, weight of the equipment, reaction of supports, impact, shock, temperature, internal and external pressure, earthquake, and any other loadings that may be present.

.2 Design equipment for ease of cleaning and maintainability.

.3 Ensure material discharge from a screw conveyor is continuous, at the rate at which it is received, without significant conveyor induced pulsing or surging.

.4 Ensure that all of the installation conforms in all respects to environmental standards, and occupational safety and health standards for air emissions and exposure limits.

.5 Include in the documentation or drawings all materials specifications, dimensions, tolerances, and fits for the proper design, supply, manufacture, fabrication, and assembly of conveyor components. Do not change the design, materials, specifications, dimensions, tolerances, and fits without the written approval of the Engineer.

.6 All information shown on the documents and drawings are for reference only. Vendor is to verify all the provided data and is responsible for screw conveyors design.

.7 Screw conveyor sizing may vary in the final design.

.2 Screw Flighting

.1 Design screw for the product as described in this specification.

.2 Vendor to recommend type of screw flight/pitch based on material handled.

.3 Minimum outside diameter: 9 inches (225 mm).

.4 Provide all screw conveyors with sectional type flighting, minimum 4.7 mm (3/16”) thick AR200 steel, full pitch, continuously welded both sides on steel schedule 40 pipes, and complete with flange on both ends for couplings and end shaft connections. Provide hard surfacing on the edge and leading face of the screw flights.

.5 Provide screws with a centre tube made from a single piece of straight seamless pipe or tubing of required schedule with a solid piece of shaft at the end of each pipe.

.6 Ensure consecutive flights are aligned so that the end of one flight and the beginning of the next flight are in the same place.

.3 Shafts

.1 Fabricate drive and tail shafts from steel, welded to flange for screw flighting connections. Surface harden all shafts. Tightly fit shafts into the tube and drill both pieces to ensure alignment. Ensure the entire assembly, including flights, is true after all operations have been completed.

.2 Provide flanged couplings for all screw flight connections. Fabricate couplings from SPS 245 steel or equal. Harden all couplings.

.3 Ensure shafting is free of any sharp corners and shaft ends are chamfered.

.4 Ensure drive shafts and pipe ends are designed with a minimum safety factor of 2.0 for both bending and torsion.

.5 Ensure support shafts are the same diameter as the drive shaft.

.6 Machine pipe ends to a 0.005" shaft clearance fit in such a manner to ensure drive and floating shaft are parallel and on the same centres.

.7 Provide quick release keys on both ends of the shaft.

.8 Large diameter shafts may be turned down at bearing and attachment locations. Limit turn-downs to the following ratios:

.1 Major/minor diameter: ≤ 1.50

.2 Fillet radius/minor diameter: ≤ 0.025

.9 Coat all exposed areas of the shaft with a thick layer of non-water soluble rust inhibitor.

.4 Hangers and Hanger Bearings

.1 Minimize the quantity of conveyor hangers.

.2 Ensure all hangers have a rigid, formed steel frame that provides the least obstruction to the flow of material. Type 226 hangers with white iron bushings are preferred.

.3 Mount all hangers inside the conveyor trough and equip them with slotted holes to facilitate assembly and alignment.

.4 Ensure hanger materials match the materials used for screw flighting.

.5 Provide non-expansion bearing on the drive side and expansion bearing on the other side. Ensure all bearings supports have a shim allowance for vertical adjustment and adjusting screws for horizontal adjustment. Position bearings cold to allow for thermal growth.

.6 Ensure hanger bearings are not installed under or over inlet or discharge chutes. Flanged bearings are not acceptable.

.5 Drives

.1 Ensure screw conveyor drives are sized to start in a fully loaded "flooded" condition (i.e. 100% trough load).

.2 Ensure all drive assemblies are shop assembled, inspected and undergo performance testing before shipment to site.

.3 Provide in-line planetary gear drive or shaft mounted drive, for motor sizes up to 55 kW (75 HP). Provide shaft mounted speed reducers complete with torque arm and motor mounting brackets..

.4 Provide a dual bearing support system for the head end shaft for shaft mounted reducers.

.5 Select speed reducers with mechanical power rating in accordance with AGMA Class II standards, with a minimum service factor of 1.4 based on the installed motor power rating.

.6 Select speed reducers with thermal rating that is not less than the motor nameplate power. Use of external cooling for reducers is not acceptable.

.7 Provide speed reducers with anti-friction bearings and triple labyrinth seals to exclude abrasive dust particles, dirt, and moisture from entering the bearings.

.8 Provide speed reducers with cast steel housings, equipped with air breathers designed for use in a dusty atmosphere.

.9 Provide lubrication fittings that are readily accessible for proper maintenance.

.10 Ensure breather oil filler port and drain are specific to mounting locations.

.11 Provide sight glass oil level indicator.

.12 Ensure all screw conveyors are equipped with zero speed switches.

.13 Provide a common base plate with electric motors, couplings, and other drive components.

.6 Trough End Bearings

.1 Provide trough ends with outboard, self-aligning, adapter mounted roller bearings, SKF Explorer Series or equivalent.

.2 Ensure bearing selection process and rating of bearings is in accordance with ABMA standards with a minimum L10 bearing life of 100,000 hours.

.3 Provide pillow blocks with triple labyrinth (taconite) seals to prevent the ingress of dust or water to the bearings. Select the labyrinth seal to avoid sliding contact and minimize resistance to rotation as much as possible.

.4 Provide thrust bearings at the discharge end of screw conveyors so as to place the screw in tension.

.5 Ensure end bearing has sufficient floating space for thermal expansion.

.7 Trough End Seals

.1 Provide split type packed gland seals where the drive shaft extends through the trough.

.2 Locate the seals outside the trough to facilitate assembly and replacement of packing material. Provide access for removal/re-stuffing of packing gland during maintenance without removal or any other item.

.6 Troughs

.1 Trough(s) for the cross screw conveyor shall, by design or by hanger design, provide a slope 1% towards the final discharge location. All other troughs shall be installed horizontally without slope.

.2 Trough design shall accommodate the transition of dry and wetted by products from the concrete floor of the room, into the trough by the transfer plate (by other).

.1 Refer to detail on drawings.

.3 Provide U-troughs with formed gasketted connection flanges, constructed from a minimum 10 gauge (3.2mm) thick 304 stainless steel material.

.4 Trough design to accommodate concrete floor to trough transition flanges, for flow of wet or dry blasting by-products, and water in general.

.5 Ensure trough ends are suitable for the end bearings and seals used.

.6 Fabricate the end plates from a minimum 6 mm thick plate of the same material as the trough.

.7 Provide gaskets at the flanged inlet and outlets and all the trough connections.

.7 Trough Covers

.1 Provide trough covers fabricated from the same material as the trough, where required for safety, and where trough is not otherwise guarded/covered.

.2 Provide covers with flanged and drilled inlet spout(s) where required.

.3 Provide the trough cover with a neoprene gasket and quick release pivoted multiple style spring clamps attached via chain.

.8 Supports

.1 Provide and fabricate all required trough supports, and any other required supports from minimum 6 mm thick plate of the same material as the trough.

.2 Troughs shall be supported from the floor of the trench in which the augers are being installed.

.3 Provide sliding supports to consume thermal expansion of troughs along the conveyors.

.4 Provide fixed support at drive side and sliding supports along the troughs.

.5 Cross screw conveyor trough supports shall accommodate or provide the 1% trough slope of that auger.

.6 Supports shall provide vertical, horizontal, and lateral support and restraint of the overall conveyors, using mechanical fasteners or other means not requiring cutting or welding for removal and reinstallation.

.9 ELECTRICAL SYSTEMS

.1 All electrical components and systems delivered to site must have CSA, cUL/ULC, or equivalent third party certification acceptable to the Authority Having Jurisdiction. The Manufacturer shall be responsible for all resources and costs to obtain any special acceptances required from the Authority Having Jurisdiction.

.2 Main power supply: 480 Volt / 3 phase / 60 Hz:

.3 Transformation to other voltages if required shall be included as part of the supply of this equipment.

.4 Single point power connection to main power/control panel.

.5 Conformance to the requirements of the Canadian Electrical Code, all applicable CSA standards and those of the Authority Having Jurisdiction.

.6 All Blast Room and Reclaim Room area enclosures, wiring and devices, and installation methods shall be designed for interior use in a dusty and wet environment, All penetrations and cabinet entry points to use watertight and vapour tight glands and seals.

.7 Motors:

.1 TEFC

.2 Class F insulation, 40C Ambient,

.3 1.15 SF

.4 Inverter duty rated if used with VFDs

.8 Main system power cabinet to include lockable disconnect switch.

.9 Integral reversing motor starters.

.1 Line voltage starters acceptable for motors up to 6kW (5HP)

.2 VFD or softstart to be used for motors greater than 6kW (5HP)

.10 Machine grounding:

.1 Ground all electrical equipment.

.2 All electrical components and systems shall be factory installed onto the system subassemblies so that field wiring shall be limited to interconnection between the individual subassemblies by installing contractor.

.10 GENERAL CONTROL REQUIREMENTS:

.1 Maximum 120 volt control voltage.

.2 Conformance to all applicable CSA standards and those of the Authority Having Jurisdiction.

.3 Control system design shall include the design of full system including all required control and communication wiring, using rigid conduit for all routing.

.4 Key control: Operations of all functions shall be prevented without the key. Same key shall operate all control panels. Provide 4 such keys.

.5 The make and model of any PLC used in the design must be confirmed as acceptable with the Owner's Representative.

.6 All indicators and other lights to be LED type.

.7 Control Station:

.1 NEMA 12 enclosure with hinged clamp type closure cover, unless otherwise indicated.

.2 Engraved anodized aluminum legend plates with contrasting text colour mechanically fastened to enclosure or device.

.3 Plastic lamacoid identifiers may only be used inside of enclosures, unless otherwise approved by Owner's Representative.

.4 Control devices mounted in the cover shall be shop wired, bundled and wired to a terminal strip mounted to a stand-off panel in the enclosure.

.5 All control components and systems shall be factory installed onto the system subassemblies so that field wiring shall be limited to interconnection between the individual subassemblies by installing contractor.

.11 CONVEYOR CONTROL SYSTEM OPERATIONS:

.1 Main control panel (in Electrical Room).

.1 Controls may be integrated into main power/disconnect panel.

.2 ON/OFF:

.1 Drive system power ON/OFF

.2 LED indicator light.

.3 Local/Remote Selector

.1 Local: control from main panel

.2 Remote: control from panels in Blast Room and Reclaim Room

.4 Conveyor Directional Selector for each conveyor drive system:

.1 Forward/OFF/Reverse Selector:

.1 Forward:

.1 Maintained Normal position.

.2 Conveyors feeding to discharge

.2 Reverse:

.1 Momentary - hold to maintain.

.2 Conveyors feeding away from discharge

.2 With LED directional indicators.

.5 Emergency Stop:

.1 Mushroom button (backlight type) for drive system.

.2 Stops all drives.

.6 Motor status indicators:

.1 For each drive motor.

.2 Running indicator

.3 Motor fault/not running

.2 Blast Room and Reclaim Room Control Panels

.1 NEMA4 enclosure, with hinged clamped closure cover.

.2 Locations:

.1 Blast room: wall near cross auger location. Field confirm.

.2 Reclaim Room: wall adjacent to conveyor discharge location. Field confirm.

.3 One panel as follows (North wall of Blast Room)

.1 Conveyor Directional Selector for each conveyor drive system:

.2 Control panel active LED indication of

.3 Forward/OFF/Reverse Selector:

.1 Forward:

.1 Maintained Normal position.

.2 Conveyors feeding to discharge

.2 Reverse:

.1 Momentary - hold to maintain.

.2 Conveyors feeding away from discharge

.4 Emergency Stop:

.1 Mushroom button (backlight type) for drive system.

.2 Stops all drives.

.5 Motor status indicators:

.1 For each drive motor.

.2 Running indicator

.3 Motor fault/not running

.4 One panel as follows (South wall of Blast Room)

.1 Emergency Stop:

.1 Mushroom button (backlight type) for drive system.

.12 PAINTING AND LABELLING

.1 Prime and finish coat the equipment with the exception of wearing surfaces, and non-ferrous materials not requiring atmospheric protection.

.2 Coating system as follows, or approved equivalent:

.1 Primer: High solids, rust inhibitive, universal, phenolic alkyd metal primer.

.1 SSPC-SP6/NAC 3 preparation.

.2 Apply coating within 8 hours of blasting to avoid flash rusting.

.3 Minimum DFT: 3 mils

.4 Sherwin Williams Kem Bond HS or approved equivalent.

.2 Top Coat: urethane alkyd enamel

.1 Preparation as per manufacturer's recommendation.

.2 2 coats, DFT: 2 mils per coat.

.3 Sherwin Williams Pro Industrial, or approved equivalent.

.3 Colour: safety yellow or as otherwise approved by Owner's Representative, from coating manufacturer's standard colours.

.13 Labels:

.1 Language – all signs, controls, documentation, etc. to be provided in English

.2 To include industry recognized graphical symbols where they exist.

3 Execution

3.1 FACTORY TEST:

.1 At any time during the manufacture of the equipment, subject to reasonable notice, the Owner's Representative or their designers may visit the Manufacturer's facility to inspect manufacturing and quality control processes.

.2 The Manufacturer shall perform a comprehensive operational test of the subassemblies and system specified herein. The test shall test all components, subsystems, systems, software and hardware.

.3 Provide all lubricants, hydraulic oils, cleaning compounds, and similar materials required for the factory test.

.4 Any changes of equipment that can cause an unsafe condition shall be re-tested.

3.2 INSTALLATION

.1 Install in accordance with reviewed shop drawings, and manufacturer's recommendations.

3.3 TESTING AND COMMISSIONING.

.1 Provide all material and resources for testing of systems.

.1 Owner will provide media for conveyor loading.

.2 Make all necessary adjustments.

.3 Complete final site cleanup.

END OF SECTION

1 General

1.1 GENERAL

.1 Design, manufacture, supply, installation, testing, and certification of a fully operational underslung overhead travelling bridge crane.

.2 Coordination with Supplier and Installer of crane runway beams as required.

1.2 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedure

.2 Section 01 74 11 - Cleaning

.3 Section 01 74 21 – Construction Demolition Waste Management and Disposal

.4 Section 01 77 00 – Closeout Procedure

.5 Section 01 78 00 – Closeout Submittals

.6 Section 01 79 00 – Demonstration and Training

.7 Section 05 12 23 – Structural Steel for Buildings

1.3 REFERENCES

.1 Refer to the current versions of:

.2 American Institute of Steel Construction (AISC):

.1 AISC 325 Steel Construction Manual, Thirteenth Edition.

.3 American Gear Manufacturers Association (AGMA):

.1 AGMA 6013-A06, Standard for Industrial Enclosed Gear Drives.

.4 American Society for Testing and Materials (ASTM):

.1 ASTM A325M, Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength (Metric).

.2 ASTM A563M, Specification for Carbon and Alloy Steel Nuts (Metric).

.3 ASTM-A668 – Specification for Steel Forging, Carbon & Alloy for General Industrial Use.

.5 ASME International (ASME):

.1 ASME B30.16 Overhead Hoists (Underhung)

.6 Canadian Standards Association (CSA):

.1 CAN/CSA-B167 – Overhead cranes, gantry cranes, monorails, hoists, and jib cranes.

.2 CSA Standard C22.1, Canadian Electrical Code.

.3 C22.2 NO. 33 - Construction and Test of Electric Cranes and Hoists.

.4 CAN/CSA G40.20/G40.21-04 General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.5 CAN/CSA-S136, North American Specification for the Design of Cold Formed Steel Structural Members.

.6 CSA-S136.1 Commentary on CSA Standard S136.

.7 CSA W47.1, Certification of Companies for Fusion Welding

.8 Steel Structures.

.9 CSA W48, Filler Metals and Allied Materials for Metal Arc Welding.

.10 CSA W59, Welded Steel Construction (Metal Arc Welding) Metric.

.7 Crane Manufacturers Association of America (CMAA):

.1 CMAA #74 Specifications for Top Running and Under Running Single Girder Electric Traveling Cranes Utilizing Under Running Trolley Hoist.

.2 MMA MH27.2 – Specification for Enclosed Track Underhung Cranes and Monorail Systems

.8 Monorail Manufacturers Association (MMA)

.1 Monorail Manufacturers Association (MMA) MH27.1 – Specification for Patented Track Underhung Cranes and Monorail Systems

1.4 DESIGN RESPONSIBILITY

.1 The crane shall be designed by a Professional Engineer, registered in the Province of fabrication, with a minimum of 5 years of experience in the design of this type of equipment.

.2 The Professional Engineer shall be responsible for establishing design requirements, compliance to applicable codes, standards and regulations, testing and commissioning of system and providing final certification of system.

1.5 SUBMITTALS

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Shop Drawings shall include all the major systems including and not limited to the following information:

.1 General arrangement drawing showing:

.1 Overall crane layout in relation to the building

.2 Overall dimensions and clearances.

.3 Hoist capacity.

.4 Hook lift and reach coverage, including dimensions relative to the nearest building gridline(s).

.2 Other important features of the crane.

.1 Runway and bridge conductor arrangement.

.3 Crane identification number.

.4 CMAA classification.

.5 Total weights, crane wheel loads, reaction loads at interface and terminal points. Provide details of bridge wheel/crane rail and bridge/end stop interfaces.

.6 Electrical drawings, showing load and power requirements, schematic wiring diagram, electrical connection point, control panel, inter-wiring details, bill of material for electrical components, lockout, etc.

.7 Type of primer and coatings.

.8 Bill of materials.

.3 All shop drawings shall be prepared and stamped by Professional Engineers of respective disciplines registered in the Province of Ontario.

1.6 QUALIFICATIONS

.1 Supplier, and Installing Contractor, and its personnel shall have a minimum five years of demonstrated experience in the related field of design, fabrication, installation, testing and certification of this type of equipment.

1.7 QUALITY ASSURANCE

.1 Manufacturer's technical representatives shall supervise the installation, testing and commissioning of the respective equipment and components.

1.8 DESIGN REQUIREMENTS

.1 Design cranes in accordance with the applicable standards and codes.

.2 Design crane systems to be capable of lifting the full rated capacity at any location along the crane bridge and runway beam.

.3 Crane systems shall be designed to fit within the space allocated on the drawings.

.4 Cranes shall remain operational under the following conditions:

.1 Building sway under wind loads: H/400 (H: Height of building).

.2 Deflection of building roof trusses and beams under live loads: L/360 (L: Span)

.3 Deflection of roof joists under live loads: L/240 (L: Span)

.4 Vertical deflection of bridge crane runway beams under crane loads: L/1000 (L = span)

.5 Lateral deflection of bridge crane and monorail runway beams under crane loads: L/600 (L = Span)

.5 Each wire rope shall be capable of lifting its full rated capacity from the floor level to the clear hook height.

1.9 PRE-START HEALTH AND SAFETY:

.1 Submit Pre-Start Health and Safety Review Report in accordance with this Section.

1.10 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling.

2 Products

2.1 ELECTRIC TRAVELLING OVERHEAD CRANE

.1 Performance:

.1 Capacity: 2 tons (1800 kg)

.2 Operating Dimensions:

.1 Refer to the drawings

.2 Maximum installed height to highest point of crane: refer to drawings?

.3 Minimum clearance under crane bridges: 19 ft – 6 in. (6000 mm).

.4 Minimum hook lift, as measured from hook bowl to floor: 19 ft. – 6 in. (6000 mm)

.3 Variable Operating Speed, all motions powered.

.4 Accelerate to, operate at, and brake from all operating speeds under full load, according to CMAA requirements.

.5 Provide maximum operating speeds of at least:

.1 Hoist ft/min (m/min.): 15 (4.5)

.2 Trolley ft/min (m/min.): 20 (15.2)

.3 Bridge ft/min (m/min.)): 60 (18.3)

.2 General

.1 Design in accordance with all applicable standards including CSA, HMI and CMAA specifications, whichever is more stringent, and meet the requirements described in the specifications.

.2 Welding shall be to CSA standards and AWS.

.3 Welders shall be qualified under the Canadian Welding Bureau.

.4 Sub-assemblies or pre-welded assemblies imported from US shall be qualified under the AWS.

.5 End stops may not act on bridge wheels.

.6 Provide safe, smooth acceleration of a full load from rest to maximum speed for the crane bridges, trolleys and hoists.

.7 Provide for “inching” or “jogging” of the crane bridges, trolleys and hoists under full load to allow for correct positioning of the load.

.8 Provide drop-stop lugs on all underslung trolleys, and all underslung end trucks.

.3 Bridge

.1 Wheelbase of the trucks shall be designed to CMAA standards.

.2 Dedicated end plates for bridge travel end stop contact.

.3 End trucks

.1 Minimum four wheels per end truck with a minimum of one driven wheel per end truck.

.2 Separate synchronized motor drive for each end truck, with integral electrically released brake.

.3 Enclosed ball or roller bearing gear drive speed reducer for each driven wheel.

.4 Trolley

.1 Electric motor with integral electrically released brake.

.2 Rigid construction designed to transmit full loads to bridge.

.3 Energy absorbing end stop bumpers.

.5 Hoist

.1 Wire rope type.

.2 Electric motor with multi-stage, totally enclosed ball or roller bearing gear reduction.

.3 Load speed control.

.4 Electrically released load holding brake.

.5 Flexible shaft coupling for separate base mounted motors.

.6 CMAA 70 Class C or equivalent HMI rating.

.7 Wire rope guide.

.8 Overload protection (adjustable) set for 110% of the rated capacity.

.6 Wire Rope

.1 Minimum of three full wraps of rope remaining on drums with hook contacting floor.

.2 Provide manufacturer's certificate for minimum breaking strength of each wire rope.

.3 End connections designed for 100% of rope breaking strength, and in accordance with rope manufacturers recommended practice.

.7 Hooks and Hook Blocks

.1 360 swivel type hook with ball or roller thrust bearing.

.2 Steel safety latch and spring.

.3 Fully enclosed load sheaves on sealed ball or roller bearings.

.4 Forged steel hook rated for lifting applications.

.5 Provide test certificates for each hook.

.6 The hook blocks shall have permanent capacity marking.

.8 Controls:

.1 Voltage not to exceed 120 volts.

.2 Radio remote control system with receiver and transmitter

.1 Crane manufacturer's recommended product.

.2 Non-licenced type

.3 Conformance to all requirements of all Authorities Having Jurisdiction for the location of the installation and use.

.4 Minimum 100 ft. operating range

.5 Rechargeable batteries (2 sets) and charger.

.6 Belt Pack type

.7 Stepless joystick controls.

.8 Motion control as follows:

.1 Bridge: North, South

.2 Trolley: East, West

.3 Hoist: Up, Down

.4 E-stop

.5 Start/Horn actuation

.4 Runway and Structure:

.1 The runways shall consist of standard structural steel shapes, included as part of the building roof structure installations.

.5 Painting

.1 All surfaces of the structural crane parts shall be cleaned, primed and painted.

.2 Clean metal surfaces shall be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with MPI requirements. Remove traces of blast products from surfaces, pockets and corners to be painted by brushing with clean brushes.

.3 Apply two coats of industrial grade paint on the surfaces of the structure crane parts.

.4 Finish color shall be safety yellow.

.5 Apply rust preventing compound on machined surfaces.

.6 After completion of installation, thoroughly clean and touch-up the paint work as required.

.6 Labelling:

.1 Provide crane systems with permanent capacity labels as follows:

.1 Rated capacity in kilograms.

.2 Marked on each side of the bridge girder.

.2 Hook block permanently marked with system capacity.

.3 Place the rated capacity labels on crane, hoist and load blocks at height and location easily read from floor level and loading position.

.4 Underside of the bridge shall be permanently labelled with arrows indicating direction of travel, which coordinates with the directions shown on the transmitter control.

.5 A corrosion- resistant nameplate shall be fixed to the bridge, and trolley/hoist assembly with the following information.

.1 Name of manufacturer

.2 Mfg.'s model number and serial number

.3 Capacity in Kilograms

.4 Date of manufacture (month and year)

2.2 ELECTRICAL REQUIREMENTS

.1 Main Power: 480 volt / 3phase / 60hz.

.2 Provide and install all electrical equipment, runway conductors, load side power and control wiring for the complete operation of the crane systems as described in this specification.

.3 Electrical Motors:

.1 Crane duty.

.2 Motor shall have class "F" insulation and shall be thermally protected by heat sensors embedded in the windings.

.4 Controllers:

.1 Thermal magnetic circuit breaker or fused disconnect switch over current and short circuit protection for each motor and controller in all three phases.

.2 Lockable breaker or disconnect switch, for OFF position.

.3 Circuit breaker shall be provided for each individual crane motor.

.4 Provide standard controls VFD on all motions.

.5 Limiting Devices:

.1 Hoist Movement:

.1 Provide a geared limit switch on each hoist drum to control upper and lower limit range.

.2 Set lower limit to protect minimum 3 wraps on the drum.

.6 Electrical Wiring, Conduit and Fittings:

.1 Threaded rigid steel conduit shall be used. Electrical metallic tubing (EMT) not acceptable.

.2 Wiring – stranded copper, in accordance with CSA C22.1, except minimum size 12 AWG XLPE RW90.

.3 Wiring between controllers and resistors – heat, moisture and abrasion resistant cable.

.7 Provide individual power factor correction capacitors, for all motors 3.7 kW and larger. Size capacitor to achieve a power factor of 0.95 pf.

.8 All wiring connections to electrical equipment in control enclosures shall be terminated on terminal strips with lugs or spades and properly identified with slip on plastic labels.

.9 A separate green insulated ground conductor shall be provided to establish effective grounding system of all electrical equipment such as motors, brakes, starters, pull button stations, boxes, etc.

.10 Cross bridge electrification shall be festooned cable on trolleys and track.

.11 Runway shall be electrified using insulated conductor bars.

2.3 MAINTENANCE AND SERVICING DESIGN

.1 Make all parts subject to servicing, adjustment or replacement by operating or maintenance personnel readily accessible. Design which renders servicing, adjustment or replacement unduly difficult under field conditions will not be acceptable.

.2 Provide any special tools required for servicing or adjustment..

.3 Plan manufacturing, delivery, installation, testing, commissioning and certification of crane systems to meet the approved construction schedule.

.4 Execute work by methods to avoid damage to other work, and which will provide proper surfaces to receive patching and finishing.

.5 Verify the installation of the crane runway beam prior to the installation of the crane rail. Any deviations to the runway steel shall be reported and documented for rectification. The report shall be provided to builder and consultant.

3 Execution

3.1 INSTALLATION

.1 Erect crane support structure to tolerances per CMAA 74 and CSA S16.

.2 Install crane systems in accordance with drawings and specifications meeting the requirements of all applicable codes, standards, specifications and regulations.

.3 Do not modify crane components in any manner without advance, written approval by crane manufacturer.

.4 Provide all necessary material, labour, tools and equipment for the installation.

.5 Ensure that installation is carried out within the tolerances specified in this Section, and applicable codes and standards.

.6 Complete all necessary electrical connections to building connection point.

.7 Supply and install supports, hangers, etc. required to support electrical services from building connection point to cranes.

.8 Upon completion of installation, touch up and restore to new condition, damaged or defaced factory finished surfaces.

.9 Remove protective coverings and clean exposed surfaces after completion.

.10 Install the main disconnect and control panel for the crane at an accessible location at ground level.

.11 All hoist equipment shall be installed in accordance with manufacturer's instructions and recommendations.

.12 Bolted connections shall be in accordance with torque tightening procedures specified in

.13 AISC Manual, Part 5.

3.2 TESTING, COMMISSIONING, CERTIFICATION AND TRAINING

.1 All crane equipment shall be operated through a complete lift and lowering cycle and through a complete travel of the bridge and trolley to determine the following:

.1 The equipment shall perform smoothly and safely.

.2 All tests shall be carried out with the crane systems loaded at 125 percent of capacity.

.3 Provide all necessary material, labour, tools and equipment required for all testing and commissioning.

.4 Supplier shall provide the test weight loads.

.1 Test weights shall be of minimal size and clearly labelled.

.5 Any defects shall be corrected by the Supplier without any expense to the Consultant.

.6 Hook Block Tests

.1 Establish a permanent throat base reference dimension before proof load testing, by making two trammel point marks on opposite sides of the hook throat.

.7 Crane Tests

.1 Test the cranes in accordance with applicable standards.

.8 Hook Tests

.1 Inspect all hooks for throat spread after completion of the crane load tests. Re-measure the distance between trammel points.

.2 An increase of 1% or more of the throat dimension based on the hook throat opening will constitute failure of this inspection. Replace hooks failing to pass the inspection and retest at Trade Contractor's expense.

3.3 TRAINING AND DEMONSTRATION

.1 Upon successful completion of testing and commissioning of crane, after the delivery of all documentation (manuals, drawings, certificates, etc) and prior to issuance of Certificate of Completion, carry out equipment and system demonstration and training.

.2 Demonstrate operations and maintenance of equipment and systems and provide training to Owner's operations and maintenance personnel.

.3 Provide certified personnel to demonstrate operation of crane.

.4 Provide Engineer a minimum of 7 days advance notice in writing of demonstration.

.5 Prior to demonstration, submit project record documents and operating and maintenance manuals to the Engineer.

.6 Instruct maintenance personnel (1 hour minimum allowance) in basic maintenance and use of the crane

END OF SECTION

1 General

1.1 GENERAL

.1 Design, manufacture, supply, installation, testing, and certification of a manual chain hoist and trolley, for monorail (by others).

.2 Coordination with supplier and installer of monorail as required.

1.2 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedure

.2 Section 01 74 11 - Cleaning

.3 Section 01 74 21 – Construction Demolition Waste Management and Disposal

.4 Section 01 77 00 – Closeout Procedure

.5 Section 01 78 00 – Closeout Submittals

.6 Section 01 79 00 – Demonstration and Training

1.3 REFERENCES

.1 Refer to the current versions of:

.2 ASME International (ASME):

.1 ASME B30.16 Overhead Hoists (Underhung)

.2 ASME HST-2 Performance Standard for Hand Chain Manually Operated Chain Hoists

.3 Canadian Standards Association (CSA):

.1 CAN/CSA-B167 – Overhead travelling cranes – Design, inspection, testing, maintenance, and safe.

.4 Hoist Manufacturer's Institute (HMI) documents.

1.4 SUBMITTALS

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Shop Drawings shall include all the major systems including and not limited to the following information:

.1 General arrangement drawing showing:

.1 Overall dimensions and clearances.

.2 Hoist Working Load Limit (WLL).

.3 Trolley WLL.

.2 HMI classification.

.3 Bill of materials.

1.5 QUALIFICATIONS

.1 Supplier, and Installing Contractor, and its personnel shall have a minimum five years of demonstrated experience in the related field of design, fabrication, installation, testing and commissioning of this type of equipment.

1.6 QUALITY ASSURANCE

.1 Manufacturer's authorized technical representative shall supervise the installation, and testing of the respective equipment and components.

1.7 DESIGN REQUIREMENTS

.1 Design equipment in accordance with the applicable standards and codes.

.2 Hoist shall be capable of lifting its full rated capacity from the floor level to the clear hook height.

1.8 PRE-START HEALTH AND SAFETY:

.1 Submit Pre-Start Health and Safety Review Report in accordance with this Section.

1.9 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling.

2 Products

2.1 MANUAL TROLLEY

.1 Underslung, four wheel.

.2 Suspension system to match hoist:

.1 Regular Hook Suspension Type

.1 WLL: ½ ton (455kg)

.3 Adjustable width – to suit monorail beam.

.4 Steel universal tread flanged hardened wheels with permanently lubricated shielded ball bearings.

.5 Drop stops in event of wheel failure.

.6 Steel side plates and connector pin

.7 Hoist suspension plate for hook mounted hoist.

.8 Acceptable product: CM 633 series or approved equivalent.

2.2 MANUAL CHAIN HOISTS

.1 Top hook mount

.1 One unit: WLL: ½ ton (455 kg)

.2 Steel or aluminum housing

.3 Integral overload protection

.4 Automatic brake for positive load control

.5 Spur gearing for greater lift with minimum effort

.6 Approved lifting chain and hook with safety latch.

.7 Welded hand chain

.8 Steel container for lifting chain

.9 Machined, forged lift wheel pockets

.10 Lift chain length: 10 ft (3m).

.11 Acceptable Product: CM Cyclone, or approved equivalent.

.12 Painting

.13 Manufacturer's standard paint and colours.

2.3 LABELLING:

.1 Hook block permanently marked with hoist capacity.

.2 A corrosion resistant nameplate shall be fixed to the trolley and hoist with the following information.

.1 Name of manufacturer

.2 Mfg.'s model number and serial number

.3 Capacity in tons

.4 Date of manufacture (month and year)

2.4 MAINTENANCE AND SERVICING DESIGN

.1 Make all parts subject to servicing, adjustment or replacement by operating or maintenance personnel readily accessible. Design which renders servicing, adjustment or replacement unduly difficult under field conditions will not be acceptable.

.2 Provide any special tools required for servicing or adjustment.

3 Execution

3.1 INSTALLATION

.1 Install in accordance with drawings and specifications meeting the requirements of all applicable codes, standards, specifications and regulations.

.2 Do not modify components in any manner without advance, written approval by product manufacturer.

.3 Provide all necessary material, labour, tools and equipment for the installation.

.4 Ensure that installation is carried out within the tolerances specified in this Section, and applicable codes and standards.

.5 Upon completion of installation, touch up and restore to new condition, damaged or defaced factory finished surfaces.

.6 Remove protective coverings and clean exposed surfaces after completion.

3.2 TESTING, COMMISSIONING, CERTIFICATION AND TRAINING

.1 All equipment shall be operated through a complete lift and lowering cycle and through a complete travel of the trolley to determine the following:

.1 The equipment shall perform smoothly and safely.

.2 All tests shall be carried out with the hoist/trolly loaded at 125 percent of capacity.

.3 Provide all necessary material, labour, tools and equipment required for all testing and commissioning.

.4 Supplier shall provide the test weight loads.

.1 Test weights shall be of minimal size and clearly labelled.

.5 Any defects shall be corrected by the Supplier without any expense to the Consultant.

.6 Hook Block Tests

.1 Establish a permanent throat base reference dimension before proof load testing, by making two trammel point marks on opposite sides of the hook throat.

.7 Hook Tests

.1 Inspect all hooks for throat spread after completion of the crane load tests. Re-measure the distance between trammel points.

.2 An increase of 1% or more of the throat dimension based on the hook throat opening will constitute failure of this inspection. Replace hooks failing to pass the inspection and retest at Trade Contractor's expense.

3.3 TRAINING AND DEMONSTRATION

.1 Upon successful completion of testing and commissioning of hoist/trolley, after the delivery of all documentation (manuals, drawings, certificates, etc) and prior to issuance of Certificate of Completion, carry out equipment and system demonstration and training.

.2 Demonstrate operations and maintenance of equipment and systems and provide training to Owner's operations and maintenance personnel.

.3 Provide certified personnel to demonstrate operation of hoist/trolley

.4 Provide Engineer a minimum of 7 days advance notice in writing of demonstration.

.5 Prior to demonstration, submit project record documents and operating and maintenance manuals to the Engineer.

.6 Instruct personnel (1/2 hour minimum allowance) in basic maintenance and use of the hoist/trolley.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 General Conditions, Supplementary Conditions and Division 01 apply to this section.

1.2 SUMMARY

.1 This Section includes requirements for the design, supply, installation, testing and commissioning of a skid/frame mounted abrasive blast media reclaim system, including but not limited to the following components.

.2 Work includes but is not limited to all materials and resources for design, supply, installation, testing, commissioning and approvals for the following:

- .1 Receiving system for used media and by products.
  - .1 Dry and wet
  - .2 From below grade level cross auger transporting media/by products from blast room
- .2 Primary liquid separation
  - .1 Prior to, inside, or after Media elevator (see next item)
  - .2 With drainage of the majority of wet blasting water to adjacent building sump or tankby other division.
- .3 Media elevator
  - .1 Lift of media (dry and wet) from Receiving System to reclaim system on main floor
- .4 Media buffering.
  - .1 Provide buffer space to compensate between used media/by-product delivery rates and reclaim system rates.
  - .2 Provide further gravity dewatering as required.
- .5 Media bypass.
  - .1 To allow by pass of reclaim system.
- .6 Wet media drying
  - .1 Final drying of dewatered media.
  - .2 May be incorporated with final media cleansing operations.
- .7 Media cleansing
  - .1 Removal of contaminants and broken media no longer suitable for reuse.
  - .2 Dust collection system to contain all dust producing activities.
  - .3 Dust collection container – forklift movable.
- .8 Reclaimed Media Delivery System
  - .1 From cleansing unit to clean media hopper
  - .2 Dust collection
- .9 Reclaimed media receiving container.

.10 Welded steel frame for major assembly.

.11 Interconnecting duct work and components.

.12 All electrical and controls including overall safety provisions and controls.

.13 Connections to all required utilities. (Utilities provided by Owner)

.14 Startup and Testing

.15 Prestart safety review.

.3 System shall be configured to fit within the spaces indicated on the drawings.

1.3 GENERAL PROCESS:

.1 The facility will use both dry blasting and wet (vapour) blasting systems.

.2 Blasting is currently operating on one 8 hour shift per day.

.3 Dry and wet blasting will not occur on the same day.

.4 The media reclamation will be required during both wet and dry blasting operations.

.5 Dry blasting.

.1 Compressed air driven, pressure pot systems

.2 Conveyed product: Media and by-products (iron based particles, paints, etc.)

.1 Media including but not limited to sand, aluminum oxide based, other non-ferrite based

.2 Assumed media and particulate maximum density: 150 lbs/cu.ft. (2400 kg/m3)

.6 Vapour (wet) blasting

.1 Compressed air driven, water and media mixture, currently using GRACO Ecoquip EQs (skid) system with integral water tank, having the following approximate capacities (as taken from publication “Instructions EcoQuip 2™ EQs, EQc, and EQ Trailer Unit Vapor Abrasive Blast System” GRACO doc # 3A7467E rev. E)

.1 Maximum Water Capacity: 115 usg (435 litres)

.2 Maximum Abrasive Capacity: 880 lbs (400kg) based on #80 grit Garnet media

.2 Conveyed product:

.1 Soupy-slurry consisting of:

.1 Water,

.2 Wetted media (as per dry media), and

.3 Wetted by-products (as per dry blasting).

.2 Assumed water/wetted media and particulate density:

.1 100 lbs/ cu.ft.

.7 General process and rates:

.1 Estimated dry blasting conveyed product generated:

.1 Particles and by-products: 400 lbs/ hr. (185 kg/hr.)

.2 Estimated wet blasting conveyed product generated:

.1 Based on use of only one Ecoquip unit, that is filled twice during an 8 hour blasting shift:

.1 Average of 220 lbs of media in 35 gallons of water per hour (100kg of media in 145 kg (145 litres) of water per hour).

.2 Confirm values with end users.

.3 Water only

.1 Occasional room floor washdown may occur after wet blasting.

.2 Traces of media or particulates may be present.

.3 Estimated 10 usgpm (380 litres/minute) flow.

.4 Water will flow through blast room conveyors and into the media system dewatering unit as per normal media reclaim.

1.4 RELATED REQUIREMENTS

.1 Not used.

1.5 DEFINITIONS

.1 Not used.

1.6 REFERENCE STANDARDS

.1 Refer to the latest version of the following documents:

.1 Air Movement and Control Association International

.1 AMCA Publications 99, Standards Handbook.

.2 AMCA Standard 220, Laboratory Methods of Testing Air Curtains for Aerodynamic Performance Ratings.

.3 AMCA Standard 300, Reverberant Room Method for Sound Testing of Fans.

.4 ANSI/AMCA Standard 301, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

.2 American Society for Testing and Materials International, (ASTM)

.1 ASTM A653/A653M-02a, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 American National Standards Institute/National Fire Prevention Association (ANSI/NFPA)

.3 ANSI/ASHRAE 51, Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.

.4 ANSI/ASHRAE Standard 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size

.5 ANSI/NFPA 91: Standard for Exhaust Systems for Air Conveying of Materials

.6 ANSI/AMCA Standard 210, Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB 1.181, Ready-Mixed Organic Zinc-Rich Coating.

.2 CGSB 31-GP-105Ma, Zinc Phosphate Conversion Coatings for Paint Base

.4 Canadian Standards Association

.1 CSA Standard C22.1, Canadian Electrical Code.

.2 CSA G40.20-04/G40.21, General Requirements for Rolled or Welded Structural Quality Steel / Structural Quality Steel

.3 CAN/CSA-G164-M92, Hot Dip Galvanizing or Irregularly Shaped Articles

.4 CSA-S16, Design of Steel Structures

.5 CSA-S136, North American Specification for the Design of Cold Formed Steel Structural Members

.6 CSA W47.1, Certification of Companies for Fusion Welding of Steel

.7 CSA W59, Welded Steel Construction (Metal Arc Welding)

.8 CSA Z432 – Safeguarding of Machinery

.5 The Society for Protective Coatings (SSPC) and National Association of Corrosion Engineers International (NACE):

.1 SSPC-SP 1, Solvent Cleaning

.2 SSPC-SP 2, Hand Tool Cleaning

.3 SSPC-SP 3, Power Tool Cleaning

.4 SSPC-SP 6/ NACE No. 3, Commercial Blast Cleaning

.6 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S102-1988 (R2000), Surface Burning Characteristics of Building Materials and Assemblies.

.7 International Organisation for Standardization:

.1 ISO-5801, Industrial Fans - Performance Testing Using Standardized Airways.

1.7 SUBMITTALS

.1 Submit the following information in electronic document format (pdf, etc.) with the additional requirements as specified for each:

.1 Total Weight

.2 Shipping breakdowns

.3 Foundation loads (forces) and layout indicating placement of all electrical conduits, anchor bolts, and any equipment that must be installed in the concrete work of the foundations.

.4 Accessories shipped loose by packaged equipment supplier, showing their final location in field assembly.

.5 Control equipment shipped loose, by packaged equipment supplier, showing final location in field assembly.

.6 Unit dimensions.

.2 Submit manufacturer's detailed composite wiring diagrams for power and control systems showing factory installed wiring, field wiring, sequences of operation and all control devices. Interconnection lists, schematic diagrams with cross-referenced components lists and sequence of operations.

.3 Type of lubricants used.

.4 Lifting plan for unloading and placing of equipment, including mass distribution drawings showing point loads and total unit weight.

.5 Elevations, sections and details of support and operating components.

.6 Overall Assembly / Installation drawings and related documents.

1.8 CLOSEOUT SUBMITTALS/MANUALS

.1 Submit the following in Operations and Maintenance Manuals.

.1 Identification: Manufacturing name, type, year, serial number, number of units, capacity, and identification of related systems.

.2 Safety precautions.

.3 Functional description detailing operation and control.

.4 Performance criteria and maintenance data.

.5 Operating instructions and precautions.

.6 Component parts availability including names and addresses of spare part

.7 Suppliers.

.8 Consumables.

.9 Lubrication schedule indicating lubrication points and type of lubricant recommended.

.10 Maintenance and troubleshooting guidelines/protocol, and recommended equipment for analysis and repair.

.11 Detailed dis-assembly and re-assembly instructions for major components complete with photographs.

.12 Final tests and commissioning reports.

.13 Items submitted to Owner’s Representative: keys, tools, special devices, maintenance manuals.

.14 Record Drawings.

1.9 QUALITY ASSURANCE

.1 Designer Qualifications:

.2 The design shall be prepared by persons with, or under continued direct supervision by a qualified technical person, with at least ten (10) years of experience in design of industrial media reclamaing systems of this type and scope.

.3 In addition, the following system designs shall be approved and stamped by a qualified Professional Engineer licenced to practice in the state or province where the system is designed and built:

.1 Structural design

1.10 MANUFACTURER QUALIFICATIONS:

.1 The Manufacturer(s) of the system shall:

.2 Demonstrate at least ten (10) years of experience designing, manufacturing, supervising installation, and providing product support for this type of equipment.

.3 Be capable of providing product support in the areas of operation, installation, engineering and product development, repair departments, and spare parts.

1.11 MANUFACTURER'S REPRESENTATIVE:

.1 A qualified manufacturer's representative shall be available to:

.1 Provide technical support to the installer, by telephone throughout the installation period, between 7am and 5pm Eastern Time, Monday through Friday throughout the installation period.

.2 Be on site for a minimum of 8 hours per day at each of the following milestones (1 site day in total):

.1 Initial start-up and ongoing testing. Include for 1 site day.

.2 Training: Provide technical representative to train Owner's Representative's maintenance personnel in operation and maintenance of specified equipment as indicated in Section 1.14 - Training.

1.12 DELIVERY, STORAGE AND HANDLING

.1 The system shall be assembled, tested, and painted, and dismantled only sufficiently for proper shipment.

.2 Pack the system components in such a way as to adequately protect them against damage during transportation, unloading, setting in place, and assembly.

.3 Pay all charges, fees, insurance, import/export duties, custom fees and all expenses related to transportation of the system and accessories to the site.

.4 Provide all necessary labor, materials, hoisting equipment, tools and all incidentals required to unload the equipment to a designated laydown area at site.

.5 Provide all necessary labor, materials, hoisting equipment, tools and all incidentals required to move equipment from laydown area and placement at final location.

.6 Vendor shall familiarize himself or herself with the limitations of delivering the equipment to the site. Delivery shall be by truck.

.7 All miscellaneous materials, tools and spare parts shall be delivered to the site in sealed containers adequately protected against the intrusion of moisture or foreign matter.

.8 Special precautions shall be taken to prevent damage to electrical components such as motors, controls and conductors.

.9 All materials shall be delivered to the site with their original manufacturer's markings and identification intact.

.10 The Owner's Representative reserves the right to reject materials that are damaged, improperly identified or not in conformance with reviewed shop drawings and catalog

1.13 SITE CONDITIONS

.1 The Manufacturer is responsible for providing all necessary information to the Owner's Representative for coordination and proper relation of all work to the site.

.2 The Manufacturer shall verify all existing dimensions of the site and of the rail equipment that relate to fabrication of the system including connecting ductwork, and notify the Owner's Representative of any discrepancy before ordering equipment and material, and starting fabrication or installation.

1.14 WARRANTY

.1 Provide complete parts and labour warranty, with no cost to the customer, for a period of a minimum of 12 months from the date of entry into service.

.2 Refer to Supplementary Conditions.

1.15 TRAINING

.1 Provide training as noted below.

.1 On site, to train in all aspects of equipment and system(s) operation(s), repair and maintenance.

.2 Each of the groups listed below shall be trained on separate days as follows:

.1 System Operators: 2 groups of 4 persons: 1 hour session per group.

.1 General familiarization.

.2 Hands-on operation

.3 Basic troubleshooting.

.2 Maintenance Mechanics and Electricians: 2 groups of 4 persons. (1 hour per session)

.1 General electrical and mechanical maintenance.

.2 Hands on.

.3 Troubleshooting – basic and control system functions, including for any PLC.

1.16 SPARE PARTS INFORMATION AND TECHNICAL SUPPORT

.1 Provide:

.1 Recommended list of spare parts for the complete system.

.2 Spare parts list shall show the original equipment manufacturer part numbers.

.3 Closest source of spare parts, preferably within Northern Ontario, and Canada.

.4 Contact number for future technical support.

.5 Records of unit design, fabrication and testing: maintained on file by the manufacturer for the life of the equipment (minimum of 30 years).

2 Products

2.1 GENERAL

.1 Design and provide all equipment and controls necessary to provide the overall reclaim system performance as indicated in this section.

.2 Refer to drawings for general locations and available spaces for the system.

.3 Designed for indoor installation and operation in temperatures ranging from 10C to +40C.

.4 System shall be skid/frame mounted to the extent possible, to simplify original site installation and possible future relocation.

.5 The system shall be able to process media at the following minimum rates:

.1 Dry Blasting / Dry media: to match the rate of used dry media delivered by cross auger, based on the production rates indicated in Part 1 of this document..

.2 Wet Blasting / Wet media: such that the wet media delivered by the cross auger during one 8 hour shift is reclaimed within a total period of 16 hours including the shift, based on the production rates indicated in Part 1 of this document.

.3 Provide media buffering storage system to adapt cross auger media delivery rates and media drying/cleaning processing rates.

.6 All components, and assembled electrical/control panels shall be CSA or ETLC approved.

2.2 MEDIA RECEIVING SYSTEM

.1 Installed below grade in open pit.

.2 Receive continuous delivery of media from Blast Room cross auger (by other discipline).

.3 Transfer media to primary dewatering system

2.3 PRIMARY DEWATERING SYSTEM

.1 Unit may be incorporated in the Media Receiving , Media Elevating, and / or Reclaim Buffering systems (see items below).

.2 Provide gravity drainage to separate majority of water from incoming products of wet blasting operations, with minimal loss of reusable media, in order to minimize media dryer load.

.3 Provide discharge for separated liquid.

.1 1-1/2 inch nominal outlet with isolation ball valve with NPT connections.

.2 Discharged liquid will flow into sump for subsequent pumping to oil-water-separator, all by other discipline.

2.4 MEDIA ELEVATING SYSTEM

.1 Provide enclosed system to lift media received from cross auger, from pit level to next processing stage.

.1 Originally dry used media,

.2 Wet and/or dewatered used media, according to component locations and layout.

.3 Buffer capacity as required.

2.5 SYSTEM BYPASS

.1 Discharge used media without processing through drying/reclamation system.

.2 Discharge chute

2.6 MEDIA DRYING AND CLEANING SYSTEM

.1 Provide system for batch or continuous drying of dewatered media.

.2 To provide level of dryness required for subsequent re-use of media.

.3 Enclosed gravity fall air-wash system for final cleaning of dry/dried media.

.4 Automatic moisture sensing and dryer activation.

.5 Provide dust collection and discharge system for collected contaminants.

.6 Provide reclaimed media discharge system complete with flexible connection to reclaimed media container.

2.7 RECLAIMED MEDIA CONTAINER

.1 For collection, transport, and transfer of reclaimed blast media directly into existing blast pots and existing Ecoquip units.

.2 For each reclaimed media discharge location

.3 Minimum 8 cubic foot (0.23 cubic meter) capacity

.4 Steel welded fabrication

.5 Complete with hinged lid with flexible connector receiver.

.6 Sloped bottom.

.7 Bottom slide gate discharge with actuating lever (for leverage)

.1 2 inch nominal size

.2 24 inch long discharge hose

.8 Integral fork lift fork tubes.

2.8 SERVICE ACCESS PLATFORMS

.1 All maintenance points and serviceable components of the reclaim system shall be located vertically within 1.5m of the floor, or the equipment shall include integrated maintenance / service access work platforms as required to meet the 1.5m height requirement.

.2 Such access platforms shall:

.1 be fully supported from the equipment itself, unless otherwise approved by ONTC,

.2 provide a minimum working standing surface of 39 in. x 39 in. (1m x 1m), to suit the minimum horizontal work clearance, whichever is greater, and

.3 include ladder access with any fall protection to meet the requirements of the Authorities Having Jurisdiction.

2.9 RECIRCULATING CARTRIDGE FILTER DUST COLLECTOR FOR RECLAIM SYSTEM

.1 Capture dusts produced by the various reclaim activities.

.2 All steel construction.

.3 Framing designed for unimpeded removal / insertion of underside dust containers.

.4 Elimination of moisture collected from media drying.

.5 Filtration:

.1 Cartridge type filters.

.2 Suitable for exposure to moist air (as may occur from media drying process).

.3 If any air is expelled outside of unit into the room, the released air shall be filtered to contain maximum particulate matter of:

.1 1 milligram / cubic metre (0.45 ppm by weight)

.4 Tool-less cartridge removal/replacement.

.5 Polyester open pleated type cartridges, with 100% active media exposure.

.6 Filter air to cloth ratio: less than 3.6 CFM/sq.ft.

.7 Automatic pulse compressed air filter cleaning (pulse cycle duration and frequency adjustable)

.8 Differential pressure indication

.2 Sloped bottom hopper(s)

.1 Flexible connector to dust container lid.

.3 Dust container

.1 Provide 205 L (nominal) steel barrel or similar

.1 Lid with quick release steel clamp, and adapter for flexible connector hose.

.2 Will be placed on wood pallet, or similar skid, provided by ONTC

2.10 FINISH:

.1 Externally sourced products to use suppliers standard coating and colour.

.2 Unfinished purchased products, and all other non wearing surfaces shall be coated as follows, or as otherwise approved by ONTC.

.1 Primer: High solids, rust inhibitive, universal, phenolic alkyd metal primer.

.1 SSPC-SP6/NAC 3 preparation.

.2 Apply coating within 8 hours of blasting to avoid flash rusting.

.3 Minimum DFT: 3 mils

.4 Sherwin Williams Kem Bond HS or approved equivalent.

.2 Top Coat: urethane alkyd enamel

.1 Preparation as per manufacturer's recommendation.

.2 2 coats, DFT: 2 mils per coat.

.3 Sherwin Williams Pro Industrial, or approved equivalent.

.3 Or approved equivalent

2.11 SYSTEM ELECTRICAL:

.1 CSA approved components and panel(s).

.2 480 volt, 3 phase power connection.

.3 Single point power connection.

.4 May be integrated with main control panel

.5 NEMA 12 enclosure, suitable for installation in Reclaim Room (refer to electrical drawings).

.6 Motors:

.1 TEFC

.2 Class F insulation, 40C Ambient,

.3 1.15 SF

.4 Inverter duty rated if used with VFDs

.7 Motor starter(s):

.1 Integral to main control panel, or

.2 Separately mounted in suitable enclosure.

.2 Motor control method:

.1 Soft start, non reversing, or VFD.

2.12 CONTROLS

.1 May be integrated into main electrical panel.

.2 CSA approved components and panel

.3 NEMA 4 enclosure, complete with,

.1 Lockable main disconnect, fused.

.2 Single point power connection.

.3 Control voltage: maximum 120V

.4 Local Panel / Remote Panels control selector

.5 Overall Reclaim System Start/stop push buttons for all components when components in AUTO mode.

.6 Reclaim / Reclaim Bypass selector switch.

.7 Individual Component mode selection for all system components: ON / OFF / AUTO, including

.1 Received media elevator

.2 Internal transfer systems including main bucket elevator

.3 Drying system

.4 Dust collector

.5 Additional components as may be included

.8 Dust Collector Pulse cleaning mode selector: DEMAND / OFF/ CONTINUOUS

.9 Emergency Stop, non-illuminated mushroom head button

.10 Dust Collector Photohelic filter system differential pressure gauge

.11 Indicator lights (all to be LED):

.1 Local Panel /Remote Panel Control

.2 Reclaim / Reclaim Bypass

.3 System Power ON

.4 Received media lift ON

.5 Reclaim elevator ON

.6 Dust collector

.1 Fan ON

.2 Filter changeout required

.3 Pulse activity

.4 Filter change indicator

.12 Auxiliary contacts (minimum 2 input, 2 output)

.2 Remote control panel:

.1 One panel for Blast Room location

.2 NEMA 4 enclosure

.3 Start/Stop push buttons for overall system

.4 Reclaim / Reclaim Bypass selector.

.5 LED indication of:

.1 Remote panel control active (if selected from main panel)

.2 Reclaim / Reclaim Bypass mode

.3 System ON

.4 Dust collector Filter changeout required

.6 Emergency Stop, non-illuminated mushroom head button

2.13 CONTROL SEQUENCES

.1 General

.1 All components shall be interlocked to operate as required by the overall system, and for safety.

.2 Main Disconnect Switch to ON

.3 Local / Remote Panel Selection

.1 Control provided by selected panel.

.4 Main Control Panel or Remote Control Panels:

.5 Start button depressed

.1 All system motors start

.1 Indicators confirm ON for each motor.

.2 Dust Collector auto-pulsing module actuated

.1 Pulse indicator light confirms operation

.3 Media drying:

.1 Drying function operates based on media moisture sensor.

.1 Media automatically recirculates through system until attained the required dryness level (adjustable).

.4 Permissive sent to media conveyor controller

.1 Enables conveyors to operate when in “AUTO” mode. Refer to conveyor specifications.

.2 Via dry contactor

.5 Stop or E-stop button depressed

.1 All system components shut down.

3 Execution

3.1 PREPARATION

.1 Provide reviewed Shop Drawings, to trades responsible for installation.

3.2 FACTORY TEST:

.1 At any time during the manufacture of the equipment, subject to reasonable notice, the Owner’s Representative or their designers may visit the Manufacturer’s facility to inspect manufacturing and quality control processes.

.2 The Manufacturer shall perform a comprehensive operational test of the subassemblies and system specified herein. The test shall test all components, subsystems, systems, software and hardware.

.3 Provide all lubricants, hydraulic oils, cleaning compounds, and similar materials required for the factory test.

.4 Any changes of equipment that can cause an unsafe condition shall be re-tested.

3.3 INSTALLATION

.1 Install in accordance with reviewed shop drawings, and manufacturer's recommendations.

3.4 TESTING AND COMMISSIONING.

.1 Provide all material and resources for testing of systems.

.1 Owner will provide dry and wet media and blasting process to provide used media for testing.

.2 Make all necessary adjustments.

.3 Complete final site cleanup.

END OF SECTION

PART 3 – RFP SPECIFICATIONS
SCHEDULE 3-A-4
REFERENCE REPORTS

Refer to the Reference Report as outlined below, and which are attached to this Schedule 3-A-4.

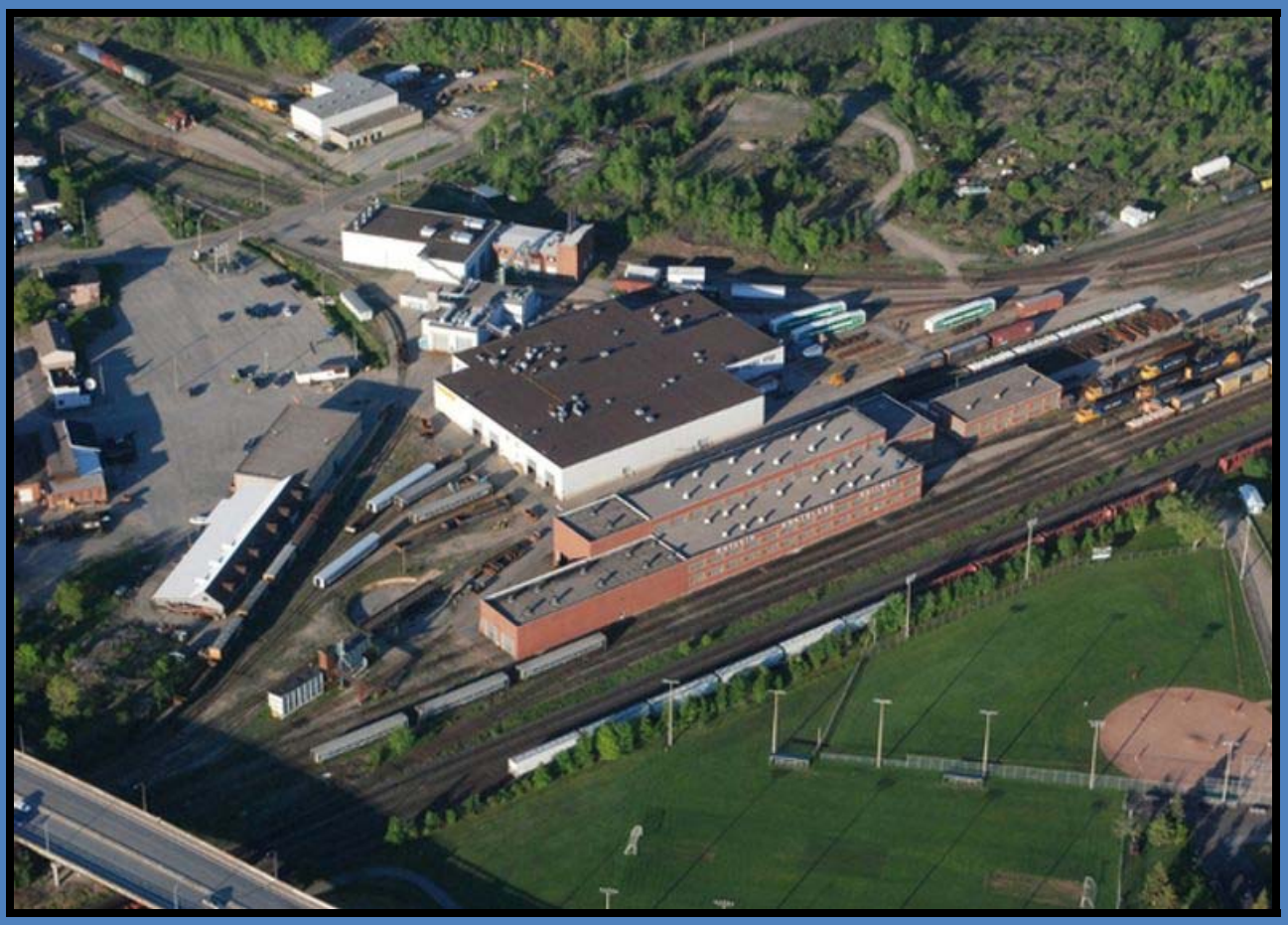
Description	Date
Designated Substances Survey Report	May 2020
EXP: Geotechnical Investigation and Design Report	30-April-2025

Issued – October 2018
Revised – May 2020

DESIGNATED SUBSTANCES SURVEY REPORT

ONTARIO NORTHLAND REMANUFACTURING AND REPAIR CENTRE

916 MCINTYRE STREET EAST
NORTH BAY, ONTARIO



Prepared and Revised by:

THOMAS CONTRACTING

Project No. TC-201434

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APPENDIX B - Lead Lab Transcripts & Sample Photos
APPENDIX C - Thermostatic Control Switch Photos
APPENDIX D - Building / Room DSS Assessment
APPENDIX E - Building Floor Plans

THOMAS CONTRACTING
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ENVIRONMENTAL MANAGEMENT EXPERTS

Reference: TC - 201434 October 31, 2018

ONTARIO NORTHLAND
555 Oak Street East
North Bay, ON
P1B 8L3

ATTENTION: Ed Rowley – Manager Facilities and Shop Equipment

Dear Sirs:

DESIGNATED SUBSTANCES SURVEY
Ontario Northland Remanufacturing and Repair Centre
916 McIntyre Street East
North Bay, Ontario

1.0 INTRODUCTION

Thomas Contracting was commissioned by the Ontario Northland Transportation Commission (ONTC) to complete a designated substances survey (DSS) of their Remanufacturing and Repair Centre located at 916 McIntyre Street East, North Bay, Ontario. The objective of this study was to determine whether any designated substances, as defined under the Ontario Occupational Health and Safety Act, were present within the Centre noted above prior to possible up-coming renovation work. This survey does not include and was not intended to cover any investigation of subsurface hazardous materials / designated substances.

Eleven substances have been "designated" in Ontario - acrylonitrile, arsenic, asbestos, benzene, coke oven emissions, ethylene oxide, isocyanates, lead, mercury, silica and vinyl chloride. Mould and PCB containing materials are also harmful to the environment if handled improperly and therefore are included in our study.

The Ontario Occupational Health and Safety Act requires that a list of all designated substances at a project site be provided to all bidders at the tendering stage. A Designated Substance Survey (DSS) identifies the designated substances present, their locations and concentrations. This information allows contractors involved in demolition or renovation activities to take appropriate steps to control exposure of workers and the general public to the designated substances that are present.

This survey satisfies requirements of the Occupational Health and Safety Act with regards to the presence / absence of designated substances identified within this report.

The study area, methodology and findings are outlined in the sections, which follow.

2.0 STUDY AREA

The study area under this assessment consisted of five (5) separate buildings (see photos 1 to 5 in Appendix 'A') located on the subject property as follows.

1. Power House
2. Grit and Paint Shop
3. Diesel Shop
4. Car Shop
5. Wheel Shop

3.0 STUDY METHODOLOGY

During October 2018, Thomas Contracting personnel conducted the fieldwork portion of the DSS assessment of the buildings noted above, focusing primarily on asbestos-containing materials, lead painted surfaces and mercury containing materials (thermostatic controls and fluorescent light tubes).

Access to suspected designated substances was made following industry-standard, testing protocols. All collected samples were subsequently labeled and the retrieval location(s) identified. All collected samples of suspected asbestos-containing material and lead-containing paint were forwarded to our laboratory subconsultant for positive identification of asbestos fibres and lead content levels.

4.0 ASBESTOS-CONTAINING MATERIALS (ACM's)

The DSS resulted in the retrieval of one hundred and fifty-three (153) representative samples of potential asbestos-containing material (90 of which required testing under Ont. Reg. 278/05). The potential ACM sampled consisted of pipewrap insulation, elbow/fitting insulation, jacket insulation, vinyl flooring, plaster, drywall mud (compound), ceiling tile, caulking and sprayed applied insulation. All samples were submitted to our laboratory sub-consultant (Lex Scientific Inc., Ontario) for PLM bulk analysis with photos of each sample material and laboratory transcripts of the findings presented in Appendix 'A'.

A summary of sample locations and type of building material is presented in Table 1 (below) with the raw laboratory results and photos given in Appendix 'A'. Locations (including floor plans) containing ACM's representative of the obtained bulk samples are shown in the "Building / Room DSS" table in Appendix 'D'.

Table 1
Summary of Asbestos Bulk Sample Results

Sample No.	***Photo No.*** *(Appendix 'A')*	***Location***	***Material***	***Asbestos Content***
ONR – 1	***6***	***Power House***	***Elbow / Fitting Insulation on Cold Water Supply lines***	***80 % Chrysotile***
ONR – 2	***7***	***Power House***	***Pipe Insulation on Condensate lines***	***80 % Amosite***
ONR – 3	***8***	***Power House***	***Exhaust / Breeching Insulation on Boilers***	***50 % Chrysotile***
ONR – 6	***9***	***Power House Mezzanine***	***Jacket Insulation on Deaerator Tank***	***80 % Chrysotile***
ONR – 7	***10***	***Wheel Shop Electrical Room***	***Pipe Insulation (anti-sweat) on Cold Water Lines***	***1 % Chrysotile***
ONR – 8	***11***	***Wheel Shop Electrical Room***	***Pipe Insulation on High Pressure Steam lines***	***90 % Chrysotile***
ONR – 9	***-***	***Wheel Shop Electrical Room***	***Pipe Insulation on Heating lines***	***80 % Chrysotile***
ONR – 12	*12*	*Wheel Shop Room 2*	*2' x 4' Drop Ceiling Tiles*	*None Detected*
ONR – 12a	*-*	*Wheel Shop Room 2*	*2' x 4' Drop Ceiling Tiles*	*None Detected*
ONR – 12b	*-*	*Wheel Shop Room 2*	*2' x 4' Drop Ceiling Tiles*	*None Detected*
ONR – 13	***13***	***Wheel Shop Room 3***	***Elbow / Clean-out Insulation on Rain Leader lines***	***80 % Chrysotile***
ONR – 14	*-*	*Wheel Shop Room 4*	*Wall Plaster*	*None Detected*
ONR – 14a	*-*	*Wheel Shop Room 4*	*Wall Plaster*	*None Detected*
ONR – 14b	*-*	*Wheel Shop Room 4*	*Wall Plaster*	*None Detected*
ONR – 15	*14*	*Wheel Shop Room 5*	*12" x 12" Vinyl Floor Tile*	*None Detected*
ONR – 15a	*-*	*Wheel Shop Room 5*	*12" x 12" Vinyl Floor Tile*	*None Detected*
ONR – 15b	*-*	*Wheel Shop Room 5*	*12" x 12" Vinyl Floor Tile*	*None Detected*

Sample No.	***Photo No.*** *(Appendix 'A')*	***Location***	***Material***	***Asbestos Content***
ONR – 16	*15*	*Wheel Shop Room 5*	*2' x 4' Drop Ceiling Tiles*	*None Detected*
ONR – 16a	*-*	*Wheel Shop Room 5*	*2' x 4' Drop Ceiling Tiles*	*None Detected*
ONR – 16b	*-*	*Wheel Shop Room 5*	*2' x 4' Drop Ceiling Tiles*	*None Detected*
ONR – 17	*-*	*Wheel Shop Room 6*	*Pipe Insulation (anti-sweat) on Cold Water lines*	*None Detected*
ONR – 17a	*-*	*Wheel Shop Room 6*	*Pipe Insulation (anti-sweat) on Cold Water lines*	*None Detected*
ONR – 17b	*-*	*Wheel Shop Room 6*	*Pipe Insulation (anti-sweat) on Cold Water lines*	*None Detected*
ONR – 18	***-***	***Wheel Shop Room 7***	***Pipe Insulation on Domestic Hot Water lines***	***70 % Chrysotile***
ONR – 20	***16***	***Wheel Shop***	***Exterior Window / Door Caulking***	***20 % Chrysotile***
ONR – 22	***-***	***"Old" Paint Shop Room 1***	***Elbow / Fitting Insulation on Low Pressure Steam lines***	***80 % Chrysotile***
ONR – 24	*-*	*"Old" Paint Shop Room 4*	*Drywall Joint Compound on walls*	*None Detected*
ONR – 24a	*-*	*"Old" Paint Shop Room 4*	*Drywall Joint Compound on walls*	*None Detected*
ONR – 24b	*-*	*"Old" Paint Shop Room 4*	*Drywall Joint Compound on walls*	*None Detected*
ONR – 25	***17***	***"Old" Paint Shop Room 5***	***12" x 12" Vinyl Floor Tile***	***1 % Chrysotile***
ONR – 27	***18***	***Diesel Shop Tunnel***	***Pipe Insulation on Steam lines (white mag-block)***	***80 % Chrysotile***
ONR – 28	***19***	***Diesel Shop Tunnel***	***Tar Paper Wrap on Steam lines***	***10 % Chrysotile***
ONR – 29	***20***	***Diesel Shop Tunnel***	***Elbow / Fitting Insulation on Cold water lines***	***45 % Chrysotile 45 % Amosite***
ONR – 30	***21***	***Diesel Shop Tunnel***	***Pipe Insulation (anti-sweat) on Cold water lines***	***1 % Chrysotile***
ONR – 31	***22***	***Diesel Shop Tunnel***	***Elbow / Fitting Insulation on Steam lines***	***10 % Chrysotile 80 % Amosite***
ONR – 32	***23***	***Diesel Shop Room # 1***	***Pipe Insulation (anti-sweat) on Heating lines***	***60 % Chrysotile***
ONR – 33	***24***	***Diesel Shop Room # 3***	***Pipe Insulation on Cold water lines (anti-sweat / tar paper)***	***7 % Chrysotile***
ONR – 35	***25***	***Diesel Shop Room # 6***	***Pipe Insulation (air-cell) on Steam lines***	***60 % Chrysotile***

Sample No.	***Photo No.*** *(Appendix 'A')*	***Location***	***Material***	***Asbestos Content***
ONR – 36	*43a*	*Diesel Shop Room # 6*	*Sprayed Insulation on ceiling deck*	*None Detected*
ONR – 36a	*-*	*Diesel Shop Room # 6*	*Sprayed Insulation on ceiling deck*	*None Detected*
ONR – 36b	*-*	*Diesel Shop Room # 6*	*Sprayed Insulation on ceiling deck*	*None Detected*
ONR – 38	***-***	***Diesel Shop Room # 5***	***Pipe Insulation on Heating lines (anti-sweat)***	***80 % Chrysotile***
ONR – 40	***26***	***Diesel Shop Room # 4***	***Elbow / Fitting Insulation on Cold water lines***	***80 % Chrysotile***
ONR – 41	***27***	***Diesel Shop East Side***	***Elbow / Fitting Insulation on Heating lines***	***80 % Chrysotile***
ONR – 42	***27***	***Diesel Shop East Side***	***Pipe Insulation on Heating lines (anti-sweat)***	***80 % Chrysotile***
ONR – 43	***27***	***Diesel Shop East Side***	***Pipe Insulation on Heating lines (anti-sweat)***	***50 % Chrysotile***
ONR – 44	*28*	*Diesel Shop Room # 10*	*Plaster on wall*	*None Detected*
ONR – 44a	*-*	*Diesel Shop Room # 10*	*Plaster on wall*	*None Detected*
ONR – 44b	*-*	*Diesel Shop Room # 10*	*Plaster on wall*	*None Detected*
ONR – 45	*29*	*Diesel Shop Room # 10*	*12" x 12" Vinyl Floor Tile (beige)*	*None Detected*
ONR – 45a	*-*	*Diesel Shop Room # 10*	*12" x 12" Vinyl Floor Tile (beige)*	*None Detected*
ONR – 45b	*-*	*Diesel Shop Room # 10*	*12" x 12" Vinyl Floor Tile (beige)*	*None Detected*
ONR – 46	*30*	*Diesel Shop Room # 10*	*2' x 4' Drop Ceiling Tile*	*None Detected*
ONR – 46a	*-*	*Diesel Shop Room # 10*	*2' x 4' Drop Ceiling Tile*	*None Detected*
ONR – 46b	*-*	*Diesel Shop Room # 10*	*2' x 4' Drop Ceiling Tile*	*None Detected*
ONR – 48	*31*	*Diesel Shop Room # 12*	*Roll Vinyl Flooring*	*None Detected*
ONR – 48a	*-*	*Diesel Shop Room # 12*	*Roll Vinyl Flooring*	*None Detected*
ONR – 48b	*-*	*Diesel Shop Room # 12*	*Roll Vinyl Flooring*	*None Detected*
ONR – 50	***32***	***Diesel Shop Room # 17***	***Pipe Insulation on Heating lines (anti-sweat)***	***70 % Chrysotile***
ONR – 51	***-***	***Diesel Shop Pit Area***	***Pipe Insulation on Steam lines (anti-sweat)***	***80 % Chrysotile***
ONR – 52	***-***	***Diesel Shop Pit Area***	***Pipe Insulation on Cold water lines (anti-sweat / tar paper)***	***15 % Chrysotile***

Sample No.	***Photo No.*** *(Appendix 'A')*	***Location***	***Material***	***Asbestos Content***
ONR – 53	***-***	***Diesel Shop Pit Area***	***Pipe Insulation on Hot water lines (anti-sweat)***	***60 % Chrysotile***
ONR – 54	*-*	*Diesel Shop 2005 Addition*	*Elbow / Fitting Insulation on Piping*	*None Detected*
ONR – 54a	*-*	*Diesel Shop 2005 Addition*	*Elbow / Fitting Insulation on Piping*	*None Detected*
ONR – 54b	*-*	*Diesel Shop 2005 Addition*	*Elbow / Fitting Insulation on Piping*	*None Detected*
ONR – 57	*33*	*Diesel Shop Room # 102*	*12" x 12" Vinyl Floor Tile*	*None Detected*
ONR – 57a	*-*	*Diesel Shop Room # 102*	*12" x 12" Vinyl Floor Tile*	*None Detected*
ONR – 57b	*-*	*Diesel Shop Room # 102*	*12" x 12" Vinyl Floor Tile*	*None Detected*
ONR – 58	*34*	*Diesel Shop Room # 103*	*Pipe Insulation (tar paper) on Rain Leader lines*	*< 0.5% Chrysotile Deem non-asbestos*
ONR – 59	*35*	*Diesel Shop Room # 104*	*12" x 12" Vinyl Floor Tile*	*None Detected*
ONR – 59a	*-*	*Diesel Shop Room # 104*	*12" x 12" Vinyl Floor Tile*	*None Detected*
ONR – 59b	*-*	*Diesel Shop Room # 104*	*12" x 12" Vinyl Floor Tile*	*None Detected*
ONR – 60	*36*	*Diesel Shop Room # 104*	*2' x 4' Drop Ceiling Tile*	*None Detected*
ONR – 60a	*-*	*Diesel Shop Room # 104*	*2' x 4' Drop Ceiling Tile*	*None Detected*
ONR – 60b	*-*	*Diesel Shop Room # 104*	*2' x 4' Drop Ceiling Tile*	*None Detected*
ONR – 61	*37*	*Diesel Shop Room # 201*	*2' x 4' Drop Ceiling Tile*	*None Detected*
ONR – 61a	*-*	*Diesel Shop Room # 201*	*2' x 4' Drop Ceiling Tile*	*None Detected*
ONR – 61b	*37*	*Diesel Shop Room # 201*	*2' x 4' Drop Ceiling Tile*	*None Detected*
ONR – 63	*38*	*Diesel Shop Room # 202*	*Drywall Joint Compound*	*None Detected*
ONR – 63a	*-*	*Diesel Shop Room # 202*	*Drywall Joint Compound*	*None Detected*
ONR – 63b	*-*	*Diesel Shop Room # 202*	*Drywall Joint Compound*	*None Detected*
ONR – 64	*39*	*Diesel Shop Room # 202*	*2' x 4' Drop Ceiling Tile*	*None Detected*
ONR – 64a	*-*	*Diesel Shop Room # 202*	*2' x 4' Drop Ceiling Tile*	*None Detected*
ONR – 64b	*-*	*Diesel Shop Room # 202*	*2' x 4' Drop Ceiling Tile*	*None Detected*
ONR – 65	***40***	***Car Shop Room # 200***	***Elbow / Fitting Insulation on Piping***	***65 % Chrysotile***

Sample No.	***Photo No.*** *(Appendix 'A')*	***Location***	***Material***	***Asbestos Content***
ONR – 70	*41*	*Car Shop Room D*	*12" x 12" Vinyl Floor Tile*	*None Detected*
ONR – 70a	*-*	*Car Shop Room D*	*12" x 12" Vinyl Floor Tile*	*None Detected*
ONR – 70b	*-*	*Car Shop Room D*	*12" x 12" Vinyl Floor Tile*	*None Detected*
ONR – 71	***42***	***Car Shop Room G***	***12" x 12" Vinyl Floor Tile***	***25 % Chrysotile***
ONR – 72	***43***	***Diesel Shop***	***Caulking Exterior Window and Door***	***8 % Chrysotile***
-	***43b***	***Car Shop Room 117***	***Asbestos Material(s) Storage Cabinet***	***Asbestos Waste***
-	***43c***	***Diesel Shop Service Pits***	***"Transite" panels on upper part of exhaust hoods for locomotives***	***8 % Chrysotile***

4.1 Asbestos Findings

Based on our site assessment and laboratory results, the following general asbestos findings are presented in table 2 (below) with a further detailed "Building / Room DSS" table of our findings presented in Appendix 'D'.

Table 2
Summary of Asbestos Findings

Building	***Asbestos Findings***
Power House	• *All thermal system insulation (Pipewrap, Elbows/Fittings, Headers, Breeching/Exhaust, Jacket Insulation and possible Refractory Brick) within Rooms 100 & 200 (boiler area & mezzanine) is asbestos-containing.* • *All thermal system insulation (Pipewrap, Elbow/Fitting Insulation) within Room 102 (electrical area) is fibreglass.* • *All Exterior Window and Door Caulking is asbestos-containing.* • *Minor repair work to existing ACM's is recommended.*
Wheel Shop	• *All thermal system insulation (Pipewrap, Elbow/Fitting and Header Insulation) is asbestos-containing.* • *All Exterior Window and Door Caulking is asbestos-containing.* • *Minor repair work to existing ACM's is recommended.* • *Vinyl Floor Tiles, Drop Ceiling Tiles and Wall / Ceiling Plaster is non-asbestos.*
"Old" Paint & Grit Shop	• *All Elbow/Fitting and Jacket Insulation is asbestos-containing.* • *Vinyl Floor Tiles are asbestos-containing.* • *Drywall Joint Compound is non-asbestos.* • *All Pipewrap and Ductwork Insulation is fiberglass.*

"New" Paint Shop 2005	• *Nothing found or suspected.*
Diesel Shop (Original Area)	• *All thermal system insulation (Pipewrap, Elbows/Fittings, Headers and Jacket Insulation) is asbestos-containing.* • *All Sprayed Applied Insulation, Wall & Ceiling Plaster, Vinyl Flooring, Drywall Joint Compound and Ceiling Tiles (including sub-ceiling 12" x 12" tiles) are non-asbestos or fibreglass.* • *"Transite" panels on upper part of exhaust hoods for locomotives are asbestos-containing (see photo # 43c in Appendix A).* • *All Exterior Window and Door Caulking is asbestos-containing.* • *Minor clean-up work to existing ACM's is recommended within Room 4.* • *Minor repair work to existing ACM's is recommended.*
Diesel Shop (Addition Area)	• *Nothing found or suspected.* • *All thermal system insulation (Pipewrap, Elbows/Fittings, Headers and Jacket Insulation) is non-asbestos or fibreglass.*
Car Shop	• *All Elbow/Fitting Insulation is asbestos-containing.* • *All Pipewrap and Ductwork Insulation is fiberglass.* • *Vinyl Flooring, Drop Ceiling Tiles and Drywall Joint Compound is non-asbestos.*
"New" Car Shop Office Area	• *Nothing found or suspected.*

Should future activities (demolition/renovation) occur within the buildings noted above which would disturb the asbestos-containing noted in this report, Thomas Contracting recommends that the affected material(s) be removed prior to these activities. This work must be carried out as outlined in R.R.O 2005, Reg. 278, Regulation respecting Asbestos on Construction Projects and in Building and Repair Operations.

5.0 LEAD-CONTAINING BUILDING MATERIALS

The survey resulted in the retrieval of twenty (20) representative samples of paint observed within the five buildings under this DSS. These paint samples were submitted to our laboratory sub-consultant (Caduceon Environmental Laboratories, Ottawa, Ontario) for follow-up lead analysis. Photo of the sampled paint(s) and the laboratory transcript of the findings are presented in Appendix 'B'.

A summary of sample location, surface paint colour and lead content is presented in Table 3 (below).

Table 3
Summary of Paint Sample Result

Sample No.	***Photo No.*** *(Appendix 'B')*	***Location***	***Sample Description***	***Lead Content (µg/g)***
ONR – 4	*44*	*Power House*	*Wall Paint (surface colour = green)*	*5830*
ONR – 5	*45*		*Ceiling Paint (surface colour = light green)*	*1010*

Sample No.	***Photo No.*** *(Appendix 'B')*	***Location***	***Sample Description***	***Lead Content (µg/g)***
ONR – 10	*46*	*Wheel Shop*	*Wall Paint in Room # 1 (surface colour = off white)*	*13800*
ONR – 11	*47*		*Wall & Ceiling Paint in Electrical Room (surface colour = yellow)*	*14200*
ONR – 19	*48*		*Wall Paint in Room # 7 (surface colour = beige)*	*6380*
ONR – 21	*49*		*Ceiling Paint in Room # 7 (surface colour = beige)*	*72*
ONR – 23	*50*	*Paint & Girt Shop "Old" Section*	*Wall Paint in Stairwell # 1 (surface colour = light beige)*	*214*
ONR – 26	*51*		*Wall Paint in Corridor # 9 (surface colour = white)*	*34*
ONR – 34	*52*	*Diesel Shop "Old" Section*	*Wall & Ceiling Paint in Room # 3 (surface colour = beige)*	*2590*
ONR – 37	*53*		*Wall Paint in Room # 6 (surface colour = green)*	*7990*
ONR – 39	*54*		*Ceiling Paint in Room # 5 (surface colour = dark green)*	*7750*
ONR – 47	*55*		*Structural Steel Paint in Main Shop (surface colour = beige)*	*13000*
ONR – 49	*56*		*Wall Paint in Room # 16 (surface colour = beige)*	*2530*
ONR – 55	*57*	*Diesel Shop Addition*	*Wall Paint throughout Shop (surface colour = beige)*	*110*
ONR – 56	*58*	*Diesel Shop "Old" Section*	*Wall & Ceiling Paint in Room # 100 (surface colour = white)*	*2880*
ONR – 62	*59*		*Wall Paint in Room # 201 (surface colour = green)*	*8010*
ONR – 66	*60*	*Car Shop*	*Ceiling Paint in Room # 200 (surface colour = beige)*	*10700*
ONR – 67	*61*		*Wall Paint in Room # 200 (surface colour = green)*	*5180*
ONR – 68	*-*		*Wall Paint in Mech. Room 'A' (surface colour = beige)*	*3950*
ONR – 69	*62*		*Wall Paint in Mech. Room 'A' (surface colour = light beige)*	*380*

5.1 Lead Paint Definition

In absence of a Canadian regulated definition of what constitutes a lead-based paint, the "Lead Guideline for Construction, Renovation, Maintenance or Repair", issued in October 2014 by the Environmental Abatement Council of Ontario (EACO) was followed.

Term	*Definition*	*Guideline Requirements*
Low-level lead paints and surface coatings	*Paint or surface coating containing less than or equal to 0.1% lead by dry weight (1000 µg/g, mg/kg, ppm).*	*If these materials (and the surfaces to which they are applied) are disturbed in a non-aggressive manner, performed using normal dust control procedures and are completed so that the TWA for PNOS is not exceeded, then worker protection from the inhalation of lead is not required. General health and safety precautions must still be implemented, which may include, in part, prohibiting eating, drinking, smoking and chewing in the work area, implementing dust suppression techniques and washing facilities for workers to wash hands and face.*
Lead-containing paints and surface coatings	*Paint or surface coating containing greater than 0.1% lead by dry weight (1000 µg/g, mg/kg, ppm) and less than 0.5% lead by dry weight (5000 µg/g, mg/kg, ppm).*	*Tasks performed that disturb these materials must be completed in accordance with the Classifications of Work Operations (in Section 7) and corresponding procedures (in Section 8). Alternatively, a hygiene or exposure assessment can be performed to determine procedures that are required.*
Lead-based paints and surface coatings	*Paint or surface coating containing equal to or greater than 0.5% lead by dry weight (5000 µg/g, mg/kg, ppm).*	*Tasks must always be completed in accordance with the procedures listed in the Classifications of Work Operations (in Section 7) and corresponding procedures (in Section 8). Alternatively, a hygiene or exposure assessment can be performed to determine procedures that are required.*

5.2 Lead Findings

Based on our site assessment and laboratory results, the following general lead findings are presented in Table 4 (below) with a further detailed "Building / Room DSS" table of our findings presented in Appendix 'D'.

Table 4
Summary of Lead Findings

Building	*Lead Findings*
Power House	• *Wall, ceiling and structural paint observed within the building is classed as Lead-containing paint.*
Wheel Shop	• *Wall, ceiling and structural paint observed within the building is classed as Lead-based paint.*
"Old" Paint & Grit Shop	• *Wall, ceiling and structural paint observed within the building is classed as Low-level lead paint.*
"New" Paint Shop 2005	• *Wall, ceiling and structural paint observed within the building is classed as Low-level lead paint.*

Diesel Shop (Original Area)	• *Wall, ceiling and structural paint observed within the building is classed as both Lead-containing and Lead-based paint.* • *Exterior window / door flashing and window sill plate caulking (see photos 63 & 64 in Appendix B) are both classed as Lead-based materials.*
Diesel Shop (Addition Area)	• *Wall, ceiling and structural paint observed within the building is classed as Low-level lead paint.* • *Exterior window / door flashing and window sill plate caulking (see photos 63 & 64 in Appendix B) are both classed as Lead-based materials.*
Car Shop	• *Wall, ceiling and structural paint observed within the building is classed as Low-level lead paint.* • *Lead-acid batteries storage in Room 117 (see photo 64a in Appendix B).*
"New" Car Shop Office Area	• *Wall, ceiling and structural paint observed within the building is classed as Low-level lead paint.*

Should future activities (demolition/renovation) occur within the buildings noted above which would disturb the lead materials noted in this report, Thomas Contracting recommends that the affected material(s) be removed prior to these activities. This work should be carried out as outlined in "Lead Guideline for Construction, Renovation, Maintenance or Repair", issued in October 2014 by the Environmental Abatement Council of Ontario (EACO).

5.3 Lead Pipes / Solder

Although not sampled due to inflicting damage / leaks to the existing plumbing within all five buildings, it is Thomas Contracting opinion based on visual inspection that lead may also be present as a component in pipes and in solder used in pipe fittings.

5.4 Lead Precautions

Prior to any renovations or demolition activities that may disturb materials identified to contain lead of any concentration, precautions must be taken as described in Ontario Regulation 213/91 as amended, Regulations for Construction Projects - made under the Occupational Health and Safety Act. This may include conducting an assessment of the potential exposure of airborne lead by a qualified person.

Exposure to lead-containing materials is regulated under the Revised Regulation of Ontario 843/90 as amended, Regulation respecting Lead - made under the Occupational Health and Safety Act including disposal of such material Ontario Regulation 347/90 Schedule 4 – Leachate Quality Criteria (Acceptable Lead Concentrations of < 5.0 mg/l). Care must be taken to prevent lead-containing particles from becoming airborne during the disturbance of lead-containing surfaces (i.e., during renovation or demolition projects). All lead abatement work must follow procedures outlined in both the "Guideline for Lead on Construction Projects", issued in September 2004 by the Occupational Health and Safety branch of the Ministry of Labour and the "Lead Guideline for Construction, Renovation, Maintenance or Repair", issued in October 2014 by the Environmental Abatement Council of Ontario (EACO).

6.0 MERCURY

Mercury is a naturally occurring metal. At room temperature it is a shiny, silver coloured odourless liquid. When heated it becomes a colourless, odourless gas. Mercury can be found in fluorescent light tubes, electrical switches, thermostats, thermometers, dental fillings, certain batteries and in some manufacturing processes.

The nervous system is very sensitive to all forms of mercury; however, vapour is especially harmful as it directly reaches the brain. Exposure to high levels of mercury may permanently damage the brain, kidneys and a developing fetus. Short-term exposure may cause lung damage, nausea, vomiting, skin rashes, and eye irritation.

6.1 Fluorescent Light Tubes Findings

Based on our site assessment the following general mercury findings are given in table 5 (below) with a further detailed "Building / Room DSS" table of our findings presented in Appendix 'D'.

Table 5
Summary of Fluorescent Light Tubes Findings

Building	***Mercury Findings***
Power House	• *Fluorescent Tubes*
Wheel Shop	• *Fluorescent Tubes*
"Old" Paint & Grit Shop	• *Fluorescent Tubes* • *Wall Thermostat*
"New" Paint Shop	• *Fluorescent Tubes*
Diesel Shop (Original Area)	• *Fluorescent Tubes* • *Wall Thermostat*
Diesel Shop (Addition Area)	• *Fluorescent Tubes* • *Wall Thermostat*
Car Shop	• *Fluorescent Tubes* • *Wall Thermostat*
"New" Car Shop Office Area	• *Fluorescent Tubes*

6.2 Thermostatic Control Switch Findings

Wall mounted thermostatic control switches, which contains small amounts of liquid mercury, were observed within all five buildings. Observed locations are detailed in our "Building / Room DSS" table of our findings presented in Appendix 'D'.

6.3 General Notes

Prior to any renovations or demolition activities that may disturb materials identified or suspected to contain mercury of any concentration, precautions must be taken to prevent mercury vapours from becoming airborne or liquid mercury contaminating the surrounding environment. Exposure to airborne mercury is regulated under the Revised Regulation of Ontario 844/90 as amended, Regulation respecting Mercury - made under the Occupational Health and Safety Act.

Mercury waste must be handled and disposed of according to the Revised Regulation of Ontario 347/90 as amended - made under the Environmental Protection Act, and may be subject to Leachate Criteria (Schedule 4) of this regulation. Therefore, it is our recommendation that prior to any demolition / renovation activity or if the fluorescent tubes/switches will not be utilized in the future, the fluorescent tubes and thermostatic control switches shall be disposed of properly or recycled by a licensed contractor.

7.0 SILICA

Although not sampled under this study, it is are opinion that free crystalline silica (common construction sand) may be present a component of concrete, mortar, brick, masonry, ceramics, granite, slate, stone, asphalt, etc., used in the construction of the building.

Precautions must be taken to prevent silica-containing particles from becoming airborne during the disturbance of silica-containing surfaces, such as during renovation or demolition projects. Exposure to airborne silica is regulated under the Revised Regulation of Ontario. 845/90 as amended, Regulation respecting Silica - made under the Occupational Health and Safety Act. All work being carried with silica containing materials should be conducted following the Guide Silica on Construction Projects issued September 2004 by the Occupational Health and Safety branch of the Ministry of Labour. Silica waste must be handled and disposed of according to the Revised Regulation of Ontario 347/90 as amended - made under the Environmental Protection Act.

8.0 OTHER DESIGNATED SUBSTANCES

8.1 Acrylonitrile

No source was identified. Acrylonitrile or CAN (also known as vinyl cyanide) is an explosive, flammable liquid used in the manufacture of acrylic fibres, robber-like materials and pesticide fumigants.

8.2 Arsenic

No source was identified. Arsenic is used in metallurgy for hardening copper, lead and alloys, in pigment production, in the manufacture of certain types of glass, in insecticides, fungicides and rodenticides, as a by-product in the smelting of copper ores, and as a dopant material in semiconductor manufacturing.

8.3 Benzene

No source was identified. Benzene or benzol is a colourless liquid. It is used as an intermediate in the production of styrene, phenol, cyclohexane, and other organic chemicals, and in the manufacture of detergents, pesticides, solvents, and paint removers. It is also found in gasoline.

8.4 Coke Oven Emissions

Not applicable for the surveyed site.

8.5 Ethylene Oxide

No source was identified. Ethylene oxide is a colourless gas liquefying below 12°C. It is used generally as a fumigant and sterilizing agent for medical equipment.

8.6 Isocyanates

No source was identified. Isocyanates (HDI, MDI and TDI) are used in the production of polyurethane and as an elastomer in casting compounds, mastics, and textile coatings (IPDI).

8.7 Vinyl Chloride

No source was identified. Vinyl chloride, also known as chloroethylene, is a colourless gas but is usually handled as a liquid under pressure. It is used in the production of PVC resins and in organic synthesis.

9.0 SUMMARY

A designated substances survey of the ONTC Remanufacturing and Repair Centre located at 916 McIntyre Street East, North Bay, Ontario, confirmed the presence of the following:

- *Asbestos-containing building material (ACM's).*
- *Lead paint.*
- *Lead materials "suspected" to be present as components in pipe and in solder used in pipe fittings.*
- *Liquid mercury in thermostatic control switch.*
- *Possible silica in concrete, mortar, brick, masonry, ceramics, granite, slate, asphalt, etc.*

10.0 RECOMMENDATIONS

10.1 Asbestos-containing Material (ACM's)

Based on our field observations, the majority of the identified ACM's do not pose a health hazard in their present state, however minor repair work is recommended to all slightly damaged ACM's including clean-up of fall-out elbow insulation noted on the floor within Room 4 of the Diesel Shop.

Should repair, removal or disposal of any asbestos-containing materials noted in this report be undertaken, all work must be performed in accordance with Ont. Reg. 278, "Regulation respecting Asbestos on Construction Projects and in Building and Repair Operations" and all applicable Federal and Provincial statutes as noted in our report.

10.2 Lead-containing Materials & Paints

Based on our observations, the identified lead paints, window flashing & caulking and possible lead containing pipes do not pose a health hazard in their present state. However, should removal and disposal of any lead-containing paint and possible lead containing pipes be undertaken, work should be performed in accordance with applicable Federal and Provincial statutes as noted in our report.

10.3 Mercury-containing Materials

Based on our observations, the identified mercury-containing equipment / products do not pose a health hazard in their present condition. All maintenance, removal and disposal of any mercury-containing materials must be performed in accordance with applicable Federal and Provincial statutes as noted in our report.

10.4 Silica-containing Materials

Based on our observations, the identified Silica - containing materials do not pose a health hazard in their present condition. All maintenance, removal and disposal of any Silica-containing materials must be performed in accordance with applicable Federal and Provincial statutes as noted in our report.

11.0 LIMITATIONS AND WARRANTY

- *This report is for the exclusive use of the client, their agents, and is neither an endorsement nor condemnation of the subject property.*
- *Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such parties. Thomas Contracting accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report. In particular, any contractors bidding on site demolition or renovation work should not rely solely upon the present report for volume or quantity estimates, and should satisfy themselves of the exact quantities and conditions encountered on-site before bidding or initiating any project work, and adapt the appropriate work practices needed to comply with the applicable Federal / Provincial codes and regulations. Proper, detailed, tender packages should be prepared and supplied to contractors prior to the initiation of any renovation or demolition activities.*
- *The findings and conclusions documented in this report have been prepared for specific application to this project and have been developed in a manner consistent with that level of care and skill normally exercised by qualified professionals currently practicing in this area of environmental assessment. No other warranty, expressed or implied, is made.*
- *The findings contained in this report are based upon conditions as they were observed at the time of investigation. No assurance is made regarding changes in conditions subsequent to the time of the investigation.*
- *Please note that the above survey was limited to the extent of the visual observation and discrete samples collected. Inaccessible areas could not be investigated, and should renovation / demolition work encounter conditions not reported in this document, Thomas Contracting should be retained to provide comments and guidelines on how to proceed.*
- *Some findings contained in this report may be based upon information provided by occupants or employees. No guarantee is made regarding the accuracy of this information. All attempts have been made to independently verify the accuracy of such information unless specifically noted in our report.*
- *If new information is developed in future work, Thomas Contracting should be contacted to re-evaluate the conclusions of this report and to provide amendments as required.*

12.0 CLOSURE

We trust this report meets your current requirements. Should you have any questions in this regard or require further clarification, please do not hesitate to contact the undersigned at this office.

Yours truly,
Thomas Contracting

Grant Johnson
Manager Environmental Services

APPENDIX 'A'

Asbestos Lab Transcripts
&
Sample Photos

SOLUTIONS
FOR A WORKING WORLD

CERTIFICATE OF ANALYSIS

Company:	Thomas Contracting	**Report Date:**	29-Oct-18
Contact:	Mr. Grant Johnson	**Analysis Date:**	26-Oct-18
Client Address:	72 Ninovan Road, CALLANDER, ON	**Received Date:**	18-Oct-18
Client Reference:	ONR - DSS	**LEX Project Number:**	08181792
Sampling Date:	18-Oct-18	**Number of Analyses:**	18

Analysis Requested **Bulk Asbestos by PLM**

Analysis was performed in accordance with the method EPA/600/R-93/116, Method for the Determination of Asbestos in Bulk Building Materials adopted in Designated Substance - Asbestos on Construction Projects and in Buildings and Repair Operations - made under the Occupational Health and Safety Act Ontario Regulation 278/05. LEX Scientific Inc. is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP 101949) by the National Institute of Standards and Technology for analysis of bulk materials for asbestos.

German Leal, B.Sc.
Laboratory Manager

			Fibrous Asbestos Content %		Other Materials Content %
Client Sample:	ONR-1	**Asbestos Detected?**	**Yes**		
LEX Sample:	01	**Chrysotile:**	80	**Cellulose:**	None Detected
Layers Analyzed:	Sample Homogenized	**Amosite:**	None Detected	**MMVF:**	None Detected
Colour:	Beige	**Crocidolite:**	None Detected	**Other Fibres:**	None Detected
Description:	Elbow/ Fitting Insulation on Cold Water Suppy lines in Power House	**Other Amphiboles:**	None Detected	**Non Fibrous:**	20
		Comments:	This sample meets the definition of "asbestos containing material" according to Ontario Regulation 278/05.		

Other Amphiboles: ac=actinolite, a=anthophyllite, t-tremolite, u=unidentified
MMVF: Man Made Vitreous Fibres: Fibreglass, Min. Wool, Rockwool, Glasswool
PLM - method detection limit is 0.1%

Analyst

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1.800.824.7082
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Company: Thomas Contracting **LEX Project #** 08181792 **Page 2 of 5**

	Fibrous Asbestos Content %	Other Materials Content %

Client Sample: ONR-2 — **Asbestos Detected?** Yes

LEX Sample: 02
Layers Analyzed: Sample Homogenized
Colour: Grey
Description: Pipe Insulation on Condensate lines in Power House

Chrysotile: None Detected
Amosite: 80
Crocidolite: None Detected
Other Amphiboles: None Detected
Comments: N/A

Cellulose: None Detected
MMVF: None Detected
Other Fibres: None Detected
Non Fibrous: 20

Client Sample: ONR-3 — **Asbestos Detected?** Yes

LEX Sample: 03
Layers Analyzed: Sample Homogenized
Colour: Light Brown
Description: Exhaust/ Breeching Insulation on Boilers in Power House

Chrysotile: 50
Amosite: None Detected
Crocidolite: None Detected
Other Amphiboles: None Detected
Comments: This sample meets the definition of "asbestos containing material" according to Ontario Regulation 278/05.

Cellulose: None Detected
MMVF: None Detected
Other Fibres: None Detected
Non Fibrous: 50

Client Sample: ONR-6 — **Asbestos Detected?** Yes

LEX Sample: 04
Layers Analyzed: Sample Homogenized
Colour: White
Description: Jacket Insulation on Deaerator Tank in Power House

Chrysotile: 80
Amosite: None Detected
Crocidolite: None Detected
Other Amphiboles: None Detected
Comments: This sample meets the definition of "asbestos containing material" according to Ontario Regulation 278/05.

Cellulose: None Detected
MMVF: None Detected
Other Fibres: None Detected
Non Fibrous: 20

Client Sample: ONR-7 — **Asbestos Detected?** Yes

LEX Sample: 05
Layers Analyzed: Sample Homogenized
Colour: Brown/Black
Description: Pip Insulation on Cold Water lines in Wheel Shop

Chrysotile: 1
Amosite: None Detected
Crocidolite: None Detected
Other Amphiboles: None Detected
Comments: This sample meets the definition of "asbestos containing material" according to Ontario Regulation 278/05.

Cellulose: 99
MMVF: None Detected
Other Fibres: None Detected
Non Fibrous: None Detected

Client Sample: ONR-8 — **Asbestos Detected?** Yes

LEX Sample: 06
Layers Analyzed: Sample Homogenized
Colour: White
Description: Pipe insulation on High Pressure Stream Lines in Wheel Shop

Chrysotile: 90
Amosite: None Detected
Crocidolite: None Detected
Other Amphiboles: None Detected
Comments: This sample meets the definition of "asbestos containing material" according to Ontario Regulation 278/05.

Cellulose: None Detected
MMVF: None Detected
Other Fibres: None Detected
Non Fibrous: 10

Other Amphiboles: ac=actinolite, a=anthophyllite, t-tremolite, u=unidentified
MMVF: Man Made Vitreous Fibres: Fibreglass, Min. Wool, Rockwool, Glasswool
PLM - method detection limit is 0.1%

Analyst

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Company: Thomas Contracting **LEX Project #** 08181792 **Page 3 of 5**

		Fibrous Asbestos Content %	Other Materials Content %
Client Sample:	ONR-9	**Asbestos Detected?**	**Yes**
LEX Sample:	07	**Chrysotile:** 80	**Cellulose:** 10
Layers Analyzed:	Sample Homogenized	**Amosite:** None Detected	**MMVF:** None Detected
Colour:	Grey/White	**Crocidolite:** None Detected	**Other Fibres:** None Detected
Description:	Pipe Insulation on Heating Lines in Wheel shop	**Other Amphiboles:** None Detected	**Non Fibrous:** 10
		Comments: This sample meets the definition of "asbestos containing material" according to Ontario Regulation 278/05.	
Client Sample:	ONR-12	**Asbestos Detected?**	**No**
LEX Sample:	08	**Chrysotile:** None Detected	**Cellulose:** 45
Layers Analyzed:	Sample Homogenized	**Amosite:** None Detected	**MMVF:** 45
Colour:	White/Grey	**Crocidolite:** None Detected	**Other Fibres:** None Detected
Description:	2x4 Drop Ceiling tiles in Wheel Shop	**Other Amphiboles:** None Detected	**Non Fibrous:** 10
		Comments: N/A	
Client Sample:	ONR-13	**Asbestos Detected?**	**Yes**
LEX Sample:	09	**Chrysotile:** 80	**Cellulose:** None Detected
Layers Analyzed:	Sample Homogenized	**Amosite:** None Detected	**MMVF:** None Detected
Colour:	Grey	**Crocidolite:** None Detected	**Other Fibres:** None Detected
Description:	Elbow/ Clean-out Insulation on Rain leader Lines in Wheel Shop	**Other Amphiboles:** None Detected	**Non Fibrous:** 20
		Comments: This sample meets the definition of "asbestos containing material" according to Ontario Regulation 278/05.	
Client Sample:	ONR-14	**Asbestos Detected?**	**No**
LEX Sample:	10	**Chrysotile:** None Detected	**Cellulose:** None Detected
Layers Analyzed:	Sample Homogenized	**Amosite:** None Detected	**MMVF:** None Detected
Colour:	White/Cream	**Crocidolite:** None Detected	**Other Fibres:** None Detected
Description:	Wall Plaster in Wheel Shop	**Other Amphiboles:** None Detected	**Non Fibrous:** 100
		Comments: N/A	
Client Sample:	ONR-15	**Asbestos Detected?**	**No**
LEX Sample:	11	**Chrysotile:** None Detected	**Cellulose:** None Detected
Layers Analyzed:	Sample Homogenized	**Amosite:** None Detected	**MMVF:** None Detected
Colour:	Brown/Black	**Crocidolite:** None Detected	**Other Fibres:** None Detected
Description:	12x12 Vinyl Floor Tile in Wheel Shop	**Other Amphiboles:** None Detected	**Non Fibrous:** 100
		Comments: N/A	

Other Amphiboles: ac=actinolite, a=anthophyllite, t-tremolite, u=unidentified
MMVF: Man Made Vitreous Fibres: Fibreglass, Min. Wool, Rockwool, Glasswool
PLM - method detection limit is 0.1%

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Company: Thomas Contracting **LEX Project #** 08181792 **Page 4 of 5**

	Fibrous Asbestos Content %	Other Materials Content %
Client Sample: ONR-16	**Asbestos Detected?**	**No**
LEX Sample: 12	**Chrysotile:** None Detected	**Cellulose:** 50
Layers Analyzed: Sample Homogenized	**Amosite:** None Detected	**MMVF:** 50
Colour: Cream/White	**Crocidolite:** None Detected	**Other Fibres:** None Detected
Description: 2x4 Drop Ceiling tiles in Wheel Shop	**Other Amphiboles:** None Detected	**Non Fibrous:** None Detected
	Comments: N/A	
Client Sample: ONR-17	**Asbestos Detected?**	**No**
LEX Sample: 13	**Chrysotile:** None Detected	**Cellulose:** 90
Layers Analyzed: Sample Homogenized	**Amosite:** None Detected	**MMVF:** None Detected
Colour: Brown/Black	**Crocidolite:** None Detected	**Other Fibres:** None Detected
Description: Pip Insulation on Cold Water lines in Wheel Shop	**Other Amphiboles:** None Detected	**Non Fibrous:** 10
	Comments: N/A	
Client Sample: ONR-18	**Asbestos Detected?**	**Yes**
LEX Sample: 14	**Chrysotile:** 70	**Cellulose:** 20
Layers Analyzed: Sample Homogenized	**Amosite:** None Detected	**MMVF:** None Detected
Colour: White	**Crocidolite:** None Detected	**Other Fibres:** None Detected
Description: Pipe Insulation on Hot water Lines in Wheel shop	**Other Amphiboles:** None Detected	**Non Fibrous:** 10
	Comments: This sample meets the definition of "asbestos containing material" according to Ontario Regulation 278/05.	
Client Sample: ONR-20	**Asbestos Detected?**	**Yes**
LEX Sample: 15	**Chrysotile:** 20	**Cellulose:** None Detected
Layers Analyzed: Sample Homogenized	**Amosite:** None Detected	**MMVF:** None Detected
Colour: Grey	**Crocidolite:** None Detected	**Other Fibres:** None Detected
Description: Window/ Door Caulking on Exterior of Wheel Shop	**Other Amphiboles:** None Detected	**Non Fibrous:** 80
	Comments: This sample meets the definition of "asbestos containing material" according to Ontario Regulation 278/05.	
Client Sample: ONR-22	**Asbestos Detected?**	**Yes**
LEX Sample: 16	**Chrysotile:** 80	**Cellulose:** None Detected
Layers Analyzed: Sample Homogenized	**Amosite:** None Detected	**MMVF:** None Detected
Colour: White	**Crocidolite:** None Detected	**Other Fibres:** None Detected
Description: Elbow/ Fitting Insulation onLow Pressure Steam Lines in Paint Shop	**Other Amphiboles:** None Detected	**Non Fibrous:** 20
	Comments: This sample meets the definition of "asbestos containing material" according to Ontario Regulation 278/05.	

Other Amphiboles: ac=actinolite, a=anthophyllite, t-tremolite, u=unidentified
MMVF: Man Made Vitreous Fibres: Fibreglass, Min. Wool, Rockwool, Glasswool
PLM - method detection limit is 0.1%

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Company: Thomas Contracting **LEX Project #** 08181792 **Page 5 of 5**

		Fibrous Asbestos Content %		Other Materials Content %	
Client Sample:	ONR-24	**Asbestos Detected?**		**No**	
LEX Sample:	17	**Chrysotile:**	None Detected	**Cellulose:**	None Detected
Layers Analyzed:	Sample Homogenized	**Amosite:**	None Detected	**MMVF:**	None Detected
Colour:	White	**Crocidolite:**	None Detected	**Other Fibres:**	None Detected
Description:	Drywall Joint Compound in Paint	**Other Amphiboles:**	None Detected	**Non Fibrous:**	100
		Comments:	N/A		
Client Sample:	ONR-25	**Asbestos Detected?**		**Yes**	
LEX Sample:	18	**Chrysotile:**	1	**Cellulose:**	None Detected
Layers Analyzed:	Sample Homogenized	**Amosite:**	None Detected	**MMVF:**	None Detected
Colour:	Beige	**Crocidolite:**	None Detected	**Other Fibres:**	None Detected
Description:	12x12 Vinyl Floor Tile in Paint Shop	**Other Amphiboles:**	None Detected	**Non Fibrous:**	99
		Comments:	This sample meets the definition of "asbestos containing material" according to Ontario Regulation 278/05.		

Other Amphiboles: ac=actinolite, a=anthophyllite, t-tremolite, u=unidentified
MMVF: Man Made Vitreous Fibres: Fibreglass, Min. Wool, Rockwool, Glasswool
PLM - method detection limit is 0.1%

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CERTIFICATE OF ANALYSIS

Company:	Thomas Contracting	**Report Date:**	29-Oct-18
Contact:	Mr. Grant Johnson	**Analysis Date:**	26-Oct-18
Client Address:	72 Ninovan Road, CALLANDER, ON	**Received Date:**	23-Oct-18
Client Reference:	ONR - DSS	**LEX Project Number:**	08181814
Sampling Date:	23-Oct-18	**Number of Analyses:**	24

Analysis Requested **Bulk Asbestos by PLM**

Analysis was performed in accordance with the method EPA/600/R-93/116, Method for the Determination of Asbestos in Bulk Building Materials adopted in Designated Substance - Asbestos on Construction Projects and in Buildings and Repair Operations - made under the Occupational Health and Safety Act Ontario Regulation 278/05. LEX Scientific Inc. is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP 101949) by the National Institute of Standards and Technology for analysis of bulk materials for asbestos.

German Leal, B.Sc.
Laboratory Manager

			Fibrous Asbestos Content %		Other Materials Content %
Client Sample:	ONR - 27	**Asbestos Detected?**	**Yes**		
LEX Sample:	01	**Chrysotile:**	80	**Cellulose:**	10
Layers Analyzed:	Sample Homogenized	**Amosite:**	None Detected	**MMVF:**	None Detected
Colour:	White	**Crocidolite:**	None Detected	**Other Fibres:**	None Detected
Description:	Pipe Insulation (white mag-block) on Steam lines in Diesel Shop - Tunnel	**Other Amphiboles:**	None Detected	**Non Fibrous:**	10
		Comments:	This sample meets the definition of "asbestos containing material" according to Ontario Regulation 278/05.		

Other Amphiboles: ac=actinolite, a=anthophyllite, t-tremolite, u=unidentified
MMVF: Man Made Vitreous Fibres: Fibreglass, Min. Wool, Rockwool, Glasswool
PLM - method detection limit is 0.1%

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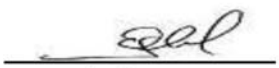
Company: Thomas Contracting **LEX Project #** 08181814 **Page 2 of 6**

		Fibrous Asbestos Content %	Other Materials Content %
Client Sample:	ONR - 28	**Asbestos Detected?**	**Yes**
LEX Sample:	02	**Chrysotile:** 10	**Cellulose:** None Detected
Layers Analyzed:	Sample Homogenized	**Amosite:** None Detected	**MMVF:** None Detected
Colour:	Black	**Crocidolite:** None Detected	**Other Fibres:** None Detected
Description:	Tar Paper Wrap on Steam lines in Diesel Shop - Tunnel	**Other Amphiboles:** None Detected	**Non Fibrous:** 90
		Comments: This sample meets the definition of "asbestos containing material" according to Ontario Regulation 278/05.	
Client Sample:	ONR - 29	**Asbestos Detected?**	**Yes**
LEX Sample:	03	**Chrysotile:** 45	**Cellulose:** None Detected
Layers Analyzed:	Sample Homogenized	**Amosite:** 45	**MMVF:** None Detected
Colour:	Grey	**Crocidolite:** None Detected	**Other Fibres:** None Detected
Description:	Elbow/Fitting Insulation on Cold Water lines in Diesel Shop - Tunnel	**Other Amphiboles:** None Detected	**Non Fibrous:** 10
		Comments: This sample meets the definition of "asbestos containing material" according to Ontario Regulation 278/05.	
Client Sample:	ONR - 30	**Asbestos Detected?**	**Yes**
LEX Sample:	04	**Chrysotile:** 1	**Cellulose:** 99
Layers Analyzed:	Sample Homogenized	**Amosite:** None Detected	**MMVF:** None Detected
Colour:	Brown	**Crocidolite:** None Detected	**Other Fibres:** None Detected
Description:	Pipe Insulation (anti-sweat) on Cold Water lines in Diesel Shop - Tunnel	**Other Amphiboles:** None Detected	**Non Fibrous:** None Detected
		Comments: This sample meets the definition of "asbestos containing material" according to Ontario Regulation 278/05.	
Client Sample:	ONR - 31	**Asbestos Detected?**	**Yes**
LEX Sample:	05	**Chrysotile:** 10	**Cellulose:** None Detected
Layers Analyzed:	Sample Homogenized	**Amosite:** 80	**MMVF:** None Detected
Colour:	Grey	**Crocidolite:** None Detected	**Other Fibres:** None Detected
Description:	Elbow/Fitting Insulation on on Steam lines in Diesel Shop - Tunnel	**Other Amphiboles:** None Detected	**Non Fibrous:** 10
		Comments: This sample meets the definition of "asbestos containing material" according to Ontario Regulation 278/05.	

Other Amphiboles: ac=actinolite, a=anthophyllite, t-tremolite, u=unidentified
MMVF: Man Made Vitreous Fibres: Fibreglass, Min. Wool, Rockwool, Glasswool
PLM - method detection limit is 0.1%



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Company: Thomas Contracting **LEX Project #** 08181814 **Page 3 of 6**

		Fibrous Asbestos Content %	Other Materials Content %
Client Sample:	ONR - 32	**Asbestos Detected?**	**Yes**
LEX Sample:	06	**Chrysotile:** 60	**Cellulose:** 20
Layers Analyzed:	Sample Homogenized	**Amosite:** None Detected	**MMVF:** None Detected
Colour:	Grey/Beige	**Crocidolite:** None Detected	**Other Fibres:** 10
Description:	Pipe Insulation (anti-sweat) on Heating lines in Diesel Shop - Room #1	**Other Amphiboles:** None Detected	**Non Fibrous:** 10
		Comments: This sample meets the definition of "asbestos containing material" according to Ontario Regulation 278/05.	
Client Sample:	ONR - 33	**Asbestos Detected?**	**Yes**
LEX Sample:	07	**Chrysotile:** 7	**Cellulose:** 93
Layers Analyzed:	Sample Homogenized	**Amosite:** None Detected	**MMVF:** None Detected
Colour:	Beige/Black	**Crocidolite:** None Detected	**Other Fibres:** None Detected
Description:	Pipe Insulation (anti-sweat/Tar paper) on Cold Water lines in Diesel Shop - Room #3	**Other Amphiboles:** None Detected	**Non Fibrous:** None Detected
		Comments: This sample meets the definition of "asbestos containing material" according to Ontario Regulation 278/05.	
Client Sample:	ONR - 35	**Asbestos Detected?**	**Yes**
LEX Sample:	08	**Chrysotile:** 60	**Cellulose:** None Detected
Layers Analyzed:	Sample Homogenized	**Amosite:** None Detected	**MMVF:** None Detected
Colour:	Beige/Yellow	**Crocidolite:** None Detected	**Other Fibres:** 30
Description:	Pipe Insulation (air-cell) on Steam lines in Diesel Shop - Room #6	**Other Amphiboles:** None Detected	**Non Fibrous:** 10
		Comments: This sample meets the definition of "asbestos containing material" according to Ontario Regulation 278/05.	
Client Sample:	ONR - 36	**Asbestos Detected?**	**No**
LEX Sample:	09	**Chrysotile:** None Detected	**Cellulose:** None Detected
Layers Analyzed:	Sample Homogenized	**Amosite:** None Detected	**MMVF:** 100
Colour:	White	**Crocidolite:** None Detected	**Other Fibres:** None Detected
Description:	Sprayed Insulation on Ceiling Deck in Diesel Sop - Room #6	**Other Amphiboles:** None Detected	**Non Fibrous:** None Detected
		Comments: N/A	
Client Sample:	ONR - 38	**Asbestos Detected?**	**Yes**
LEX Sample:	10	**Chrysotile:** 80	**Cellulose:** 10
Layers Analyzed:	Sample Homogenized	**Amosite:** None Detected	**MMVF:** None Detected
Colour:	Beige	**Crocidolite:** None Detected	**Other Fibres:** None Detected
Description:	Pipe Insulation (anti-sweat) on Heating lines in Diesel Shop - Room #5	**Other Amphiboles:** None Detected	**Non Fibrous:** 10
		Comments: This sample meets the definition of "asbestos containing material" according to Ontario Regulation 278/05.	

Other Amphiboles: ac=actinolite, a=anthophyllite, t-tremolite, u=unidentified
MMVF: Man Made Vitreous Fibres: Fibreglass, Min. Wool, Rockwool, Glasswool
PLM - method detection limit is 0.1%

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LEX SCIENTIFIC INC

Company: Thomas Contracting **LEX Project #** 08181814 **Page 4 of 6**

	Fibrous Asbestos Content %	Other Materials Content %

Client Sample: ONR - 40 — **Asbestos Detected?** **Yes**

LEX Sample: 11
Layers Analyzed: Sample Homogenized
Colour: Beige
Description: Elbow/Fitting Insulation on Cold Water lines in Diesel Shop - Room #4

Chrysotile:	80	**Cellulose:**	10
Amosite:	None Detected	**MMVF:**	None Detected
Crocidolite:	None Detected	**Other Fibres:**	10
Other Amphiboles:	None Detected	**Non Fibrous:**	None Detected

Comments: This sample meets the definition of "asbestos containing material" according to Ontario Regulation 278/05.

Client Sample: ONR - 41 — **Asbestos Detected?** **Yes**

LEX Sample: 12
Layers Analyzed: Sample Homogenized
Colour: Brown/Grey
Description: Elbow/Fitting Insulation on Heating lines in Diesel Shop -East-side

Chrysotile:	80	**Cellulose:**	None Detected
Amosite:	None Detected	**MMVF:**	None Detected
Crocidolite:	None Detected	**Other Fibres:**	None Detected
Other Amphiboles:	None Detected	**Non Fibrous:**	20

Comments: This sample meets the definition of "asbestos containing material" according to Ontario Regulation 278/05.

Client Sample: ONR - 42 — **Asbestos Detected?** **Yes**

LEX Sample: 13
Layers Analyzed: Sample Homogenized
Colour: Yellow
Description: Pipe Insulation (anti-sweat) on Heating lines in Diesel Shop - East-side

Chrysotile:	80	**Cellulose:**	10
Amosite:	None Detected	**MMVF:**	None Detected
Crocidolite:	None Detected	**Other Fibres:**	None Detected
Other Amphiboles:	None Detected	**Non Fibrous:**	10

Comments: This sample meets the definition of "asbestos containing material" according to Ontario Regulation 278/05.

Client Sample: ONR - 43 — **Asbestos Detected?** **Yes**

LEX Sample: 14
Layers Analyzed: Sample Homogenized
Colour: Beige
Description: Pipe Insulation (anti-sweat) on Heating lines in Diesel Shop - East-side

Chrysotile:	50	**Cellulose:**	40
Amosite:	None Detected	**MMVF:**	None Detected
Crocidolite:	None Detected	**Other Fibres:**	None Detected
Other Amphiboles:	None Detected	**Non Fibrous:**	10

Comments: This sample meets the definition of "asbestos containing material" according to Ontario Regulation 278/05.

Client Sample: ONR - 44 — **Asbestos Detected?** **No**

LEX Sample: 15
Layers Analyzed: Sample Homogenized
Colour: White/Yellow
Description: Plaster on Wall in Diesel Shop - Room #10

Chrysotile:	None Detected	**Cellulose:**	None Detected
Amosite:	None Detected	**MMVF:**	None Detected
Crocidolite:	None Detected	**Other Fibres:**	None Detected
Other Amphiboles:	None Detected	**Non Fibrous:**	100

Comments: N/A

Other Amphiboles: ac=actinolite, a=anthophyllite, t-tremolite, u=unidentified
MMVF: Man Made Vitreous Fibres: Fibreglass, Min. Wool, Rockwool, Glasswool
PLM - method detection limit is 0.1%

Analyst

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Company: Thomas Contracting **LEX Project #** 08181814 **Page 5 of 6**

	Fibrous Asbestos Content %	Other Materials Content %

Client Sample: ONR - 45
LEX Sample: 16
Layers Analyzed: Tile
Colour: Beige/Brown
Description: 12"x12" Vinyl Floor Tile (beige) in Diesel Shop - Room #10

Asbestos Detected? No
Chrysotile: None Detected
Amosite: None Detected
Crocidolite: None Detected
Other Amphiboles: None Detected
Comments: N/A

Cellulose: None Detected
MMVF: None Detected
Other Fibres: None Detected
Non Fibrous: 100

Client Sample: ONR - 46
LEX Sample: 17
Layers Analyzed: Sample Homogenized
Colour: White/Grey
Description: 2'x4' Drop Ceiling Tile in Diesel Shop - Room #10

Asbestos Detected? No
Chrysotile: None Detected
Amosite: None Detected
Crocidolite: None Detected
Other Amphiboles: None Detected
Comments: N/A

Cellulose: 40
MMVF: 60
Other Fibres: None Detected
Non Fibrous: 10

Client Sample: ONR - 48
LEX Sample: 18
Layers Analyzed: Sample Homogenized
Colour: Dark Green
Description: Roll Vinyl Flooring in Diesel Shop - Room #12

Asbestos Detected? No
Chrysotile: None Detected
Amosite: None Detected
Crocidolite: None Detected
Other Amphiboles: None Detected
Comments: N/A

Cellulose: None Detected
MMVF: None Detected
Other Fibres: None Detected
Non Fibrous: 100

Client Sample: ONR - 50
LEX Sample: 19
Layers Analyzed: Sample Homogenized
Colour: Beige/Yellow
Description: Pipe Insulation (anti-sweat) on Heating lines in Diesel Shop - Room #17

Asbestos Detected? Yes
Chrysotile: 70
Amosite: None Detected
Crocidolite: None Detected
Other Amphiboles: None Detected
Comments: This sample meets the definition of "asbestos containing material" according to Ontario Regulation 278/05.

Cellulose: None Detected
MMVF: None Detected
Other Fibres: 20
Non Fibrous: 10

Client Sample: ONR - 51
LEX Sample: 20
Layers Analyzed: Sample Homogenized
Colour: Grey/Beige
Description: Pipe Insulation (anti-sweat) on Stream lines in Diesel Shop - Pit Area

Asbestos Detected? Yes
Chrysotile: 80
Amosite: None Detected
Crocidolite: None Detected
Other Amphiboles: None Detected
Comments: This sample meets the definition of "asbestos containing material" according to Ontario Regulation 278/05.

Cellulose: 10
MMVF: None Detected
Other Fibres: None Detected
Non Fibrous: 10

Other Amphiboles: ac=actinolite, a=anthophyllite, t-tremolite, u=unidentified
MMVF: Man Made Vitreous Fibres: Fibreglass, Min. Wool, Rockwool, Glasswool
PLM - method detection limit is 0.1%

Analyst

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Company: Thomas Contracting **LEX Project #** 08181814 **Page 6 of 6**

		Fibrous Asbestos Content %		Other Materials Content %	
Client Sample:	ONR - 52	**Asbestos Detected?**	**Yes**		
LEX Sample:	21	**Chrysotile:**	15	**Cellulose:**	75
Layers Analyzed:	Sample Homogenized	**Amosite:**	None Detected	**MMVF:**	None Detected
Colour:	Beige/Black	**Crocidolite:**	None Detected	**Other Fibres:**	None Detected
Description:	Pipe Insulation (anti-sweat/Tar paper) on Cold Water lines in Diesel Shop - Pit Area	**Other Amphiboles:**	None Detected	**Non Fibrous:**	10
		Comments:	This sample meets the definition of "asbestos containing material" according to Ontario Regulation 278/05.		
Client Sample:	ONR - 53	**Asbestos Detected?**	**Yes**		
LEX Sample:	22	**Chrysotile:**	60	**Cellulose:**	30
Layers Analyzed:	Sample Homogenized	**Amosite:**	None Detected	**MMVF:**	None Detected
Colour:	Yellow/Beige	**Crocidolite:**	None Detected	**Other Fibres:**	None Detected
Description:	Pipe Insulation (anti-sweat) on Hot Water lines in Diesel Shop - Pit Area	**Other Amphiboles:**	None Detected	**Non Fibrous:**	10
		Comments:	This sample meets the definition of "asbestos containing material" according to Ontario Regulation 278/05.		
Client Sample:	ONR - 54	**Asbestos Detected?**	**No**		
LEX Sample:	23	**Chrysotile:**	None Detected	**Cellulose:**	20
Layers Analyzed:	Sample Homogenized	**Amosite:**	None Detected	**MMVF:**	40
Colour:	Beige	**Crocidolite:**	None Detected	**Other Fibres:**	None Detected
Description:	Elbow/Fitting Insulation on piping in Diesel Shop - Addition	**Other Amphiboles:**	None Detected	**Non Fibrous:**	40
		Comments:	N/A		
Client Sample:	ONR - 57	**Asbestos Detected?**	**No**		
LEX Sample:	24	**Chrysotile:**	None Detected	**Cellulose:**	None Detected
Layers Analyzed:	Tile	**Amosite:**	None Detected	**MMVF:**	None Detected
Colour:	White/Black	**Crocidolite:**	None Detected	**Other Fibres:**	None Detected
Description:	12"x12" Vinyl Floor Tile (beige) in Diesel Shop - Room #102	**Other Amphiboles:**	None Detected	**Non Fibrous:**	100
		Comments:	N/A		

Other Amphiboles: ac=actinolite, a=anthophyllite, t-tremolite, u=unidentified
MMVF: Man Made Vitreous Fibres: Fibreglass, Min. Wool, Rockwool, Glasswool
PLM - method detection limit is 0.1%

Analyst

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LEX SCIENTIFIC INC.

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CERTIFICATE OF ANALYSIS

Company:	Thomas Contracting	**Report Date:**	30-Oct-18
Contact:	Mr. Grant Johnson	**Analysis Date:**	30-Oct-18
Client Address:	72 Ninovan Road, CALLANDER, ON	**Received Date:**	29-Oct-18
Client Reference:	ONR-DSS	**LEX Project Number:**	08181850
Sampling Date:	29-Oct-18	**Number of Analyses:**	10

Analysis Requested **Bulk Asbestos by PLM**

Analysis was performed in accordance with the method EPA/600/R-93/116, Method for the Determination of Asbestos in Bulk Building Materials adopted in Designated Substance - Asbestos on Construction Projects and in Buildings and Repair Operations - made under the Occupational Health and Safety Act Ontario Regulation 278/05. LEX Scientific Inc. is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP 101949) by the National Institute of Standards and Technology for analysis of bulk materials for asbestos.

German Leal, B.Sc.
Laboratory Manager

			Fibrous Asbestos Content %		Other Materials Content %
Client Sample:	ONR-58	**Asbestos Detected?**	**Yes**		
LEX Sample:	01	**Chrysotile:**	< 0.5	**Cellulose:**	None Detected
Layers Analyzed:	Sample Homogenized	**Amosite:**	None Detected	**MMVF:**	None Detected
Colour:	Black	**Crocidolite:**	None Detected	**Other Fibres:**	10
Description:	Pipe Insulation (tar paper) on Rain Leader lines in Diesel Shop - Room #103	**Other Amphiboles:**	None Detected	**Non Fibrous:**	90
		Comments:	Not asbestos containing material under Ontario Regulation 278/05.		

Other Amphiboles: ac=actinolite, a=anthophyllite, t-tremolite, u=unidentified
MMVF: Man Made Vitreous Fibres: Fibreglass, Min. Wool, Rockwool, Glasswool
PLM - method detection limit is 0.1%

Analyst

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291 Woodlawn Road West, Unit B-12 Guelph, Ontario N1H 7L6
1.800.824.7082
e-mail: admin@lexscientific.com Website: www.lexscientific.com

Company: Thomas Contracting **LEX Project #** 08181850 **Page 2 of 3**

		Fibrous Asbestos Content %		Other Materials Content %	
Client Sample:	ONR-59	**Asbestos Detected?**	**No**		
LEX Sample:	02	**Chrysotile:**	None Detected	**Cellulose:**	None Detected
Layers Analyzed:	Sample Homogenized	**Amosite:**	None Detected	**MMVF:**	None Detected
Colour:	Beige	**Crocidolite:**	None Detected	**Other Fibres:**	None Detected
Description:	12"x12" Vinyl Floor Tile in Diesel Shop - Room # 104	**Other Amphiboles:**	None Detected	**Non Fibrous:**	100
		Comments:	N/A		
Client Sample:	ONR-60	**Asbestos Detected?**	**No**		
LEX Sample:	03	**Chrysotile:**	None Detected	**Cellulose:**	40
Layers Analyzed:	Sample Homogenized	**Amosite:**	None Detected	**MMVF:**	60
Colour:	Grey/White	**Crocidolite:**	None Detected	**Other Fibres:**	None Detected
Description:	2'x4' Drop Ceiling Tile in Diesel Shop - Room # 104	**Other Amphiboles:**	None Detected	**Non Fibrous:**	None Detected
		Comments:	N/A		
Client Sample:	ONR-61	**Asbestos Detected?**	**No**		
LEX Sample:	04	**Chrysotile:**	None Detected	**Cellulose:**	40
Layers Analyzed:	Sample Homogenized	**Amosite:**	None Detected	**MMVF:**	60
Colour:	Grey/White	**Crocidolite:**	None Detected	**Other Fibres:**	None Detected
Description:	2'x4' Drop Ceiling Tile in Diesel Shop - Room # 201	**Other Amphiboles:**	None Detected	**Non Fibrous:**	None Detected
		Comments:	N/A		
Client Sample:	ONR-63	**Asbestos Detected?**	**No**		
LEX Sample:	05	**Chrysotile:**	None Detected	**Cellulose:**	None Detected
Layers Analyzed:	Sample Homogenized	**Amosite:**	None Detected	**MMVF:**	None Detected
Colour:	White	**Crocidolite:**	None Detected	**Other Fibres:**	None Detected
Description:	Drywall Joint Compound on wall in Diesel Shop - Room # 202	**Other Amphiboles:**	None Detected	**Non Fibrous:**	100
		Comments:	N/A		
Client Sample:	ONR-64	**Asbestos Detected?**	**No**		
LEX Sample:	06	**Chrysotile:**	None Detected	**Cellulose:**	50
Layers Analyzed:	Sample Homogenized	**Amosite:**	None Detected	**MMVF:**	50
Colour:	Grey/White	**Crocidolite:**	None Detected	**Other Fibres:**	None Detected
Description:	2'x4' Drop Ceiling Tile in Diesel Shop - Room # 202	**Other Amphiboles:**	None Detected	**Non Fibrous:**	None Detected
		Comments:	N/A		

Other Amphiboles: ac=actinolite, a=anthophyllite, t-tremolite, u=unidentified
MMVF: Man Made Vitreous Fibres: Fibreglass, Min. Wool, Rockwool, Glasswool
PLM - method detection limit is 0.1%

Analyst

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Company: Thomas Contracting **LEX Project #** 08181850 **Page 3 of 3**

		Fibrous Asbestos Content %	Other Materials Content %
Client Sample:	ONR-65	**Asbestos Detected?**	**Yes**
LEX Sample:	07	**Chrysotile:** 60	**Cellulose:** None Detected
Layers Analyzed:	Sample Homogenized	**Amosite:** None Detected	**MMVF:** None Detected
Colour:	Grey	**Crocidolite:** None Detected	**Other Fibres:** 5
Description:	Elbow/Fitting Insulation on pipes in Car Shop - Room #200	**Other Amphiboles:** None Detected	**Non Fibrous:** 35
		Comments: This sample meets the definition of "asbestos containing material" according to Ontario Regulation 278/05.	
Client Sample:	ONR-70	**Asbestos Detected?**	**No**
LEX Sample:	08	**Chrysotile:** None Detected	**Cellulose:** None Detected
Layers Analyzed:	Sample Homogenized	**Amosite:** None Detected	**MMVF:** None Detected
Colour:	Beige	**Crocidolite:** None Detected	**Other Fibres:** None Detected
Description:	12"x12" Vinyl Floor Tile in Car Shop - Room # D	**Other Amphiboles:** None Detected	**Non Fibrous:** 100
		Comments: N/A	
Client Sample:	ONR-71	**Asbestos Detected?**	**Yes**
LEX Sample:	09	**Chrysotile:** 25	**Cellulose:** None Detected
Layers Analyzed:	Sample Homogenized	**Amosite:** None Detected	**MMVF:** None Detected
Colour:	Beige	**Crocidolite:** None Detected	**Other Fibres:** None Detected
Description:	12"x12" Vinyl Floor Tile in Car Shop - Room # G	**Other Amphiboles:** None Detected	**Non Fibrous:** 75
		Comments: This sample meets the definition of "asbestos containing material" according to Ontario Regulation 278/05.	
Client Sample:	ONR-72	**Asbestos Detected?**	**Yes**
LEX Sample:	10	**Chrysotile:** 8	**Cellulose:** None Detected
Layers Analyzed:	Sample Homogenized	**Amosite:** None Detected	**MMVF:** None Detected
Colour:	Grey	**Crocidolite:** None Detected	**Other Fibres:** None Detected
Description:	Caulking on exterior windows of Diesel Shop	**Other Amphiboles:** None Detected	**Non Fibrous:** 92
		Comments: This sample meets the definition of "asbestos containing material" according to Ontario Regulation 278/05.	

Other Amphiboles: ac=actinolite, a=anthophyllite, t-tremolite, u=unidentified
MMVF: Man Made Vitreous Fibres: Fibreglass, Min. Wool, Rockwool, Glasswool
PLM - method detection limit is 0.1%

Analyst

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CERTIFICATE OF ANALYSIS

Company:	Thomas Contracting	**Report Date:**	31-Oct-18
Contact:	Mr. Grant Johnson	**Analysis Date:**	31-Oct-18
Client Address:	72 Ninovan Road, CALLANDER, ON	**Received Date:**	30-Oct-18
Client Reference:	ONR-DSS	**LEX Project Number:**	08181859
Sampling Date:	30-Oct-18	**Number of Analyses:**	26

Analysis Requested **Bulk Asbestos by PLM**

Analysis was performed in accordance with the method EPA/600/R-93/116, Method for the Determination of Asbestos in Bulk Building Materials adopted in Designated Substance - Asbestos on Construction Projects and in Buildings and Repair Operations - made under the Occupational Health and Safety Act Ontario Regulation 278/05. LEX Scientific Inc. is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP 101949) by the National Institute of Standards and Technology for analysis of bulk materials for asbestos.

German Leal, B.Sc.
Laboratory Manager

Analysis Notes: Samples ONR-45, ONR-45b, ONR-57a and ONR-57b are floor tiles instead of what is described in CoC

	Fibrous Asbestos Content %	**Other Materials Content %**

Client Sample: ONR - 12a
LEX Sample: 01
Layers Analyzed: Sample Homogenized
Colour: Grey
Description: 2' x 4' Drop Ceiling Tiles in Wheel Shop

Asbestos Detected? No

Chrysotile:	None Detected	**Cellulose:**	50
Amosite:	None Detected	**MMVF:**	50
Crocidolite:	None Detected	**Other Fibres:**	None Detected
Other Amphiboles:	None Detected	**Non Fibrous:**	None Detected
Comments:	N/A		

Other Amphiboles: ac=actinolite, a=anthophyllite, t-tremolite, u=unidentified
MMVF: Man Made Vitreous Fibres: Fibreglass, Min. Wool, Rockwool, Glasswool
PLM - method detection limit is 0.1%

Analyst

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291 Woodlawn Road West, Unit B-12 Guelph, Ontario N1H 7L6
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e-mail: admin@lexscientific.com Website: www.lexscientific.com

Company: Thomas Contracting **LEX Project #** 08181859 **Page 2 of 6**

		Fibrous Asbestos Content %		Other Materials Content %	
Client Sample:	ONR - 12b	**Asbestos Detected?**		**No**	
LEX Sample:	02	**Chrysotile:**	None Detected	**Cellulose:**	50
Layers Analyzed:	Sample Homogenized	**Amosite:**	None Detected	**MMVF:**	50
Colour:	Grey	**Crocidolite:**	None Detected	**Other Fibres:**	None Detected
Description:	2' x 4' Drop Ceiling Tiles in Wheel Shop	**Other Amphiboles:**	None Detected	**Non Fibrous:**	None Detected
		Comments:	N/A		
Client Sample:	ONR - 14a	**Asbestos Detected?**		**No**	
LEX Sample:	03	**Chrysotile:**	None Detected	**Cellulose:**	None Detected
Layers Analyzed:	Sample Homogenized	**Amosite:**	None Detected	**MMVF:**	None Detected
Colour:	White/Beige	**Crocidolite:**	None Detected	**Other Fibres:**	None Detected
Description:	Wall Plaster in Wheel Shop	**Other Amphiboles:**	None Detected	**Non Fibrous:**	100
		Comments:	N/A		
Client Sample:	ONR - 14b	**Asbestos Detected?**		**No**	
LEX Sample:	04	**Chrysotile:**	None Detected	**Cellulose:**	None Detected
Layers Analyzed:	Sample Homogenized	**Amosite:**	None Detected	**MMVF:**	None Detected
Colour:	White/Beige	**Crocidolite:**	None Detected	**Other Fibres:**	None Detected
Description:	Wall Plaster in Wheel Shop	**Other Amphiboles:**	None Detected	**Non Fibrous:**	100
		Comments:	N/A		
Client Sample:	ONR - 15a	**Asbestos Detected?**		**No**	
LEX Sample:	05	**Chrysotile:**	None Detected	**Cellulose:**	None Detected
Layers Analyzed:	Sample Homogenized	**Amosite:**	None Detected	**MMVF:**	None Detected
Colour:	Beige	**Crocidolite:**	None Detected	**Other Fibres:**	None Detected
Description:	12" x 12" Vinyl Floor Tile in Wheel Shop	**Other Amphiboles:**	None Detected	**Non Fibrous:**	100
		Comments:	N/A		
Client Sample:	ONR - 15b	**Asbestos Detected?**		**No**	
LEX Sample:	06	**Chrysotile:**	None Detected	**Cellulose:**	None Detected
Layers Analyzed:	Sample Homogenized	**Amosite:**	None Detected	**MMVF:**	None Detected
Colour:	Beige	**Crocidolite:**	None Detected	**Other Fibres:**	None Detected
Description:	12" x 12" Vinyl Floor Tile in Wheel Shop	**Other Amphiboles:**	None Detected	**Non Fibrous:**	100
		Comments:	N/A		
Client Sample:	ONR - 16a	**Asbestos Detected?**		**No**	
LEX Sample:	07	**Chrysotile:**	None Detected	**Cellulose:**	50
Layers Analyzed:	Sample Homogenized	**Amosite:**	None Detected	**MMVF:**	50
Colour:	Light Brown	**Crocidolite:**	None Detected	**Other Fibres:**	None Detected
Description:	2' x 4' Drop Ceiling Tiles in Wheel Shop	**Other Amphiboles:**	None Detected	**Non Fibrous:**	None Detected
		Comments:	N/A		

Other Amphiboles: ac=actinolite, a=anthophyllite, t-tremolite, u=unidentified
MMVF: Man Made Vitreous Fibres: Fibreglass, Min. Wool, Rockwool, Glasswool
PLM - method detection limit is 0.1%

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Company: Thomas Contracting **LEX Project #** 08181859 **Page 3 of 6**

	Fibrous Asbestos Content %	Other Materials Content %
Client Sample: ONR - 16b	**Asbestos Detected?**	**No**
LEX Sample: 08	**Chrysotile:** None Detected	**Cellulose:** 50
Layers Analyzed: Sample Homogenized	**Amosite:** None Detected	**MMVF:** 50
Colour: Light Brown	**Crocidolite:** None Detected	**Other Fibres:** None Detected
Description: 2' x 4' Drop Ceiling Tiles in Wheel Shop	**Other Amphiboles:** None Detected	**Non Fibrous:** None Detected
	Comments: N/A	
Client Sample: ONR - 17a	**Asbestos Detected?**	**No**
LEX Sample: 09	**Chrysotile:** None Detected	**Cellulose:** 90
Layers Analyzed: Sample Homogenized	**Amosite:** None Detected	**MMVF:** None Detected
Colour: Brown	**Crocidolite:** None Detected	**Other Fibres:** None Detected
Description: Pipe Insulation (anti-sweat) on Cold Water lines in Wheel Shop	**Other Amphiboles:** None Detected	**Non Fibrous:** 10
	Comments: N/A	
Client Sample: ONR - 17b	**Asbestos Detected?**	**No**
LEX Sample: 10	**Chrysotile:** None Detected	**Cellulose:** 90
Layers Analyzed: Sample Homogenized	**Amosite:** None Detected	**MMVF:** None Detected
Colour: Brown	**Crocidolite:** None Detected	**Other Fibres:** None Detected
Description: Pipe Insulation (anti-sweat) on Cold Water lines in Wheel Shop	**Other Amphiboles:** None Detected	**Non Fibrous:** 10
	Comments: N/A	
Client Sample: ONR - 24a	**Asbestos Detected?**	**No**
LEX Sample: 11	**Chrysotile:** None Detected	**Cellulose:** None Detected
Layers Analyzed: Sample Homogenized	**Amosite:** None Detected	**MMVF:** None Detected
Colour: White	**Crocidolite:** None Detected	**Other Fibres:** None Detected
Description: Drywall Joint Compound on walls in Paint Shop	**Other Amphiboles:** None Detected	**Non Fibrous:** 100
	Comments: N/A	
Client Sample: ONR - 24b	**Asbestos Detected?**	**No**
LEX Sample: 12	**Chrysotile:** None Detected	**Cellulose:** None Detected
Layers Analyzed: Sample Homogenized	**Amosite:** None Detected	**MMVF:** None Detected
Colour: White	**Crocidolite:** None Detected	**Other Fibres:** None Detected
Description: Drywall Joint Compound on walls in Paint Shop	**Other Amphiboles:** None Detected	**Non Fibrous:** 100
	Comments: N/A	

Other Amphiboles: ac=actinolite, a=anthophyllite, t-tremolite, u=unidentified
MMVF: Man Made Vitreous Fibres: Fibreglass, Min. Wool, Rockwool, Glasswool
PLM - method detection limit is 0.1%

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Company: Thomas Contracting **LEX Project #** 08181859 **Page 4 of 6**

	Fibrous Asbestos Content %	Other Materials Content %
Client Sample: ONR - 36a	**Asbestos Detected?**	**No**
LEX Sample: 13	**Chrysotile:** None Detected	**Cellulose:** None Detected
Layers Analyzed: Sample Homogenized	**Amosite:** None Detected	**MMVF:** 100
Colour: White	**Crocidolite:** None Detected	**Other Fibres:** None Detected
Description: Sprayed Insulation on Ceiling Deck in Diesel Shop - Room #6	**Other Amphiboles:** None Detected	**Non Fibrous:** None Detected
	Comments: N/A	
Client Sample: ONR - 36b	**Asbestos Detected?**	**No**
LEX Sample: 14	**Chrysotile:** None Detected	**Cellulose:** None Detected
Layers Analyzed: Sample Homogenized	**Amosite:** None Detected	**MMVF:** 100
Colour: White	**Crocidolite:** None Detected	**Other Fibres:** None Detected
Description: Sprayed Insulation on Ceiling Deck in Diesel Shop - Room #6	**Other Amphiboles:** None Detected	**Non Fibrous:** None Detected
	Comments: N/A	
Client Sample: ONR - 44a	**Asbestos Detected?**	**No**
LEX Sample: 15	**Chrysotile:** None Detected	**Cellulose:** None Detected
Layers Analyzed: Sample Homogenized	**Amosite:** None Detected	**MMVF:** None Detected
Colour: White	**Crocidolite:** None Detected	**Other Fibres:** None Detected
Description: Plaster on wall in Diesel Shop - Room #10	**Other Amphiboles:** None Detected	**Non Fibrous:** 100
	Comments: N/A	
Client Sample: ONR - 44b	**Asbestos Detected?**	**No**
LEX Sample: 16	**Chrysotile:** None Detected	**Cellulose:** None Detected
Layers Analyzed: Sample Homogenized	**Amosite:** None Detected	**MMVF:** None Detected
Colour: White	**Crocidolite:** None Detected	**Other Fibres:** None Detected
Description: Plaster on wall in Diesel Shop - Room #10	**Other Amphiboles:** None Detected	**Non Fibrous:** 100
	Comments: N/A	
Client Sample: ONR - 45a	**Asbestos Detected?**	**No**
LEX Sample: 17	**Chrysotile:** None Detected	**Cellulose:** None Detected
Layers Analyzed: Sample Homogenized	**Amosite:** None Detected	**MMVF:** None Detected
Colour: Light Grey/ Dark Grey	**Crocidolite:** None Detected	**Other Fibres:** None Detected
Description: 12"x12" Vinyl Floor Tile (beige) in Diesel n Shop - Room #10	**Other Amphiboles:** None Detected	**Non Fibrous:** 100
	Comments: N/A	

Other Amphiboles: ac=actinolite, a=anthophyllite, t-tremolite, u=unidentified
MMVF: Man Made Vitreous Fibres: Fibreglass, Min. Wool, Rockwool, Glasswool
PLM - method detection limit is 0.1%

Analyst

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Company: Thomas Contracting **LEX Project #** 08181859 **Page 5 of 6**

	Fibrous Asbestos Content %	Other Materials Content %
Client Sample: ONR - 45b	**Asbestos Detected?**	**No**
LEX Sample: 18	**Chrysotile:** None Detected	**Cellulose:** None Detected
Layers Analyzed: Sample Homogenized	**Amosite:** None Detected	**MMVF:** None Detected
Colour: Light Grey/ Dark Grey	**Crocidolite:** None Detected	**Other Fibres:** None Detected
Description: 12"x12" Vinyl Floor Tile (beige) in Diesel n Shop - Room #10	**Other Amphiboles:** None Detected	**Non Fibrous:** 100
	Comments: N/A	
Client Sample: ONR - 46a	**Asbestos Detected?**	**No**
LEX Sample: 19	**Chrysotile:** None Detected	**Cellulose:** 60
Layers Analyzed: Sample Homogenized	**Amosite:** None Detected	**MMVF:** 40
Colour: Light Grey	**Crocidolite:** None Detected	**Other Fibres:** None Detected
Description: 2' x 4' Drop Ceiling Tiles in Diesel Shop - Room #10	**Other Amphiboles:** None Detected	**Non Fibrous:** None Detected
	Comments: N/A	
Client Sample: ONR - 46b	**Asbestos Detected?**	**No**
LEX Sample: 20	**Chrysotile:** None Detected	**Cellulose:** 60
Layers Analyzed: Sample Homogenized	**Amosite:** None Detected	**MMVF:** 40
Colour: Light Grey	**Crocidolite:** None Detected	**Other Fibres:** None Detected
Description: 2' x 4' Drop Ceiling Tiles in Diesel Shop - Room #10	**Other Amphiboles:** None Detected	**Non Fibrous:** None Detected
	Comments: N/A	
Client Sample: ONR - 48a	**Asbestos Detected?**	**No**
LEX Sample: 21	**Chrysotile:** None Detected	**Cellulose:** None Detected
Layers Analyzed: Sample Homogenized	**Amosite:** None Detected	**MMVF:** None Detected
Colour: Green/Brown	**Crocidolite:** None Detected	**Other Fibres:** None Detected
Description: Roll Vinyl Flooring in Diesel Shop - Room #12	**Other Amphiboles:** None Detected	**Non Fibrous:** 100
	Comments: N/A	
Client Sample: ONR - 48b	**Asbestos Detected?**	**No**
LEX Sample: 22	**Chrysotile:** None Detected	**Cellulose:** None Detected
Layers Analyzed: Sample Homogenized	**Amosite:** None Detected	**MMVF:** None Detected
Colour: Green/Brown	**Crocidolite:** None Detected	**Other Fibres:** None Detected
Description: Roll Vinyl Flooring in Diesel Shop - Room #12	**Other Amphiboles:** None Detected	**Non Fibrous:** 100
	Comments: N/A	

Other Amphiboles: ac=actinolite, a=anthophyllite, t-tremolite, u=unidentified
MMVF: Man Made Vitreous Fibres: Fibreglass, Min. Wool, Rockwool, Glasswool
PLM - method detection limit is 0.1%

Analyst

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Company: Thomas Contracting **LEX Project #** 08181859 **Page 6 of 6**

	Fibrous Asbestos Content %	Other Materials Content %
Client Sample: ONR - 54a	**Asbestos Detected?**	**No**
LEX Sample: 23	**Chrysotile:** None Detected	**Cellulose:** 10
Layers Analyzed: Sample Homogenized	**Amosite:** None Detected	**MMVF:** 50
Colour: Beige	**Crocidolite:** None Detected	**Other Fibres:** None Detected
Description: Elbow/Fitting Insulation on Piping in Diesel Shop - Addition	**Other Amphiboles:** None Detected	**Non Fibrous:** 40
	Comments: N/A	
Client Sample: ONR - 54b	**Asbestos Detected?**	**No**
LEX Sample: 24	**Chrysotile:** None Detected	**Cellulose:** 10
Layers Analyzed: Sample Homogenized	**Amosite:** None Detected	**MMVF:** 50
Colour: Beige	**Crocidolite:** None Detected	**Other Fibres:** None Detected
Description: Elbow/Fitting Insulation on Piping in Diesel Shop - Addition	**Other Amphiboles:** None Detected	**Non Fibrous:** 40
	Comments: N/A	
Client Sample: ONR - 57a	**Asbestos Detected?**	**No**
LEX Sample: 25	**Chrysotile:** None Detected	**Cellulose:** None Detected
Layers Analyzed: Sample Homogenized	**Amosite:** None Detected	**MMVF:** None Detected
Colour: Beige	**Crocidolite:** None Detected	**Other Fibres:** None Detected
Description: 12"x12" Vinyl Floor Tile (beige) in Diesel Shop - Room #102	**Other Amphiboles:** None Detected	**Non Fibrous:** 100
	Comments: N/A	
Client Sample: ONR - 57b	**Asbestos Detected?**	**No**
LEX Sample: 26	**Chrysotile:** None Detected	**Cellulose:** None Detected
Layers Analyzed: Sample Homogenized	**Amosite:** None Detected	**MMVF:** None Detected
Colour: Beige	**Crocidolite:** None Detected	**Other Fibres:** None Detected
Description: 12"x12" Vinyl Floor Tile (beige) in Diesel Shop - Room #102	**Other Amphiboles:** None Detected	**Non Fibrous:** 100
	Comments: N/A	

Other Amphiboles: ac=actinolite, a=anthophyllite, t-tremolite, u=unidentified
MMVF: Man Made Vitreous Fibres: Fibreglass, Min. Wool, Rockwool, Glasswool
PLM - method detection limit is 0.1%

Analyst

This test report relates only to the items tested and must not be used to claim product endorsement by NVLAP or any agency of the United States government. This test report must not be reproduced, except in full, without the written consent of the laboratory.

SOLUTIONS
FOR A WORKING WORLD

CERTIFICATE OF ANALYSIS

Company:	Thomas Contracting	**Report Date:**	01-Nov-18
Contact:	Mr. Grant Johnson	**Analysis Date:**	01-Nov-18
Client Address:	72 Ninovan Road, CALLANDER, ON	**Received Date:**	31-Oct-18
Client Reference:	ONR - DSS	**LEX Project Number:**	08181864
Sampling Date:	30-Nov-18	**Number of Analyses:**	14

Analysis Requested **Bulk Asbestos by PLM**

Analysis was performed in accordance with the method EPA/600/R-93/116, Method for the Determination of Asbestos in Bulk Building Materials adopted in Designated Substance - Asbestos on Construction Projects and in Buildings and Repair Operations - made under the Occupational Health and Safety Act Ontario Regulation 278/05. LEX Scientific Inc. is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP 101949) by the National Institute of Standards and Technology for analysis of bulk materials for asbestos.

German Leal, B.Sc.
Laboratory Manager

			Fibrous Asbestos Content %		Other Materials Content %
Client Sample:	ONR - 61a	**Asbestos Detected?**		**No**	
LEX Sample:	01	**Chrysotile:**	None Detected	**Cellulose:**	30
Layers Analyzed:	Sample Homogenized	**Amosite:**	None Detected	**MMVF:**	60
Colour:	Grey/White	**Crocidolite:**	None Detected	**Other Fibres:**	None Detected
Description:	2' x 4' Drop Ceiling Tiles in Diesel Shop - Room #201	**Other Amphiboles:**	None Detected	**Non Fibrous:**	10
		Comments:	N/A		

Other Amphiboles: ac=actinolite, a=anthophyllite, t-tremolite, u=unidentified
MMVF: Man Made Vitreous Fibres: Fibreglass, Min. Wool, Rockwool, Glasswool
PLM - method detection limit is 0.1%

Analyst

This test report relates only to the items tested and must not be used to claim product endorsement by NVLAP or any agency of the United States government. This test report must not be reproduced, except in full, without the written consent of the laboratory.

291 Woodlawn Road West, Unit B-12 Guelph, Ontario N1H 7L6
1.800.824.7082
e-mail: admin@lexscientific.com Website: www.lexscientific.com

Company: Thomas Contracting **LEX Project #** 08181864 **Page 2 of 4**

	Fibrous Asbestos Content %	Other Materials Content %
Client Sample: ONR - 61b	**Asbestos Detected?**	**No**
LEX Sample: 02	**Chrysotile:** None Detected	**Cellulose:** 30
Layers Analyzed: Sample Homogenized	**Amosite:** None Detected	**MMVF:** 60
Colour: Grey/White	**Crocidolite:** None Detected	**Other Fibres:** None Detected
Description: 2' x 4' Drop Ceiling Tiles in Diesel Shop - Room #201	**Other Amphiboles:** None Detected	**Non Fibrous:** 10
	Comments: N/A	
Client Sample: ONR - 63a	**Asbestos Detected?**	**No**
LEX Sample: 03	**Chrysotile:** None Detected	**Cellulose:** None Detected
Layers Analyzed: Sample Homogenized	**Amosite:** None Detected	**MMVF:** None Detected
Colour: White	**Crocidolite:** None Detected	**Other Fibres:** None Detected
Description: Drywall Joint Compound on walls in Diesel shop-Room #202	**Other Amphiboles:** None Detected	**Non Fibrous:** 100
	Comments: N/A	
Client Sample: ONR - 63b	**Asbestos Detected?**	**No**
LEX Sample: 04	**Chrysotile:** None Detected	**Cellulose:** None Detected
Layers Analyzed: Sample Homogenized	**Amosite:** None Detected	**MMVF:** None Detected
Colour: White	**Crocidolite:** None Detected	**Other Fibres:** None Detected
Description: Drywall Joint Compound on walls in Diesel shop-Room #202	**Other Amphiboles:** None Detected	**Non Fibrous:** 100
	Comments: N/A	
Client Sample: ONR - 64a	**Asbestos Detected?**	**No**
LEX Sample: 05	**Chrysotile:** None Detected	**Cellulose:** 45
Layers Analyzed: Sample Homogenized	**Amosite:** None Detected	**MMVF:** 45
Colour: Grey/White	**Crocidolite:** None Detected	**Other Fibres:** None Detected
Description: 2' x 4' Drop Ceiling Tiles in Diesel Shop - Room #202	**Other Amphiboles:** None Detected	**Non Fibrous:** 10
	Comments: N/A	
Client Sample: ONR - 64b	**Asbestos Detected?**	**No**
LEX Sample: 06	**Chrysotile:** None Detected	**Cellulose:** 45
Layers Analyzed: Sample Homogenized	**Amosite:** None Detected	**MMVF:** 45
Colour: Grey/White	**Crocidolite:** None Detected	**Other Fibres:** None Detected
Description: 2' x 4' Drop Ceiling Tiles in Diesel Shop - Room #202	**Other Amphiboles:** None Detected	**Non Fibrous:** 10
	Comments: N/A	

Other Amphiboles: ac=actinolite, a=anthophyllite, t-tremolite, u=unidentified
MMVF: Man Made Vitreous Fibres: Fibreglass, Min. Wool, Rockwool, Glasswool
PLM - method detection limit is 0.1%

Analyst

This test report relates only to the items tested and must not be used to claim product endorsement by NVLAP or any agency of the United States government. This test report must not be reproduced, except in full, without the written consent of the laboratory.

Company: Thomas Contracting **LEX Project #** 08181864 **Page 3 of 4**

		Fibrous Asbestos Content %		Other Materials Content %	
Client Sample:	ONR - 58a	**Asbestos Detected?**		**No**	
LEX Sample:	07	**Chrysotile:**	None Detected	**Cellulose:**	50
Layers Analyzed:	Sample Homogenized	**Amosite:**	None Detected	**MMVF:**	None Detected
Colour:	Black	**Crocidolite:**	None Detected	**Other Fibres:**	None Detected
Description:	Pipe Insulation (Tar Paper) on Rain leader linesin Diesel Shop-Room #103	**Other Amphiboles:**	None Detected	**Non Fibrous:**	50
		Comments:	N/A		
Client Sample:	ONR - 58b	**Asbestos Detected?**		**No**	
LEX Sample:	08	**Chrysotile:**	None Detected	**Cellulose:**	50
Layers Analyzed:	Sample Homogenized	**Amosite:**	None Detected	**MMVF:**	None Detected
Colour:	Black	**Crocidolite:**	None Detected	**Other Fibres:**	None Detected
Description:	Pipe Insulation (Tar Paper) on Rain leader linesin Diesel Shop-Room #103	**Other Amphiboles:**	None Detected	**Non Fibrous:**	50
		Comments:	N/A		
Client Sample:	ONR - 59a	**Asbestos Detected?**		**No**	
LEX Sample:	09	**Chrysotile:**	None Detected	**Cellulose:**	None Detected
Layers Analyzed:	Sample Homogenized	**Amosite:**	None Detected	**MMVF:**	None Detected
Colour:	Beige	**Crocidolite:**	None Detected	**Other Fibres:**	None Detected
Description:	12" x 12" Vinyl Floor Tile in Diesel Shop - Room # 104	**Other Amphiboles:**	None Detected	**Non Fibrous:**	100
		Comments:	N/A		
Client Sample:	ONR - 59b	**Asbestos Detected?**		**No**	
LEX Sample:	10	**Chrysotile:**	None Detected	**Cellulose:**	None Detected
Layers Analyzed:	Sample Homogenized	**Amosite:**	None Detected	**MMVF:**	None Detected
Colour:	Beige	**Crocidolite:**	None Detected	**Other Fibres:**	None Detected
Description:	12" x 12" Vinyl Floor Tile in Diesel Shop - Room # 104	**Other Amphiboles:**	None Detected	**Non Fibrous:**	100
		Comments:	N/A		
Client Sample:	ONR - 60a	**Asbestos Detected?**		**No**	
LEX Sample:	11	**Chrysotile:**	None Detected	**Cellulose:**	45
Layers Analyzed:	Sample Homogenized	**Amosite:**	None Detected	**MMVF:**	45
Colour:	Grey/White	**Crocidolite:**	None Detected	**Other Fibres:**	None Detected
Description:	2' x 4' Drop Ceiling Tiles in Diesel Shop - Room # 104	**Other Amphiboles:**	None Detected	**Non Fibrous:**	10
		Comments:	N/A		

Other Amphiboles: ac=actinolite, a=anthophyllite, t-tremolite, u=unidentified
MMVF: Man Made Vitreous Fibres: Fibreglass, Min. Wool, Rockwool, Glasswool
PLM - method detection limit is 0.1%

Analyst

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Company: Thomas Contracting **LEX Project #** 08181864 **Page 4 of 4**

	Fibrous Asbestos Content %	Other Materials Content %
Client Sample: ONR - 60b	**Asbestos Detected?**	**No**
LEX Sample: 12	**Chrysotile:** None Detected	**Cellulose:** 45
Layers Analyzed: Sample Homogenized	**Amosite:** None Detected	**MMVF:** 45
Colour: Grey/White	**Crocidolite:** None Detected	**Other Fibres:** None Detected
Description: 2' x 4' Drop Ceiling Tiles in Diesel Shop - Room # 104	**Other Amphiboles:** None Detected	**Non Fibrous:** 10
	Comments: N/A	
Client Sample: ONR - 71a	**Asbestos Detected?**	**No**
LEX Sample: 13	**Chrysotile:** None Detected	**Cellulose:** None Detected
Layers Analyzed: Sample Homogenized	**Amosite:** None Detected	**MMVF:** None Detected
Colour: Beige/Black	**Crocidolite:** None Detected	**Other Fibres:** None Detected
Description: 12" x 12" Vinyl Floor Tile in Car Shop - Room # G	**Other Amphiboles:** None Detected	**Non Fibrous:** 100
	Comments: N/A	
Client Sample: ONR - 71b	**Asbestos Detected?**	**No**
LEX Sample: 14	**Chrysotile:** None Detected	**Cellulose:** None Detected
Layers Analyzed: Sample Homogenized	**Amosite:** None Detected	**MMVF:** None Detected
Colour: Beige/Black	**Crocidolite:** None Detected	**Other Fibres:** None Detected
Description: 12" x 12" Vinyl Floor Tile in Car Shop - Room # G	**Other Amphiboles:** None Detected	**Non Fibrous:** 100
	Comments: N/A	

Other Amphiboles: ac=actinolite, a=anthophyllite, t-tremolite, u=unidentified
MMVF: Man Made Vitreous Fibres: Fibreglass, Min. Wool, Rockwool, Glasswool
PLM - method detection limit is 0.1%

Analyst

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PHOTO # 1
POWER HOUSE

PHOTO # 2
WHEEL SHOP

PHOTO # 3
PAINT & GRIT SHOP

PHOTO # 4
DIESEL SHOP

PHOTO # 5
CAR SHOP

PHOTO # 6
Sample # ONR 1 : Asbestos-containing Elbow / Fitting Insulation
on Cold Water Supply lines in Power House. (80% chrysotile asbestos)

PHOTO # 7
Sample # ONR – 2 : Asbestos-containing Pipe Insulation
on Condensate lines in Power House. (80% amosite asbestos)

PHOTO # 8
Sample # ONR 3 : Asbestos-containing Exhaust / Breeching Insulation
on Boilers in Power House. (50% chrysotile asbestos)

PHOTO # 9
Sample # ONR – 6 : Asbestos-containing Jacket Insulation
on Deaerator Tank in Power House - Mezzanine. (80% chrysotile asbestos)

PHOTO # 10
Sample # ONR – 7 : Asbestos-containing Pipe Insulation (anti-sweat)
on Cold Water Lines in Wheel Shop – Electrical Room. (1% chrysotile asbestos)

.

PHOTO # 11
Sample # ONR – 8 : Asbestos-containing Pipe Insulation on High Pressure Steam lines in Wheel Shop – Electrical Room. (90% chrysotile asbestos)

.

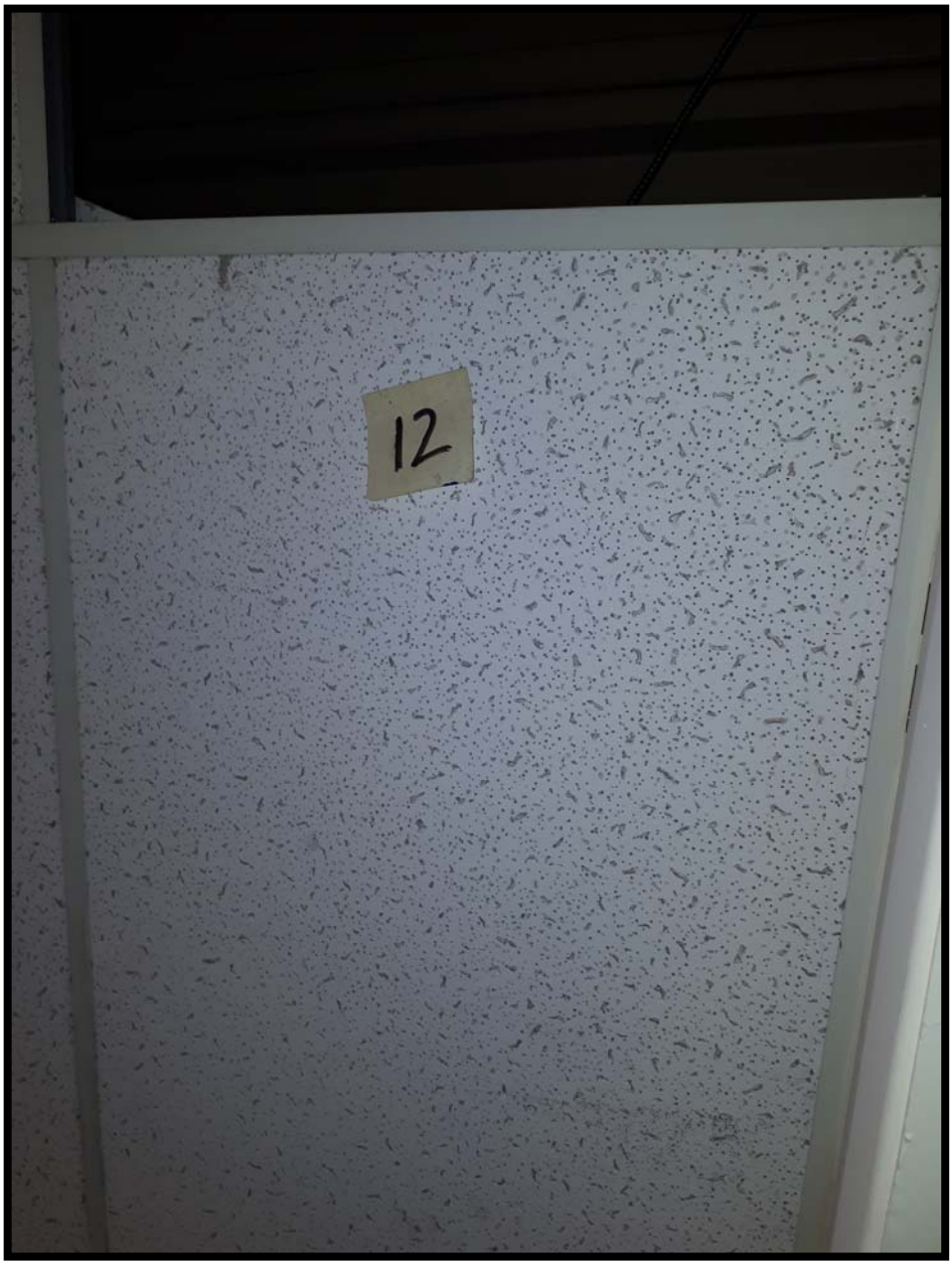

PHOTO # 12
Sample # ONR – 12 : Non-asbestos 2' x 4' Drop Ceiling Tiles in Wheel Shop – Room # 2.

PHOTO # 13
Sample # ONR – 13 : Asbestos-containing Elbow / Clean-out Insulation on Rain Leader lines in Wheel Shop – Room # 3. (80% chrysotile asbestos)

.

PHOTO # 14
Sample # ONR – 15 : Non-asbestos 12” x 12” vinyl floor tile in Wheel Shop – Room # 5.

.

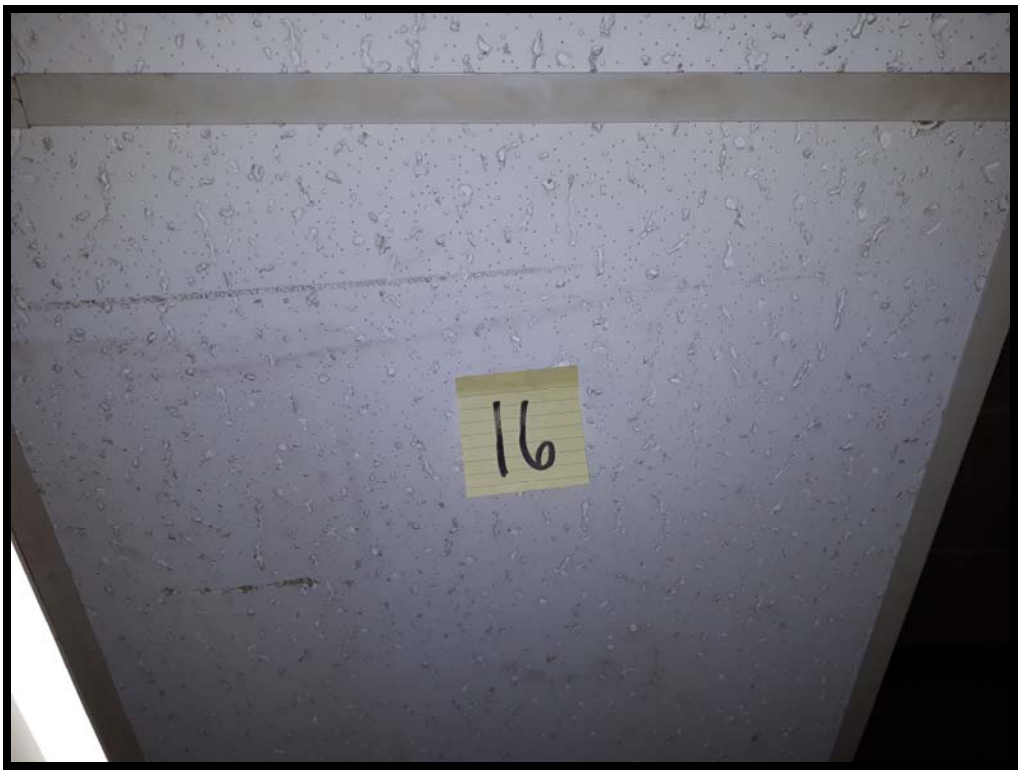

PHOTO # 15
Sample # ONR – 16 : Non-asbestos 2' x 4' Drop Ceiling Tiles in Wheel Shop – Room # 5..

PHOTO # 16
Sample # ONR – 20 : Asbestos-containing Window / Door Caulking on Exterior of Wheel Shop. (20 % Chrysotile asbestos)

PHOTO # 17
Sample # ONR – 25 : Asbestos-containing 12" x 12" Vinyl Floor Tile in Paint Shop – Room # 5. (1% chrysotile asbestos)

PHOTO # 18
Sample # ONR – 27 : Asbestos-containing Pipe Insulation (white mag-block) on Steam lines in Diesel Shop - Tunnel. (80% chrysotile asbestos)

PHOTO # 19
Sample # ONR – 28 : Asbestos-containing Tar Paper Wrap
on Steam lines in Diesel Shop - Tunnel. (10% chrysotile asbestos)

PHOTO # 20
Sample # ONR – 29 : Asbestos-containing Elbow / Fitting Insulation
on Cold water lines in Diesel Shop - Tunnel. (45% chrysotile and 45% amosite asbestos)

PHOTO # 21
Sample # ONR – 30 : Asbestos-containing Pipe Insulation (anti-sweat) on Cold water lines in Diesel Shop - Tunnel. (1% chrysotile asbestos)

PHOTO # 22
Sample # ONR – 31 : Asbestos-containing Elbow / Fitting Insulation on Steam lines in Diesel Shop – Tunnel (10% chrysotile and 80% amosite asbestos).

PHOTO # 23
Sample # ONR – 32 : Asbestos-containing Pipe Insulation (anti-sweat) on Heating lines in Diesel Shop - Room # 1. (60% chrysotile asbestos)

PHOTO # 24
Sample # ONR – 33 : Asbestos-containing Pipe Insulation (anti-sweat / tar paper) on Cold water lines in Diesel Shop - Room # 3. (7% chrysotile asbestos).

PHOTO # 25
Sample # ONR – 35 : Asbestos-containing Pipe Insulation (air-cell)
on Steam lines in Diesel Shop - Room # 6. (60% chrysotile asbestos)

PHOTO # 26
Sample # ONR – 40 : Asbestos-containing Elbow / Fitting Insulation
on Cold water lines in Diesel Shop - Room # 4. (80% chrysotile asbestos)

PHOTO # 27
Sample # ONR – 41, 42 and 43 : Asbestos-containing Elbow / Fitting and Pipewrap Insulation on Heating lines in Diesel Shop - East-side. (80% chrysotile asbestos)

PHOTO # 28
Sample # ONR – 44 : Non-asbestos Plaster on wall in Diesel Shop - Room # 10.

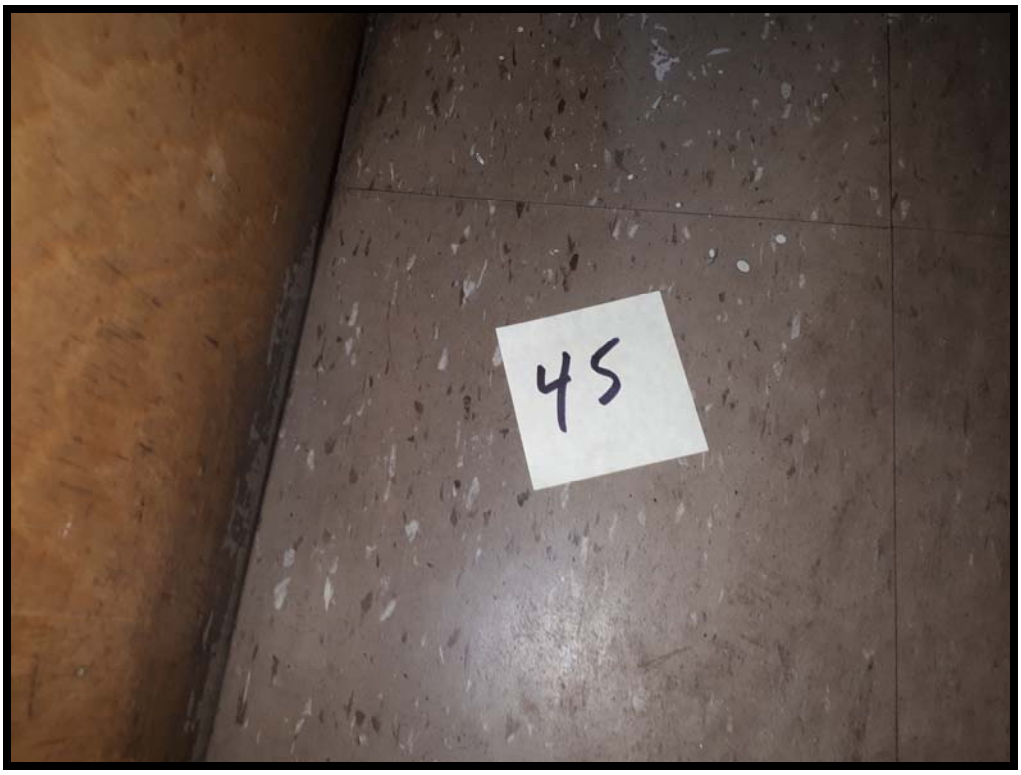

PHOTO # 29
Sample # ONR – 45 : Non-asbestos 12" x 12" Vinyl Floor Tile (beige)
in Diesel Shop - Room # 10.

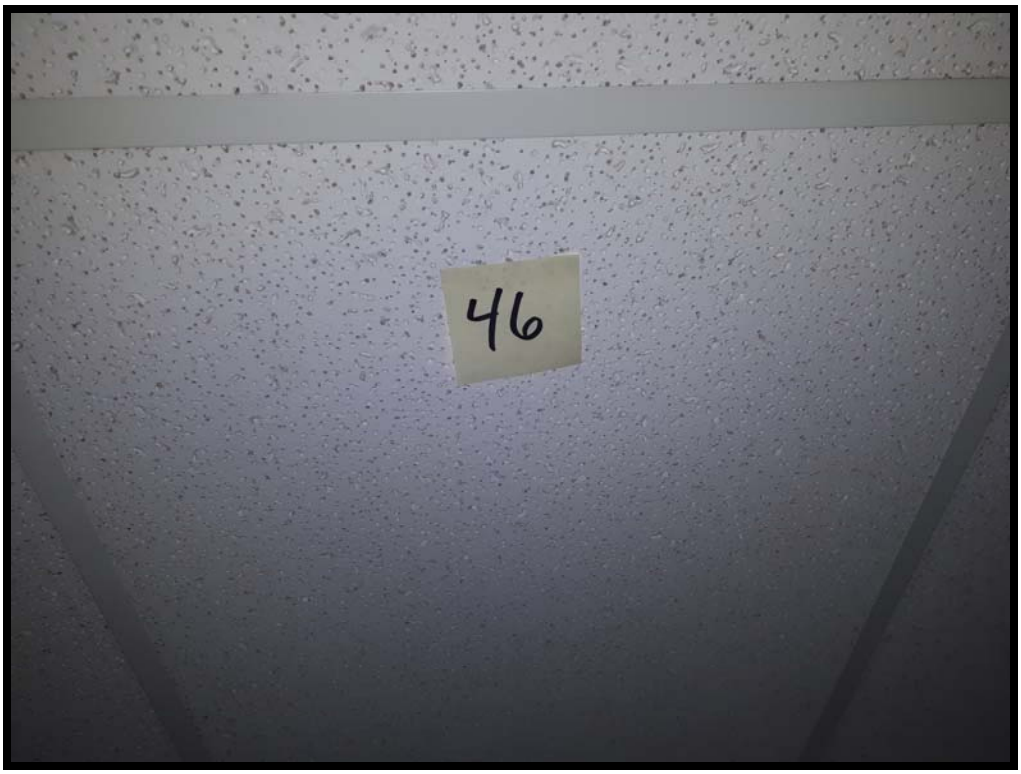

PHOTO # 30
Sample # ONR – 46 : Non-asbestos 2' x 4' Drop Ceiling Tile
in Diesel Shop - Room # 10.

PHOTO # 31
Sample # ONR – 48 : Non-asbestos Roll Vinyl Flooring
in Diesel Shop - Room # 12.

PHOTO # 32
Sample # ONR – 50 : Asbestos-containing Pipe Insulation (anti-sweat)
on Heating lines in Diesel Shop - Room # 17. (70% chrysotile asbestos)

PHOTO # 33
Sample # ONR – 57 : Non-asbestos 12" x 12" Vinyl Floor Tile in Diesel Shop - Room # 102.

PHOTO # 34
Sample # ONR – 58 : Pipe Insulation (tar paper)
on Rain Leader lines in Diesel Shop - Room # 103.
.

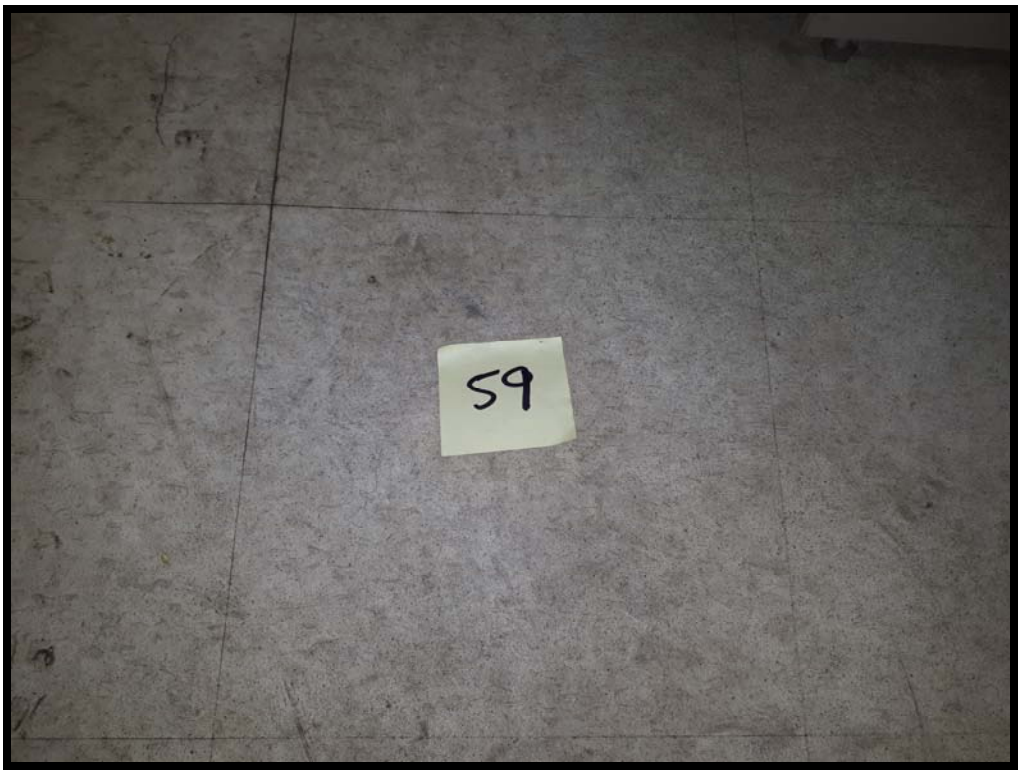

PHOTO # 35
Sample # ONR – 59 : Non-asbestos 12" x 12" Vinyl Floor Tile
in Diesel Shop - Room # 104.

PHOTO # 36
Sample # ONR – 60 : Non-asbestos 2' x 4' Drop Ceiling Tile
in Diesel Shop - Room # 104.

PHOTO # 37
Sample # ONR – 61 :Non-asbestos 2' x 4' Drop Ceiling Tile in Diesel Shop - Room # 201.

PHOTO # 38
Sample # ONR – 63 : Non-asbestos Drywall Joint Compound on wall in Diesel Shop - Room # 202.

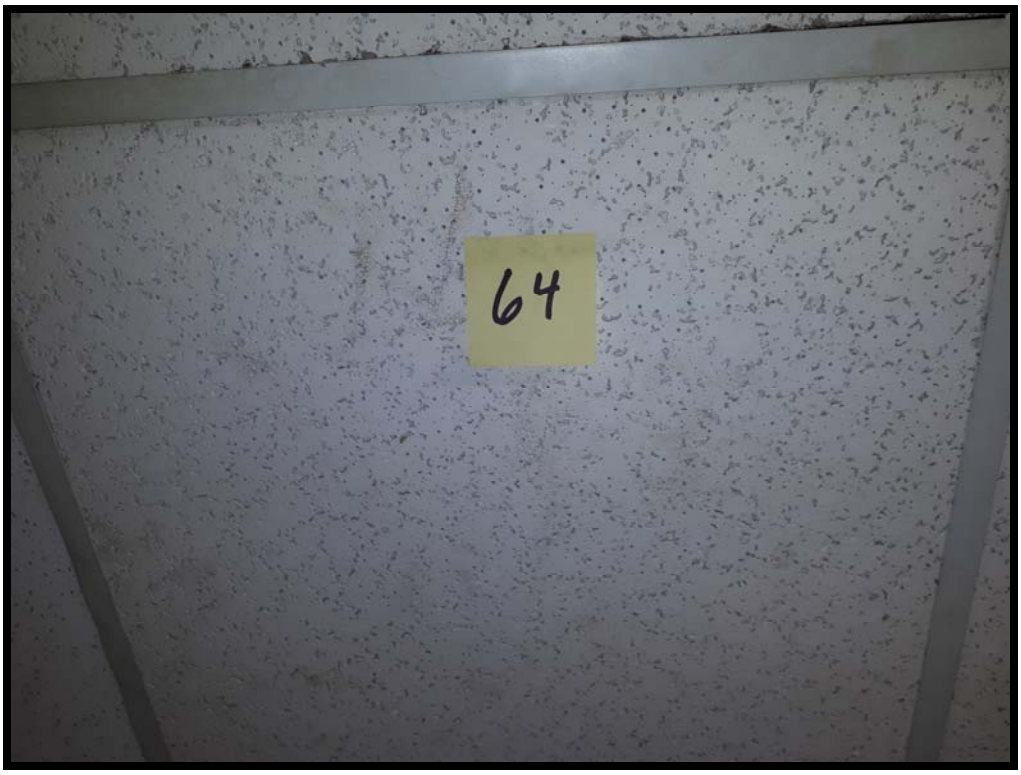

PHOTO # 39
Sample # ONR – 64 : Non-asbestos 2' x 4' Drop Ceiling Tile in Diesel Shop - Room # 202.

PHOTO # 40
Sample # ONR – 65 : Asbestos-containing Elbow / Fitting Insulation on pipes in Car Shop - Room # 200. (60% chrysotile asbestos).

PHOTO # 41
Sample # ONR – 70 : Non-asbestos 12" x 12" Vinyl Floor Tile
in Car Shop - Room # D.

PHOTO # 42
Sample # ONR – 71 : Asbestos-containing 12" x 12" Vinyl Floor Tile
in Car Shop - Room # G (25% chrysotile asbestos)

PHOTO # 43
Sample # ONR – 72 : Asbestos-containing Caulking
on exterior widows of Diesel Shop. (8% chrysotile asbestos)

PHOTO # 43a
Sample # ONR – 36 : Non-asbestos Sprayed Applied Insulation
on ceiling in Diesel Shop – Room 6.

PHOTO # 43b
Asbestos-containing materials within storage cabinet
in Car Shop – Room 117

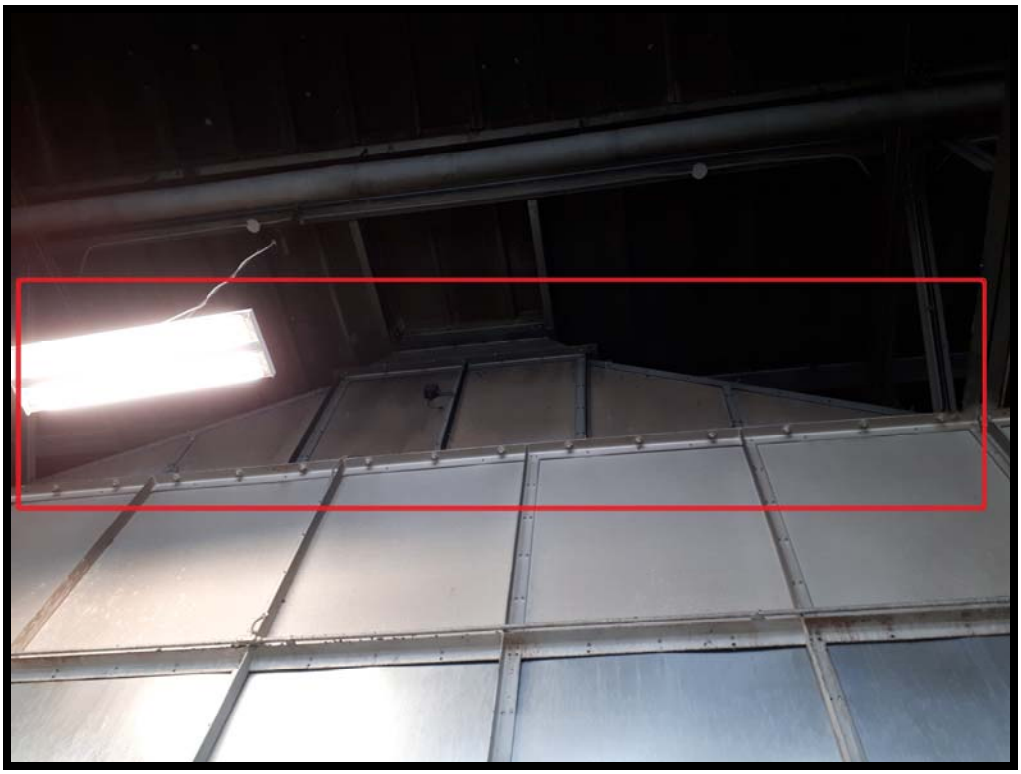

PHOTO # 43c
Asbestos-containing "Transite" panels on upper part of
exhaust hoods for locomotives in Diesel Shop – above Service Pits

APPENDIX 'B'

Lead Lab Transcripts
&
Sample Photos

CADUCEON ENVIRONMENTAL LABORATORIES
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CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: --- **REPORT No. B18-32158**

Report To:
Thomas Contracting
72 Ninovan Road,
Callander ON P0H 1H0 Canada
Attention: Grant Johnson

Caduceon Environmental Laboratories
2378 Holly Lane
Ottawa Ontario K1V 7P1
Tel: 613-526-0123
Fax: 613-526-1244

DATE RECEIVED: 17-Oct-18
DATE REPORTED: 30-Oct-18
SAMPLE MATRIX: Paint Chips

JOB/PROJECT NO.: ONR-DSS
P.O. NUMBER: TC-201434
WATERWORKS NO.

	Parameter		Lead	Lead			
	Units		µg/g	µg/g			
	R.L.		5	5			
	Reference Method		EPA 6010	EPA 6010			
	Date Analyzed/Site		29-Oct-18/O	30-Oct-18/O			
Client I.D.	**Sample I.D.**	**Date Collected**					
ONR-4	B18-32158-1	15-Oct-18		5830			
ONR-5	B18-32158-2	15-Oct-18	1010				
ONR-10	B18-32158-3	15-Oct-18		13800			
ONR-11	B18-32158-4	15-Oct-18		14200			
ONR-19	B18-32158-5	15-Oct-18		6380			
ONR-21	B18-32158-6	15-Oct-18	72				
ONR-23	B18-32158-7	15-Oct-18	214				
ONR-26	B18-32158-8	15-Oct-18	34				

Greg Clarkin , BSc., C. Chem
Lab Manager - Ottawa District

R.L. = Reporting Limit
Test methods may be modified from specified reference method unless indicated by an *
Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

The analytical results reported herein refer to the samples as received. Reproduction of this analytical report in full or in part is prohibited without prior consent from Caduceon Environmental Laboratories.

Page 1 of 1.

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CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: --- **REPORT No. B18-32692**

Report To:
Thomas Contracting
72 Ninovan Road,
Callander ON P0H 1H0 Canada
Attention: Grant Johnson

Caduceon Environmental Laboratories
2378 Holly Lane
Ottawa Ontario K1V 7P1
Tel: 613-526-0123
Fax: 613-526-1244

DATE RECEIVED: 23-Oct-18
DATE REPORTED: 26-Oct-18
SAMPLE MATRIX: Paint Chips

JOB/PROJECT NO.: ONR-DSS
P.O. NUMBER: TC-201434
WATERWORKS NO.

	Parameter		Lead	Lead			
	Units		µg/g	µg/g			
	R.L.		5	5			
	Reference Method		EPA 6010	EPA 6010			
	Date Analyzed/Site		25-Oct-18/O	26-Oct-18/O			
Client I.D.	**Sample I.D.**	**Date Collected**					
ONR-34	B18-32692-1	18-Oct-18	2590				
ONR-37	B18-32692-2	18-Oct-18		7990			
ONR-39	B18-32692-3	18-Oct-18		7750			
ONR-47	B18-32692-4	18-Oct-18		13000			
ONR-49	B18-32692-5	18-Oct-18	2530				
ONR-55	B18-32692-6	18-Oct-18	110				
ONR-56	B18-32692-7	18-Oct-18	2880				

Greg Clarkin , BSc., C. Chem
Lab Manager - Ottawa District

R.L. = Reporting Limit
Test methods may be modified from specified reference method unless indicated by an *
Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

The analytical results reported herein refer to the samples as received. Reproduction of this analytical report in full or in part is prohibited without prior consent from Caduceon Environmental Laboratories.

Page 1 of 1.

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CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: --- **REPORT No. B18-33320**

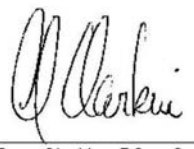
Report To:
Thomas Contracting
72 Ninovan Road,
Callander ON P0H 1H0 Canada
Attention: Grant Johnson

Caduceon Environmental Laboratories
2378 Holly Lane
Ottawa Ontario K1V 7P1
Tel: 613-526-0123
Fax: 613-526-1244

DATE RECEIVED: 29-Oct-18
DATE REPORTED: 01-Nov-18
SAMPLE MATRIX: Paint Chips

JOB/PROJECT NO.: ONR-DSS
P.O. NUMBER: TC-201434
WATERWORKS NO.

	Parameter		Lead	Lead			
	Units		µg/g	µg/g			
	R.L.		5	5			
	Reference Method		EPA 6010	EPA 6010			
	Date Analyzed/Site		31-Oct-18/O	01-Nov-18/O			
Client I.D.	Sample I.D.	Date Collected					
ONR-62	B18-33320-1	24-Oct-18		8010			
ONR-66	B18-33320-2	24-Oct-18		10700			
ONR-67	B18-33320-3	24-Oct-18		5180			
ONR-68	B18-33320-4	24-Oct-18	3950				
ONR-69	B18-33320-5	24-Oct-18	380				



Greg Clarkin , BSc., C. Chem
Lab Manager - Ottawa District

R.L. = Reporting Limit
Test methods may be modified from specified reference method unless indicated by an *
Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

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Page 1 of 1.

Photo # 44
Sample # ONR – 4 : Wall paint located within the Power House - Room 100.
Deem to be Lead-based paint. (surface colour = green)

Photo # 45
Sample # ONR – 5 : Ceiling paint located within the Power House – Room 100.
Deem to be Lead-containing paint. (surface colour = off white)

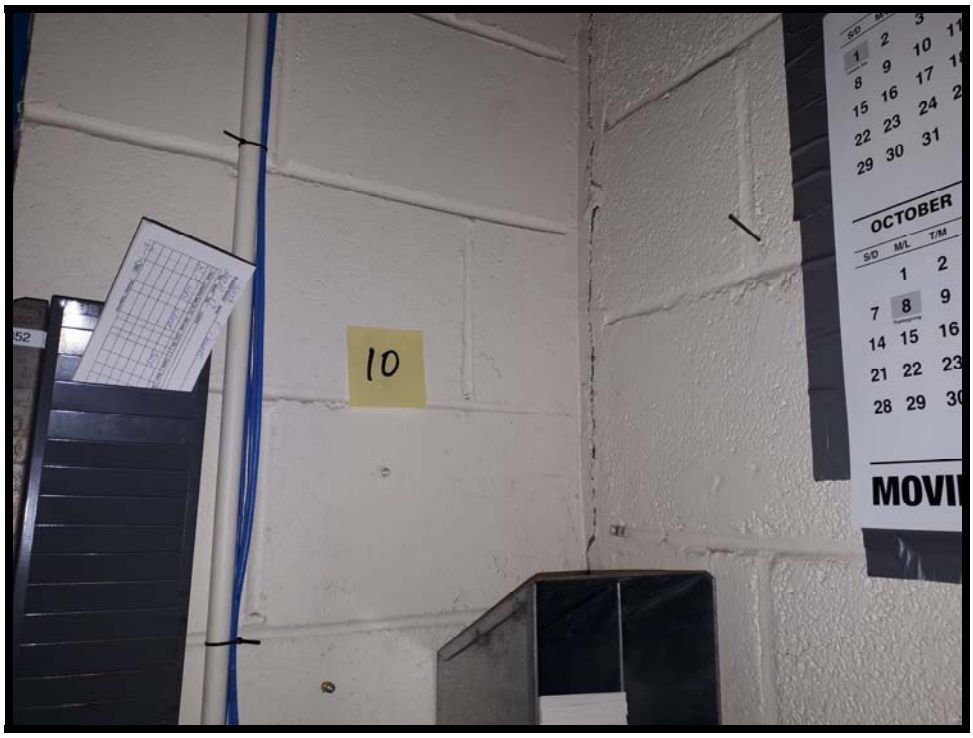

Photo # 46
Sample # ONR – 10 : Wall & Ceiling paint located within the Wheel Shop - Room 1.
Deem to be Lead-based paint. (surface colour = off white)

Photo # 47
Sample # ONR – 11 : Wall & Ceiling paint located within the Wheel Shop – Electrical Room.
Deem to be Lead-containing paint. (surface colour = yellow)

Photo # 48
Sample # ONR – 19 : Wall paint located within the Wheel Shop - Room 7.
Deem to be Lead-based paint. (surface colour = beige)

Photo # 49
Sample # ONR – 21 : Ceiling paint located within the Wheel Shop – Room 7.
Deem to be Low-level lead paint. (surface colour = off white)

Photo # 50
Sample # ONR – 23 : Wall paint located within the "Old" Paint & Grit Shop – Stairs 1. Deem to be Low-level lead paint. (surface colour = light beige)

Photo # 51
Sample # ONR – 26 : Wall paint located within the "Old" Paint & Grit Shop – Room 9. Deem to be Low-level lead paint. (surface colour = light beige)

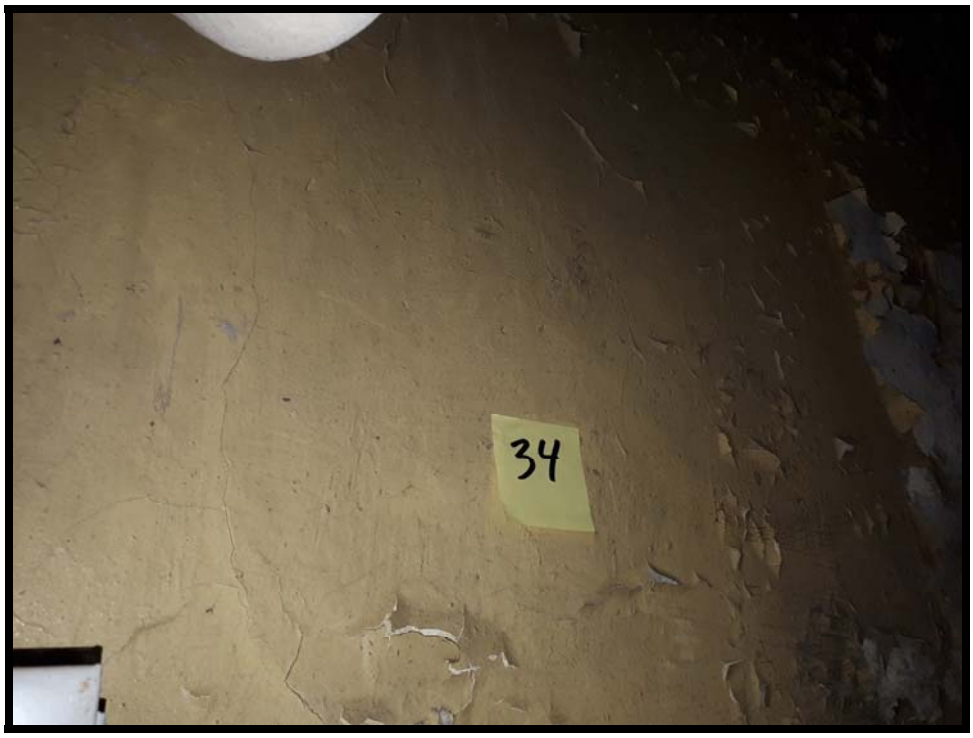

Photo # 52
Sample # ONR – 34 : Wall & Ceiling paint located within the Diesel Shop – Room 3.
Deem to be Lead-containing paint. (surface colour = beige)

Photo # 53
Sample # ONR – 37 : Wall paint located within the Diesel Shop – Room 6.
Deem to be Lead-based paint. (surface colour = green)

Photo # 54
Sample # ONR – 39 : Ceiling paint located within the Diesel Shop – Room 5.
Deem to be Lead based paint. (surface colour = dark green)

Photo # 55
Sample # ONR – 47 : Structural Steel paint located within the Diesel Shop – East Area. Deem to be Lead-based paint. (surface colour = beige)

Photo # 56
Sample # ONR – 49 : Wall & Ceiling paint located within the Diesel Shop – Room 16.
Deem to be Lead-containing paint. (surface colour = light beige)

Photo # 57
Sample # ONR – 55 : Wall paint located within the Diesel Shop – Addition Area.
Deem to be Low-level lead paint. (surface colour = green)

Photo # 58
Sample # ONR – 56 : Wall & Ceiling paint located within the Diesel Shop – Room 100.
Deem to be Lead-containing paint. (surface colour = light beige)

Photo # 59
Sample # ONR – 62 : Wall paint located within the Diesel Shop – Room 201.
Deem to be Lead-based paint. (surface colour = green)

Photo # 60
Sample # ONR – 66 : Ceiling paint located within the Car Shop – Room 200.
Deem to be Lead-based paint. (surface colour = beige)

Photo # 61
Sample # ONR – 67 : Wall paint located within the Car Shop – Room 200.
Deem to be Lead-based paint. (surface colour = green)

Photo # 62
Sample # ONR – 69 : Wall paint located within the Car Shop – Room B.
Deem to be Low-level lead paint. (surface colour = light beige)

Photo # 63
Lead-based metal flashing used on exterior windows and doors on Wheel Shop.
Also used on exterior windows and doors on Wheel Shop.

Photo # 64
Lead-based caulking used on exterior windows sill's on Wheel Shop.
Also used on exterior windows and doors on Wheel Shop.

Photo # 64a
Lead-based caulking used on exterior windows sill's on Wheel Shop.
Also used on exterior windows and doors on Wheel Shop.

APPENDIX 'C'

Thermostatic Control Switch Photo (Mercury)

Photo # 65
Wall mounted "Honeywell" Thermostatic Control Switch – Mercury Containing.
Located within the "Old" Paint & Grit Shop – Room 10.
Typical of other Thermostats' found throughout all buildings

Photo # 66
Wall mounted "Honeywell" Thermostatic Control Switch – Mercury Containing.
Located within the Diesel Shop – Room D.
Typical of other Thermostats' found throughout all buildings.

Photo # 67
Wall mounted "Honeywell" Thermostatic Control Switch – Mercury Containing.
Located within the Car Shop – Room 200.
Typical of other Thermostats' found throughout all buildings.

APPENDIX 'D'

Building / Room DSS Assessment

BUILDING / ROOM DSS ASSESSMENT

POWER HOUSE

Location (Room / Area)	***Asbestos-Containing Materials (Component – Material – Sample # – Est. Qty.)***	***Lead-Containing Materials (Material – Sample #)***	***Mercury-Containing Materials***	***Silica***
Exterior	• *Window Caulking – ONR 20 – 50 ft^2*	• *No suspected LCM's*	• *No suspected MCM's*	• *Block / Brick Walls* • *Concrete Slabs* • *Concrete Foundations*
100 (Boiler Area)	• *Cold Water – Elbow/Fitting Insulation – ONR 1 – 22* • *HPS – Pipewrap Insulation – SAS 2 – 200 ft* • *HPS – Header Insulation – SAS 2 – 20 ft* • *HPS – Elbow/Fitting Insulation – SAS 1 – 10* • *Condensate Line – Pipewrap Insulation – ONR 2 – 200 ft* • *Condensate Line – Elbow/Fitting Insulation – SAS 1 – 23* • *Boiler Feed & Make-up Line – Pipewrap Insulation – SAS 2 – 130 ft* • *Boiler Feed & Make-up Line – Elbow/Fitting Insulation – SAS 1 – 10* • *Boiler Breeching/Exhaust – Pipewrap Insulation – ONR 3 – 160 ft* • *Boiler Units – Possible jacket insulation and refractory brick*	• *Green Wall Paint – ONR 4* • *White Ceiling Paint – ONR 5*	• *Fluorescent Tubes (50)*	• *Ceramic Floor Tile* • *Block Walls* • *Concrete Slabs* • *Concrete Foundations* • *Refractory Brick*
101 (Office)	• *No suspected ACM's*	• *No suspected LCM's (modern blue latex paint)*	• *Fluorescent Tubes (4)* • *Possible PCB's in light fixture ballast*	
102 (Electrical Area)	• *No suspected ACM's*	• *Green Wall Paint – ONR 4* • *White Ceiling Paint – ONR 5*	• *No suspected MCM's*	
200 (Mezzanine)	• *Jacket Insulation on Deaerator Tank – ONR 6 – 250 ft^2* • *HPS – Pipewrap Insulation – SAS 2 – 22 ft* • *HPS – Elbow/Fitting Insulation – SAS 1 – 10*	• *Green Wall Paint – ONR 4* • *White Ceiling Paint – ONR 5*	• *No suspected MCM's*	

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c) Estimated quantities are for guidance only and are not to be used for tendering purposes.

BUILDING / ROOM DSS ASSESSMENT

WHEEL SHOP

Location (Room / Area)	***Asbestos-Containing Materials (Component – Material – Sample # – Est. Qty.)***	***Lead-Containing Materials (Material – Sample #)***	***Mercury-Containing Materials***	***Silica***
Exterior	• *Window Caulking – ONR 20 – 50 ft^2*	• *Bar flashing around windows* • *Caulking on window sill plates*	• *No suspected MCM's*	• *Block / Brick Walls* • *Concrete Slabs* • *Concrete Foundations*
Electrical Room	• *HPS – Pipewrap Insulation – ONR 8 – 15 ft* • *Cold Water – Pipewrap Insulation – ONR 7 – 20 ft* • *Heating Line – Pipewrap Insulation – ONR 9 – 35 ft* • *Heating Line – Elbow/Fitting Insulation – SAS 13 – 2*	• *Yellow Wall Paint – ONR 11* • *Yellow Ceiling Paint – SAS 11*	• *Fluorescent Tubes (6)* • *Possible PCB's in light fixture ballast*	• *Ceramic Floor Tile* • *Block Walls* • *Concrete Slabs* • *Concrete Foundations*
Room 1	• *No suspected ACM's*	• *White Wall Paint – ONR 10* • *White Ceiling Paint – SAS 10*	• *Fluorescent Tubes (2)*	• *Ceramic Floor Tile* • *Block Walls* • *Concrete Slabs* • *Concrete Foundations*
Room 2	• *Heating Line – Pipewrap Insulation – SAS 9 – 16 ft*	• *White Wall Paint – SAS 10* • *White Ceiling Paint – SAS 10*	• *Fluorescent Tubes (4)*	
Room 3	• *Heating Line – Pipewrap Insulation – SAS 9 – 18 ft* • *Rain Leader – Elbow/Fitting Insulation – ONR 13 – 5*	• *White Wall Paint – SAS 10* • *White Ceiling Paint – SAS 10*	• *Fluorescent Tubes (12)* • *Possible PCB's in light fixture ballast*	
Room 4	• *Heating Line – Pipewrap Insulation – SAS 9 – 120 ft* • *Rain Leader – Elbow/Fitting Insulation – SAS 13 – 16* • *Wall Plaster – ONR 14*	• *Yellow Wall Paint – SAS 19* • *Yellow Ceiling Paint – SAS 19*	• *Fluorescent Tubes (40)* • *Possible PCB's in light fixture ballast*	
Room 5	• *Rain Leader – Elbow/Fitting Insulation – SAS 13 – 2*	• *Yellow Wall Paint – SAS 19* • *Yellow Ceiling Paint – SAS 19*	• *Fluorescent Tubes (8)* • *Possible PCB's in light fixture ballast*	
Room 6	• *Heating Line – Pipewrap Insulation – SAS 9 – 50 ft* • *Heating Line – Elbow/Fitting Insulation – SAS 13 – 6* • *Cold Water Line – Elbow/Fitting Insulation – SAS 13 – 4* • *HPS – Pipewrap Insulation – SAS 8 – 21 ft* • *HPS – Elbow/Fitting Insulation – SAS 13 – 2*	• *Yellow Wall Paint – SAS 19* • *Yellow Ceiling Paint – SAS 19*	• *Fluorescent Tubes (6)* • *Possible PCB's in light fixture ballast*	• *Ceramic Floor Tile* • *Block Walls* • *Concrete Slabs* • *Concrete Foundations*

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BUILDING / ROOM DSS ASSESSMENT

WHEEL SHOP (con't)

Location (Room / Area)	***Asbestos-Containing Materials (Component – Material – Sample # – Est. Qty.)***	***Lead-Containing Materials (Material – Sample #)***	***Mercury-Containing Materials***	***Silica***
Room 6A	• *Heating Line – Pipewrap Insulation – SAS 9 – 40 ft*	• *No suspected LCM's (modern dark beige latex paint)*	• *Fluorescent Tubes (8)* • *Possible PCB's in light fixture ballast*	• *Ceramic Floor Tile* • *Block Walls* • *Concrete Slabs* • *Concrete Foundations*
Room 7	• *HPS – Pipewrap Insulation – SAS 8 – 150 ft* • *HPS – Elbow/Fitting Insulation – SAS 13 – 8* • *Heating Line – Pipewrap Insulation – SAS 9 – 150 ft* • *Heating Line – Elbow/Fitting Insulation – SAS 13 – 25* • *Cold Water Line – Elbow/Fitting Insulation – SAS 13 – 30* • *Domestic Hot Water Line – Pipewrap Insulation – ONR 18 – 310ft* • *Domestic Hot Water Line – Elbow/Fitting Insulation – SAS 13 – 4* • *Rain Leader – Elbow/Fitting Insulation – SAS 13 – 16*	• *Yellow Wall Paint – ONR 19* • *Beige Ceiling Paint – ONR 21*	• *Fluorescent Tubes (4)* • *Possible PCB's in light fixture ballast*	
Attic Space (above offices)	• *No suspected ACM's*	• *No suspected LCM's*	• *No suspected MCM's*	• *No suspected Silica*

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b) Samples : "ONR" designation are primary samples obtained and "SAS" designation are representative materials based on the primary sample.
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BUILDING / ROOM DSS ASSESSMENT

"OLD" PAINT & GRIT SHOP

Location (Room / Area)	***Asbestos-Containing Materials (Component – Material – Sample # – Est. Qty.)***	***Lead-Containing Materials (Material – Sample #)***	***Mercury-Containing Materials***	***Silica***
Exterior	• *No suspected ACM's*	• *No suspected LCM's*	• *No suspected MCM's*	• *Block / Brick Walls* • *Concrete Slabs* • *Concrete Foundations*
Stairs 1	• *Heating Line – Elbow/Fitting Insulation – SAS 22 – 10*	• *Light Blue Paint – ONR 23*	• *Fluorescent Tubes (6)* • *Possible PCB's in light fixture ballast*	
Room 1 (Upper Mech. Rm.)	• *Piping – Elbow/Fitting Insulation – ONR 22 – 40* • *Tank Insulation – SAS 22 – 12 ft*	• *Light Blue Paint – SAS 23*	• *Fluorescent Tubes (8)* • *Possible PCB's in light fixture ballast*	• *Block Walls* • *Concrete Slabs*
Room 2 (Upper Elect. Rm.)	• *No suspected ACM's*	• *No suspected LCM's*	• *Fluorescent Tubes (4)* • *Possible PCB's in light fixture ballast*	
Room 3	• *Heating Line – Elbow/Fitting Insulation – SAS 22 – 10* • *Cold Water Line – Elbow/Fitting Insulation – SAS 22 – 4*	• *Light Blue Paint – SAS 23*	• *Fluorescent Tubes (10)* • *Possible PCB's in light fixture ballast*	• *Block / Brick Walls* • *Concrete Slabs* • *Concrete Foundations*
Room 4	• *No suspected ACM's*	• *Light Beige Paint – SAS 26*	• *Fluorescent Tubes (8)* • *Possible PCB's in light fixture ballast*	
Room 5	• *12" x 12" Vinyl Floor Tile – ONR 25 – 22 ft^2*	• *Light Beige Paint – SAS 26*	• *Fluorescent Tubes (4)* • *Possible PCB's in light fixture ballast*	
Room 6	• *12" x 12" Vinyl Floor Tile – ONR 25 – 830 ft^2* • *Heating Line – Elbow/Fitting Insulation – SAS 22 – 15*	• *Light Beige Paint – SAS 26*	• *Fluorescent Tubes (16)* • *Possible PCB's in light fixture ballast*	
Room 7	• *No suspected ACM's*	• *No suspected LCM's (modern beige latex paint)*	• *Fluorescent Tubes (4)* • *Possible PCB's in light fixture ballast*	
Room 8	• *Rain Leader Line – Elbow & Hopper Insulation – SAS 22 – 2*	• *Light Beige Paint – SAS 26*	• *Fluorescent Tubes (44)*	

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BUILDING / ROOM DSS ASSESSMENT

"OLD" PAINT & GRIT SHOP (con't)

Location (Room / Area)	***Asbestos-Containing Materials (Component – Material – Sample # – Est. Qty.)***	***Lead-Containing Materials (Material – Sample #)***	***Mercury-Containing Materials***	***Silica***
Rooms 10 to 12	• *No suspected ACM's*	• *Light Beige Paint – SAS 26*	• *Fluorescent Tubes (24)* • *Wall Thermostat*	• *Block / Brick Walls* • *Concrete Slabs* • *Concrete Foundations*
Room 13	• *No suspected ACM's*	• *No suspected LCM's*	• *Fluorescent Tubes (4)*	
Room 14	• *Heating Line – Elbow/Fitting Insulation – SAS 22 – 9*	• *No suspected LCM's*	• *Fluorescent Tubes (18)* • *Possible PCB's in light fixture ballast*	
Room 15	• *No suspected ACM's*	• *Possible lead paint debris from sandblasting work*	• *No suspected MCM's*	• *Block / Brick Walls* • *Concrete Slabs* • *Concrete Foundations* • *Sandblasting medium*
Room 16	• *No suspected ACM's*	• *Light Beige Paint – SAS 26*	• *Fluorescent Tubes (8)* • *Possible PCB's in light fixture ballast*	
Room 17	• *HPS Line – Elbow/Fitting Insulation – SAS 22 – 8*	• *Light Beige Paint – SAS 26*	• *No suspected MCM's*	
Room 18	• *No suspected ACM's*	• *Light Beige Paint – SAS 26* • *Possible lead paint in stored cans*	• *No suspected MCM's*	• *Block / Brick Walls* • *Concrete Slabs* • *Concrete Foundations*

"NEW" PAINT SHOP

Location (Room / Area)	***Asbestos-Containing Materials (Component – Material – Sample # – Est. Qty.)***	***Lead-Containing Materials (Material – Sample #)***	***Mercury-Containing Materials***	***Silica***
Entire Shop	• *No suspected ACM's*	• *Wall, ceiling and structural paint observed within the building is classed as Low-level lead paint.*	• *Fluorescent Tubes*	• *Block / Brick Walls* • *Concrete Slabs* • *Concrete Foundations*

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BUILDING / ROOM DSS ASSESSMENT

DIESEL SHOP

Location (Room / Area)	***Asbestos-Containing Materials (Component – Material – Sample # – Est. Qty.)***	***Lead-Containing Materials (Material – Sample #)***	***Mercury-Containing Materials***	***Silica***
Exterior	• *Window Caulking – ONR 72*	• *Bar flashing around windows* • *Caulking on window sill plates*	• *No suspected MCM's*	• *Block / Brick Walls* • *Concrete Slabs* • *Concrete Foundations*
Tunnel	• *HPS Line – Elbow/Fitting Insulation – ONR 31 – 15* • *HPS Line – Pipewrap Insulation – ONR 27 – 400 ft* • *HPS Line – Tar Paper Insulation – ONR 28 – 400 ft* • *Cold Water Line – Elbow/Fitting Insulation – ONR 29 – 15* • *Cold Water Line – Pipewrap Insulation – ONR 30 – 50 ft*	• *No suspected LCM's*	• *No suspected MCM's*	• *Block / Brick Walls* • *Concrete Slabs* • *Concrete Foundations*
Room 1	• *Heating Line – Pipewrap Insulation – ONR 32 – 80 ft* • *Heating Line – Elbow/Fitting Insulation – SAS 31 – 2*	• *Light Beige Paint – SAS 34*	• *Fluorescent Tubes (24)* • *Possible PCB's in light fixture ballast*	• *Ceramic Tiles* • *Block / Brick Walls* • *Concrete Slabs* • *Concrete Foundations*
Room 2	• *Heating Line – Pipewrap Insulation – SAS 32 – 16 ft* • *Heating Line – Elbow/Fitting Insulation – SAS 31 – 2*	• *Light Beige Paint – SAS 34*	• *Fluorescent Tubes (4)* • *Possible PCB's in light fixture ballast*	
Room 3	• *No suspected ACM's*	• *Light Beige Paint – SAS 34*	• *Fluorescent Tubes (8)* • *Possible PCB's in light fixture ballast*	
Room 4	• *Heating Line – Pipewrap Insulation – SAS 32 – 130 ft* • *Heating Line – Elbow/Fitting Insulation – SAS 31 – 4*	• *Light Beige Paint – SAS 26*	• *No suspected MCM's*	
Room 5	• *No suspected ACM's*	• *Dark Green Paint – ONR 39*	• *No suspected MCM's*	

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c) Estimated quantities are for guidance only and are not to be used for tendering purposes.

BUILDING / ROOM DSS ASSESSMENT

DIESEL SHOP (con't)

Location (Room / Area)	***Asbestos-Containing Materials (Component – Material – Sample # – Est. Qty.)***	***Lead-Containing Materials (Material – Sample #)***	***Mercury-Containing Materials***	***Silica***
Room 6	• *No suspected ACM's*	• *Green Paint – ONR 37*	• *Fluorescent Tubes (6)*	• *Ceramic Tiles* • *Block / Brick Walls* • *Concrete Slabs* • *Concrete Foundations*
Room 7	• *Cold Water Line – Pipewrap Insulation – SAS 33 – 125 ft* • *Cold Water Line – Elbow/Fitting Insulation – SAS 29 – 13* • *Steam Line – Pipewrap Insulation – ONR 35 – 100 ft* • *Steam Line – Elbow/Fitting Insulation – SAS 31 – 5*	• *Green Paint – ONR 37*	• *Fluorescent Tubes (4)* • *Possible PCB's in light fixture ballast*	
Room 8	• *Heating Line – Pipewrap Insulation – SAS 50 – 75 ft* • *Heating Line – Elbow/Fitting Insulation – SAS 31 – 2* • *Rain Leader Line – Elbow/Fitting Insulation – SAS 29 – 2*	• *Light Beige Paint – SAS 49*	• *Fluorescent Tubes (14)* • *Possible PCB's in light fixture ballast*	
Room 9	• *Heating Line – Pipewrap Insulation – SAS 50 – 100 ft*	• *Light Beige Paint – SAS 49*	• *Fluorescent Tubes (32)* • *Possible PCB's in light fixture ballast*	
Room 10	• *Heating Line – Pipewrap Insulation – SAS 50 – 20 ft*	• *Light Beige Paint – SAS 49*	• *Fluorescent Tubes (4)* • *Possible PCB's in light fixture ballast*	
Room 11	• *Heating Line – Pipewrap Insulation – SAS 50 – 20 ft*	• *Light Beige Paint – SAS 49*	• *Fluorescent Tubes (4)* • *Possible PCB's in light fixture ballast*	
Room 12	• *Heating Line – Pipewrap Insulation – SAS 50 – 40 ft*	• *Light Beige Paint – SAS 49*	• *Fluorescent Tubes (12)* • *Possible PCB's in light fixture ballast*	

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BUILDING / ROOM DSS ASSESSMENT

DIESEL SHOP (con't)

Location (Room / Area)	***Asbestos-Containing Materials (Component – Material – Sample # – Est. Qty.)***	***Lead-Containing Materials (Material – Sample #)***	***Mercury-Containing Materials***	***Silica***
Room 13	• *Heating Line – Pipewrap Insulation – SAS 50 – 20 ft*	• *Light Beige Paint – SAS 49*	• *Fluorescent Tubes (6)* • *Possible PCB's in light fixture ballast*	• *Ceramic Tiles* • *Block / Brick Walls* • *Concrete Slabs* • *Concrete Foundations*
Room 14	• *Heating Line – Pipewrap Insulation – SAS 50 – 40 ft*	• *No suspected LCM's (New white latex paint)*	• *Fluorescent Tubes (18)* • *Possible PCB's in light fixture ballast*	
Room 15	• *Heating Line – Pipewrap Insulation – SAS 50 – 10 ft*	• *Light Beige Paint – SAS 49*	• *Fluorescent Tubes (2)*	
Room 16	• *Heating Line – Pipewrap Insulation – SAS 50 – 70 ft*	• *Light Beige Paint – ONR 49*	• *Fluorescent Tubes (36)*	
Room 17	• *Heating Line – Pipewrap Insulation – ONR 50 – 20 ft*	• *Light Beige Paint – SAS 49*	• *Fluorescent Tubes (8)* • *Possible PCB's in light fixture ballast*	
Room 18	• *Heating Line – Pipewrap Insulation – SAS 50 – 20 ft*	• *Light Beige Paint – SAS 49*	• *Fluorescent Tubes (8)* • *Possible PCB's in light fixture ballast*	
East Area	• *Heating Line – Elbow/Fitting Insulation – ONR 41 – 44* • *Heating Line – Pipewrap Insulation – ONR 42 – 175 ft* • *Heating Line – Pipewrap Insulation – ONR 43 – 175 ft* • *Rain Leader Line – Elbow/Fitting Insulation – ONR 41 – 6* • *HPS Line – Elbow/Fitting Insulation – SAS 41 – 10*	• *Beige Structural Steel Paint – ONR 47*	• *Fluorescent Tubes (40)*	• *Block / Brick Walls* • *Concrete Slabs* • *Concrete Foundations*
Centre Area	• *Heating Line – Elbow/Fitting Insulation – SAS 41 – 12* • *Heating Line – Pipewrap Insulation – SAS 43 – 170 ft* • *Rain Leader Line – Elbow/Fitting Insulation – SAS 41 – 4* • *HPS Line – Elbow/Fitting Insulation – SAS 41 – 14*	• *Beige Structural Steel Paint – SAS 47*	• *Fluorescent Tubes (40)*	

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c) Estimated quantities are for guidance only and are not to be used for tendering purposes.

BUILDING / ROOM DSS ASSESSMENT

DIESEL SHOP (con't)

Location (Room / Area)	***Asbestos-Containing Materials (Component – Material – Sample # – Est. Qty.)***	***Lead-Containing Materials (Material – Sample #)***	***Mercury-Containing Materials***	***Silica***
West Area	• *Cold Water Line – Pipewrap Insulation – SAS 52 – 80 ft* • *Hot Water Line – Pipewrap Insulation – SAS 53 – 80 ft* • *Heating Line – Pipewrap Insulation – SAS 43 – 300 ft* • *Rain Leader Line – Elbow/Fitting Insulation – SAS 41 – 15*	• *Beige Structural Steel Paint – SAS 47*	• *Fluorescent Tubes (40)*	
Service Pits	• *Cold Water Line – Pipewrap Insulation – ONR 52 – 720 ft* • *Hot Water Line – Pipewrap Insulation – ONR 53 – 720 ft* • *Steam Line – Pipewrap Insulation – ONR 51 – 720 ft* • *All Pipe – Elbow/Fitting Insulation – SAS 41 – 80* • *"Transite" Panels – Top of Train Exhaust Hoods – 1200 ft^2*	• *Beige Structural Steel Paint – SAS 47*	• *Fluorescent Tubes (200)*	• *Block / Brick Walls* • *Concrete Slabs* • *Concrete Foundations*
Room 100	• *Domestic Water Line – Pipewrap Insulation – SAS 52 – 36 ft* • *Domestic Water Line – Elbow/Fitting Insulation – SAS 40 - 8*	• *Light Beige Wall Paint – ONR 56* • *Light Beige Ceiling Paint – SAS 56*	• *Fluorescent Tubes (36)* • *Possible PCB's in light fixture ballast*	
Room 101	• *No suspected ACM's*	• *Light Beige Paint – SAS 56*	• *Fluorescent Tubes (8)* • *Possible PCB's in light fixture ballast*	• *Ceramic Tiles* • *Block / Brick Walls* • *Concrete Slabs* • *Concrete Foundations*
Room 102	• *No suspected ACM's*	• *Light Beige Paint – SAS 56*	• *Fluorescent Tubes (8)*	
Room 103	• *Rain Leader Line – Elbow/Fitting Insulation – SAS 41 – 5*	• *Beige Structural Steel Paint – SAS 47* • *Light Beige Paint – SAS 56*	• *Fluorescent Tubes (60)* • *Possible PCB's in light fixture ballast*	• *Block / Brick Walls* • *Concrete Slabs* • *Concrete Foundations*
Room 104	• *No suspected ACM's*	• *Light Beige Paint – SAS 56*	• *Fluorescent Tubes (8)* • *Possible PCB's in light fixture ballast*	
Stairs 1	• *No suspected ACM's*	• *Light Beige Paint – SAS 56*	• *Fluorescent Tubes (10)* • *Possible PCB's in light fixture ballast*	• *Block / Brick Walls* • *Concrete Slabs* • *Concrete Foundations*

Notes:
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b) Samples : "ONR" designation are primary samples obtained and "SAS" designation are representative materials based on the primary sample.
c) Estimated quantities are for guidance only and are not to be used for tendering purposes.

BUILDING / ROOM DSS ASSESSMENT

DIESEL SHOP (con't)

Location (Room / Area)	***Asbestos-Containing Materials (Component – Material – Sample # – Est. Qty.)***	***Lead-Containing Materials (Material – Sample #)***	***Mercury-Containing Materials***	***Silica***
Room 201	• *No suspected ACM's*	• *Green Wall Paint – ONR 62*	• *Fluorescent Tubes (60)* • *Possible PCB's in light fixture ballast*	• *Ceramic Tiles* • *Block / Brick Walls* • *Concrete Slabs*
Room 202	• *No suspected ACM's*	• *Light Beige Paint – SAS 56*	• *Fluorescent Tubes (60)* • *Possible PCB's in light fixture ballast*	
Room 203	• *No suspected ACM's*	• *No suspected LCM's*	• *Fluorescent Tubes (40)*	
Diesel Shop Addition	• *No suspected ACM's*	• *Beige Structural Steel and Wall Paint – ONR 55*	• *Fluorescent Tubes (175)*	• *Block / Brick Walls* • *Concrete Slabs* • *Concrete Foundations*

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b) Samples : "ONR" designation are primary samples obtained and "SAS" designation are representative materials based on the primary sample.
c) Estimated quantities are for guidance only and are not to be used for tendering purposes.

BUILDING / ROOM DSS ASSESSMENT

CAR SHOP

Location (Room / Area)	***Asbestos-Containing Materials (Component – Material – Sample # – Est. Qty.)***	***Lead-Containing Materials (Material – Sample #)***	***Mercury-Containing Materials***	***Silica***
Mech. Room 200 (above Rm. 112)	• *All Pipe – Elbow/Fitting Insulation – ONR 65 – 160*	• *Beige Ceiling Paint – ONR 66* • *Green Wall Paint – ONR 67*	• *Fluorescent Tubes (14)* • *Possible PCB's in light fixture ballast*	• *Block / Brick Walls* • *Concrete Slabs*
Elect. Room 201 (above Rm. 112)	• *No suspected ACM's*	• *Beige Ceiling Paint – SAS 66* • *Green Wall Paint – SAS 67*	• *Fluorescent Tubes (14)* • *Possible PCB's in light fixture ballast*	
Mech. Room 202 (above Rm. 110)	• *All Pipe – Elbow/Fitting Insulation – SAS 65 – 55*	• *Beige Ceiling Paint – SAS 66* • *Green Wall Paint – SAS 67*	• *Fluorescent Tubes (14)*	
Mech. Room 'A' (above Rm. 103)	• *All Pipe – Elbow/Fitting Insulation – SAS 65 – 30*	• *Beige Wall Paint – ONR 68*	• *Fluorescent Tubes (12)* • *Possible PCB's in light fixture ballast*	
Room 'B'	• *Above Ceiling – Elbow/Fitting Insulation – SAS 65 – 1*	• *Light Beige Paint – ONR 69*	• *Fluorescent Tubes (28)* • *Possible PCB's in light fixture ballast*	
Stairs 'C'	• *No suspected ACM's*	• *Light Beige Paint – SAS 69*	• *Fluorescent Tubes (8)* • *Possible PCB's in light fixture ballast*	
Room 'D'	• *All Pipe – Elbow/Fitting Insulation – SAS 65 – 15*	• *Light Beige Paint – SAS 69*	• *Fluorescent Tubes (34)* • *Wall Thermostat*	
Room 'E'	• *Rain Leader Line – Elbow/Hopper Insulation – SAS 65 – 4*	• *Beige Ceiling Paint – SAS 66* • *Green Wall Paint – SAS 67*	• *Fluorescent Tubes (74)* • *Wall Thermostat*	
Room 'F'	• *Above Ceiling – Elbow/Fitting Insulation – SAS 65 – 3*	• *Light Beige Paint – SAS 69*	• *Fluorescent Tubes (20)* • *Possible PCB's in light fixture ballast*	• *Ceramic Tiles* • *Block / Brick Walls* • *Concrete Slabs*
Room 'G'	• *12" x 12" Vinyl Floor Tile – ONR 71 – 300 ft^2* • *Above Ceiling – Elbow/Fitting Insulation – SAS 65 – 6*	• *Light Beige Paint – SAS 69*	• *Fluorescent Tubes (30)* • *Possible PCB's in light fixture ballast*	• *Block / Brick Walls* • *Concrete Slabs*

Notes:
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b) Samples : "ONR" designation are primary samples obtained and "SAS" designation are representative materials based on the primary sample.
c) Estimated quantities are for guidance only and are not to be used for tendering purposes.

BUILDING / ROOM DSS ASSESSMENT

CAR SHOP (con't)

Location (Room / Area)	***Asbestos-Containing Materials (Component – Material – Sample # – Est. Qty.)***	***Lead-Containing Materials (Material – Sample #)***	***Mercury-Containing Materials***	***Silica***
Stairs 'H'	• *All Pipe – Elbow/Fitting Insulation – SAS 65 – 11*	• *Dark Beige Paint – SAS 66*	• *Fluorescent Tubes (8)* • *Possible PCB's in light fixture ballast*	• *Block / Brick Walls* • *Concrete Slabs*
Stairs 'J'	• *No suspected ACM's*	• *Dark Beige Paint – SAS 66*	• *Fluorescent Tubes (6)* • *Possible PCB's in light fixture ballast*	
Room 100	• *All Pipe – Elbow/Fitting Insulation – ONR 65 – 30*	• *Gray Paint – SAS 66*	• *Fluorescent Tubes (40)* • *Possible PCB's in light fixture ballast*	• *Ceramic Tiles* • *Block / Brick Walls* • *Concrete Slabs* • *Concrete Foundations*
Room 101 & Room 101A	• *No suspected ACM's*	• *Light Beige Paint – SAS 69*	• *Fluorescent Tubes (8)* • *Possible PCB's in light fixture ballast*	
Room 101B (2 Offices)	• *No suspected ACM's*	• *No suspected LCM's (New blue latex paint)*	• *No suspected MCM's*	
Room 101C	• *All Pipe – Elbow/Fitting Insulation – SAS 65 – 10*	• *Green Wall Paint – SAS 67*	• *Fluorescent Tubes (12)* • *Possible PCB's in light fixture ballast*	
Room 101D	• *Above Ceiling – Elbow/Fitting Insulation – SAS 65 – 2*	• *Light Beige Paint – SAS 69*	• *Fluorescent Tubes (2)* • *Possible PCB's in light fixture ballast*	
Room 102	• *All Pipe – Elbow/Fitting Insulation – SAS 65 – 12*	• *Green Wall Paint – SAS 67*	• *Fluorescent Tubes (26)* • *Possible PCB's in light fixture ballast*	
Room 103	• *All Pipe – Elbow/Fitting Insulation – SAS 65 – 15*	• *Green Wall Paint – SAS 67*	• *Fluorescent Tubes (38)* • *Possible PCB's in light fixture ballast*	
Room 104	• *No suspected ACM's*	• *Light Beige Paint – SAS 69*	• *Fluorescent Tubes (6)* • *Possible PCB's in light fixture ballast*	

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c) Estimated quantities are for guidance only and are not to be used for tendering purposes.

BUILDING / ROOM DSS ASSESSMENT

CAR SHOP (con't)

Location (Room / Area)	***Asbestos-Containing Materials (Component – Material – Sample # – Est. Qty.)***	***Lead-Containing Materials (Material – Sample #)***	***Mercury-Containing Materials***	***Silica***
Room 105	• *Above Ceiling – Elbow/Fitting Insulation – SAS 65 – 1*	• *Light Beige Paint – SAS 69*	• *Fluorescent Tubes (8)* • *Possible PCB's in light fixture ballast*	• *Ceramic Tiles* • *Block / Brick Walls* • *Concrete Slabs* • *Concrete Foundations*
Room 106	• *All Pipe – Elbow/Fitting Insulation – SAS 65 – 150*	• *Light Beige Paint – SAS 69* • *Dark Beige Paint – SAS 66*	• *Fluorescent Tubes (6)* • *Possible PCB's in light fixture ballast*	
Room 107	• *All Pipe – Elbow/Fitting Insulation – SAS 65 – 11*	• *Light Beige Paint – SAS 69*	• *Fluorescent Tubes (16)* • *Possible PCB's in light fixture ballast*	
Room 108	• *All Pipe – Elbow/Fitting Insulation – SAS 65 – 17*	• *Light Beige Paint – SAS 69*	• *Fluorescent Tubes (4)* • *Possible PCB's in light fixture ballast*	
Room 109	• *All Pipe – Elbow/Fitting Insulation – SAS 65 – 150*	• *Light Beige Paint – SAS 69* • *Dark Beige Paint – SAS 66*	• *No suspected MCM's*	
Room 110	• *All Pipe – Elbow/Fitting Insulation – SAS 65 – 25*	• *Dark Beige Paint – SAS 66* • *Green Wall Paint – SAS 67*	• *Fluorescent Tubes (24)*	
Room 111	• *All Pipe – Elbow/Fitting Insulation – SAS 65 – 30*	• *Light Beige Paint – SAS 69* • *Dark Beige Paint – SAS 66*	• *No suspected MCM's*	
Room 112	• *All Pipe – Elbow/Fitting Insulation – SAS 65 – 23*	• *Dark Beige Paint – SAS 66* • *Green Wall Paint – SAS 67*	• *Fluorescent Tubes (32)* • *Possible PCB's in light fixture ballast* • *Wall Thermostat*	
Corridor 113	• *Above Ceiling – Elbow/Fitting Insulation – SAS 65 – 7*	• *Light Beige Paint – SAS 69*	• *Fluorescent Tubes (14)* • *Possible PCB's in light fixture ballast* • *Wall Thermostat*	
Room 114	• *All Pipe – Elbow/Fitting Insulation – SAS 65 – 2*	• *Light Beige Paint – SAS 69* • *Dark Beige Paint – SAS 66*	• *Fluorescent Tubes (12)* • *Possible PCB's in light fixture ballast*	

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b) Samples : "ONR" designation are primary samples obtained and "SAS" designation are representative materials based on the primary sample.
c) Estimated quantities are for guidance only and are not to be used for tendering purposes.

BUILDING / ROOM DSS ASSESSMENT

CAR SHOP (con't)

Location (Room / Area)	***Asbestos-Containing Materials (Component – Material – Sample # – Est. Qty.)***	***Lead-Containing Materials (Material – Sample #)***	***Mercury-Containing Materials***	***Silica***
Room 114A	• *No suspected ACM's*	• *Light Beige Paint – SAS 69*	• *Fluorescent Tubes (4)* • *Possible PCB's in light fixture ballast*	• *Ceramic Tiles* • *Block / Brick Walls* • *Concrete Slabs* • *Concrete Foundations*
Room 115	• *No suspected ACM's*	• *Light Beige Paint – SAS 69*	• *Fluorescent Tubes (4)* • *Possible PCB's in light fixture ballast*	
Room 116	• *No suspected ACM's*	• *Light Beige Paint – SAS 69*	• *Fluorescent Tubes (4)* • *Possible PCB's in light fixture ballast*	
Room 117	• *All Pipe – Elbow/Fitting Insulation – SAS 65 – 15* • *Asbestos Storage Cabinet – contains asbestos materials*	• *Green Wall Paint – SAS 67* • *Lead-acid Batteries Storage*	• *Stored (225) and in use Fluorescent Tubes (10)* • *Possible PCB's in light fixture ballast*	
Room 118	• *All Pipe – Elbow/Fitting Insulation – SAS 65 – 4*	• *Green Wall Paint – SAS 67*	• *Fluorescent Tubes (10)* • *Possible PCB's in light fixture ballast*	
Room 119	• *All Pipe – Elbow/Fitting Insulation – SAS 65 – 12*	• *Green Wall Paint – SAS 67*	• *Fluorescent Tubes (36)* • *Possible PCB's in light fixture ballast*	
Room 120	• *All Pipe – Elbow/Fitting Insulation – SAS 65 – 23*	• *Green Wall Paint – SAS 67*	• *Wall Thermostat*	
Room 121	• *No suspected ACM's*	• *Green Wall Paint – SAS 67*	• *Fluorescent Tubes (4)* • *Possible PCB's in light fixture ballast*	
Car Shop Office Area (New 2005)	• *No suspected ACM's*	• *No suspected LCM's (New latex paint)*	• *Fluorescent Tubes (46)*	

Notes:
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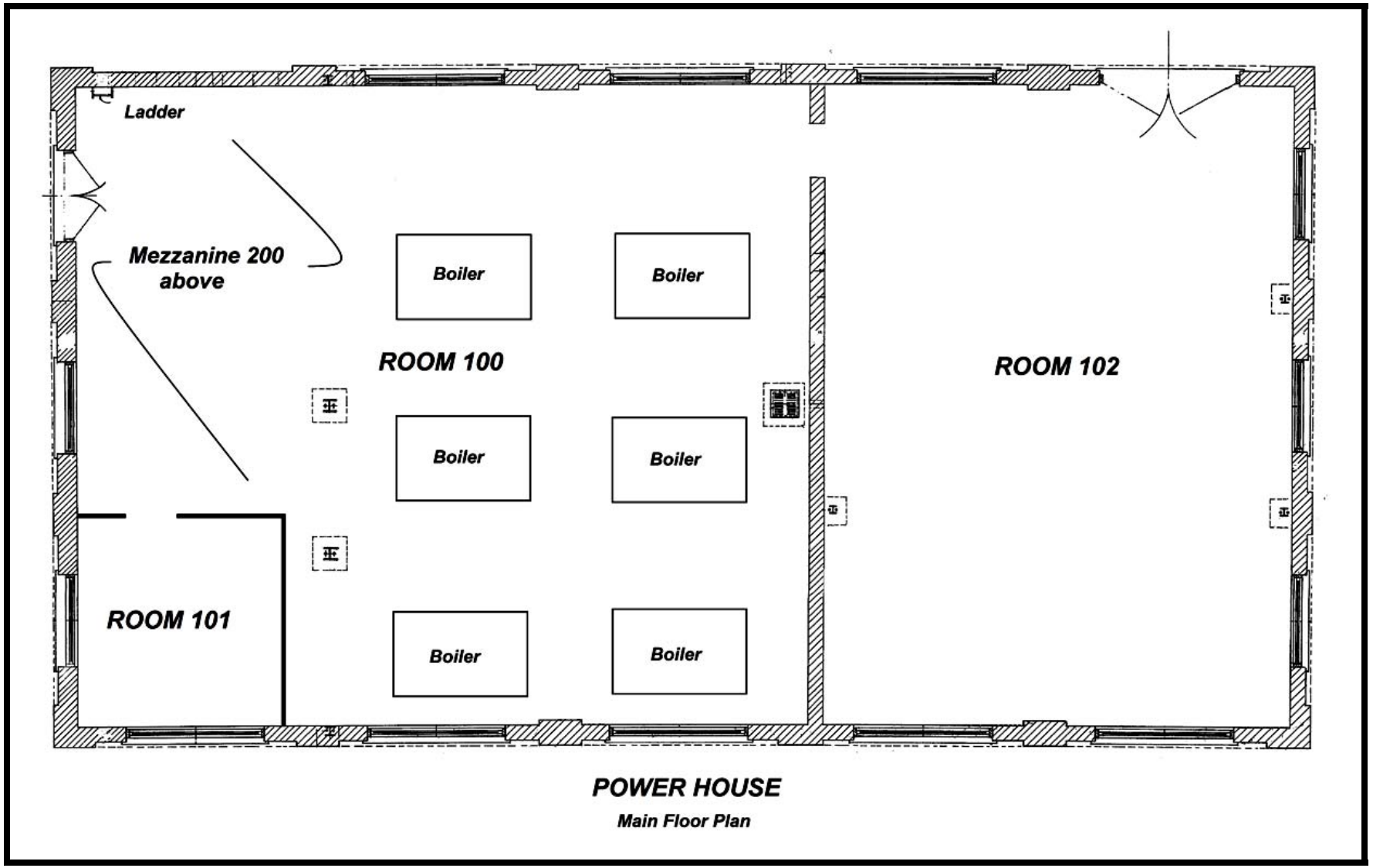
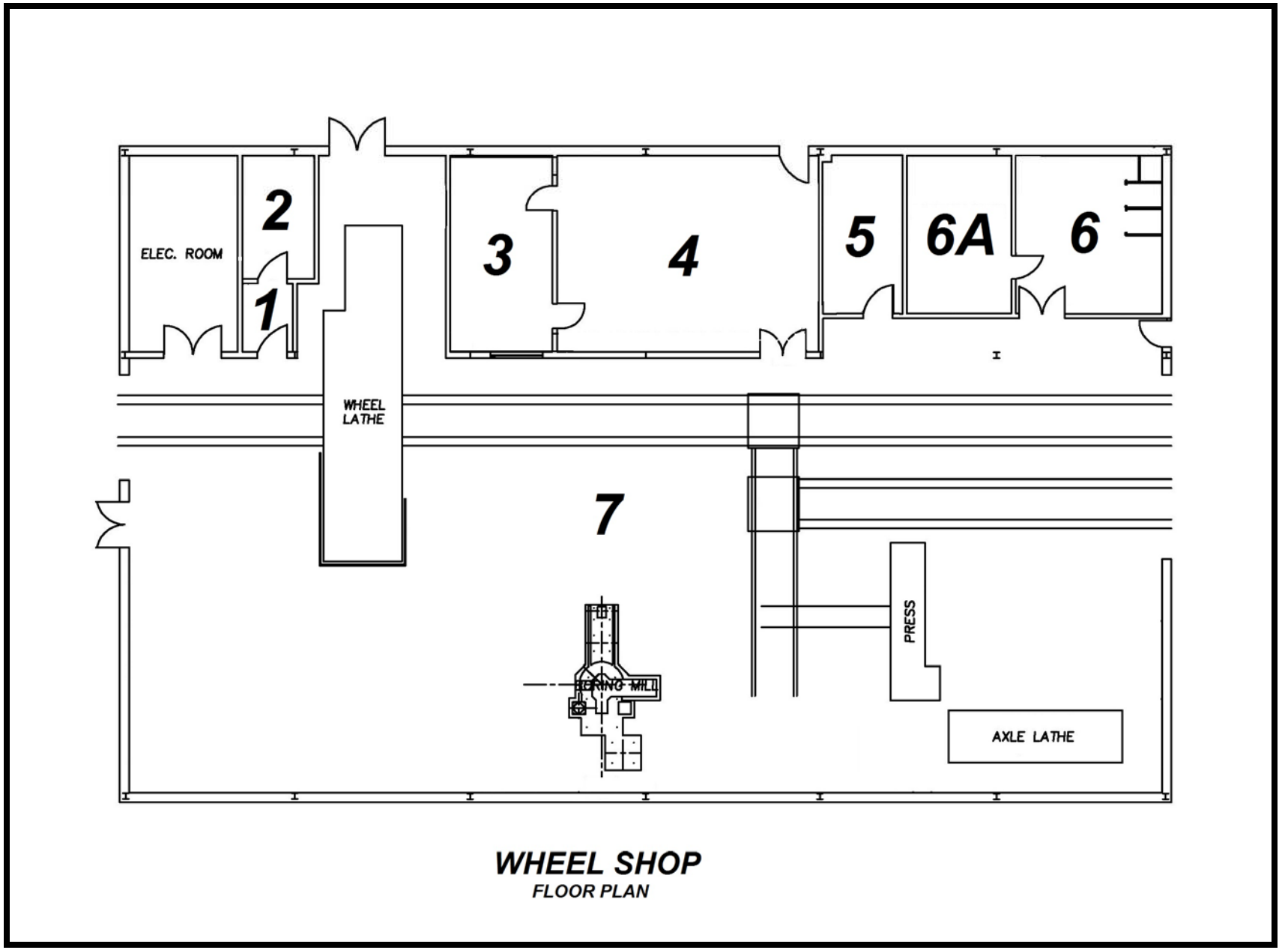
c) Estimated quantities are for guidance only and are not to be used for tendering purposes.

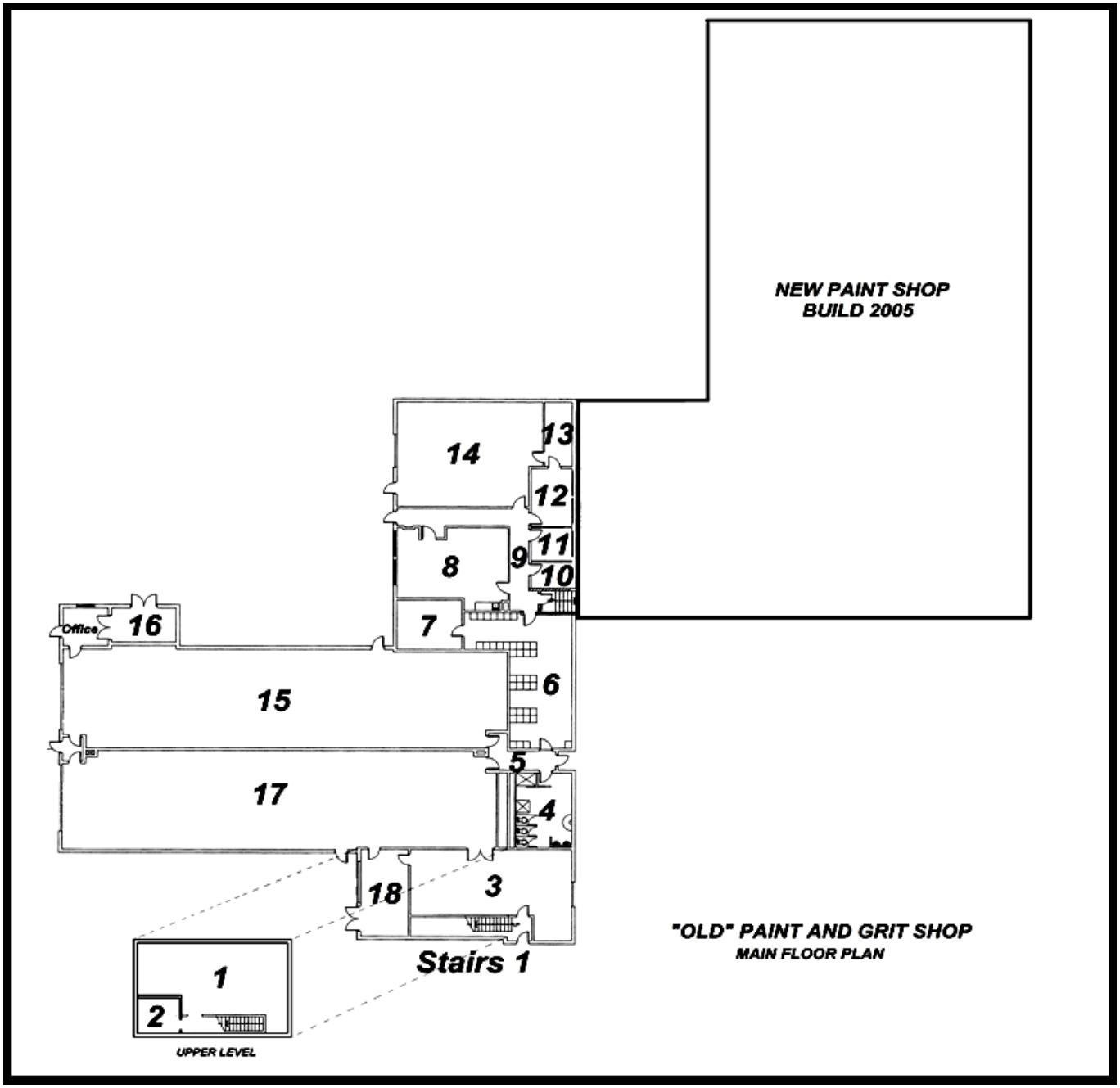
APPENDIX 'E'

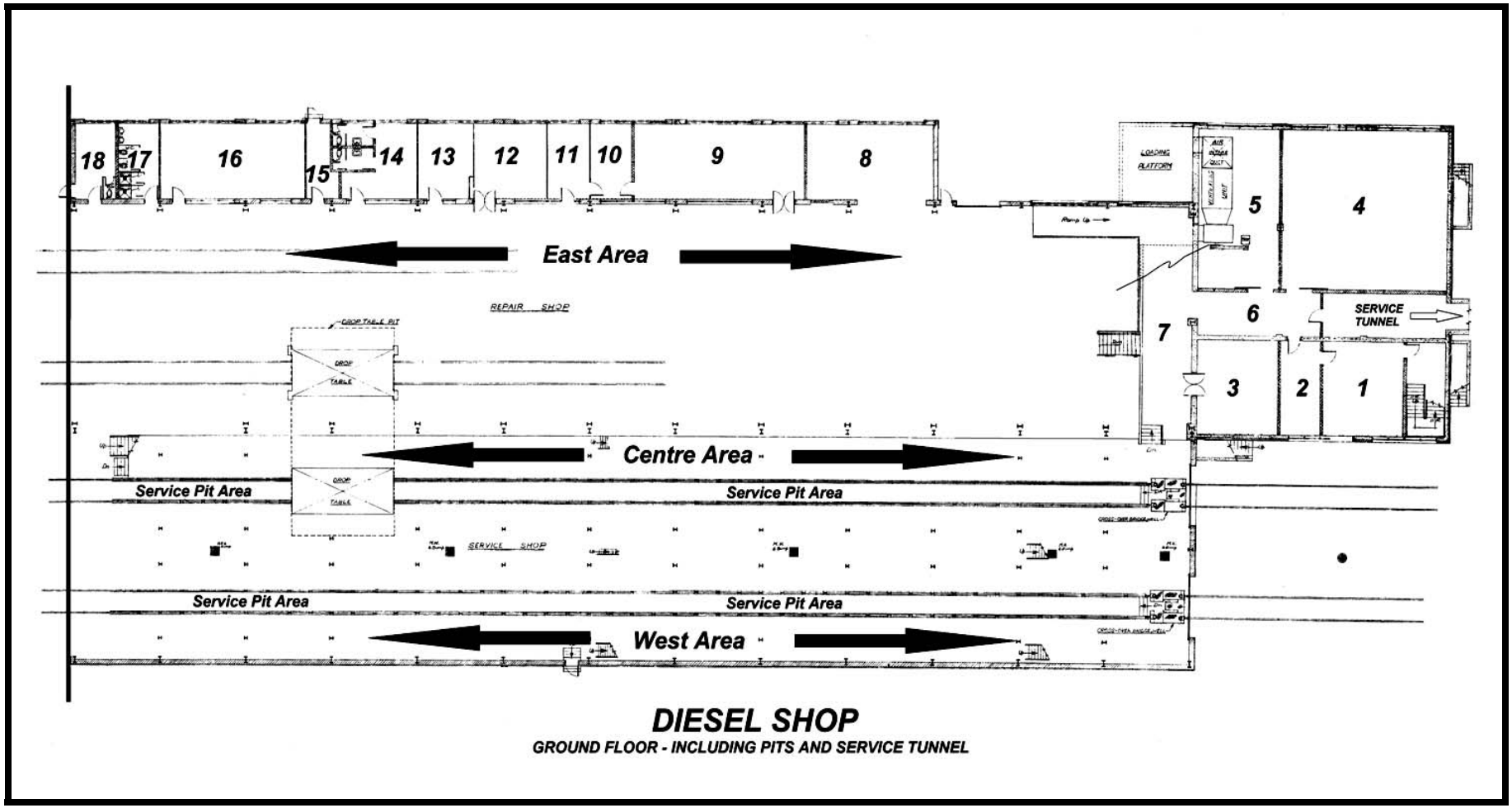
BUILDING FLOOR PLANS


Ladder
Mezzanine 200 above
Boiler
Boiler
ROOM 100
ROOM 102
Boiler
Boiler
ROOM 101
Boiler
Boiler
POWER HOUSE
Main Floor Plan



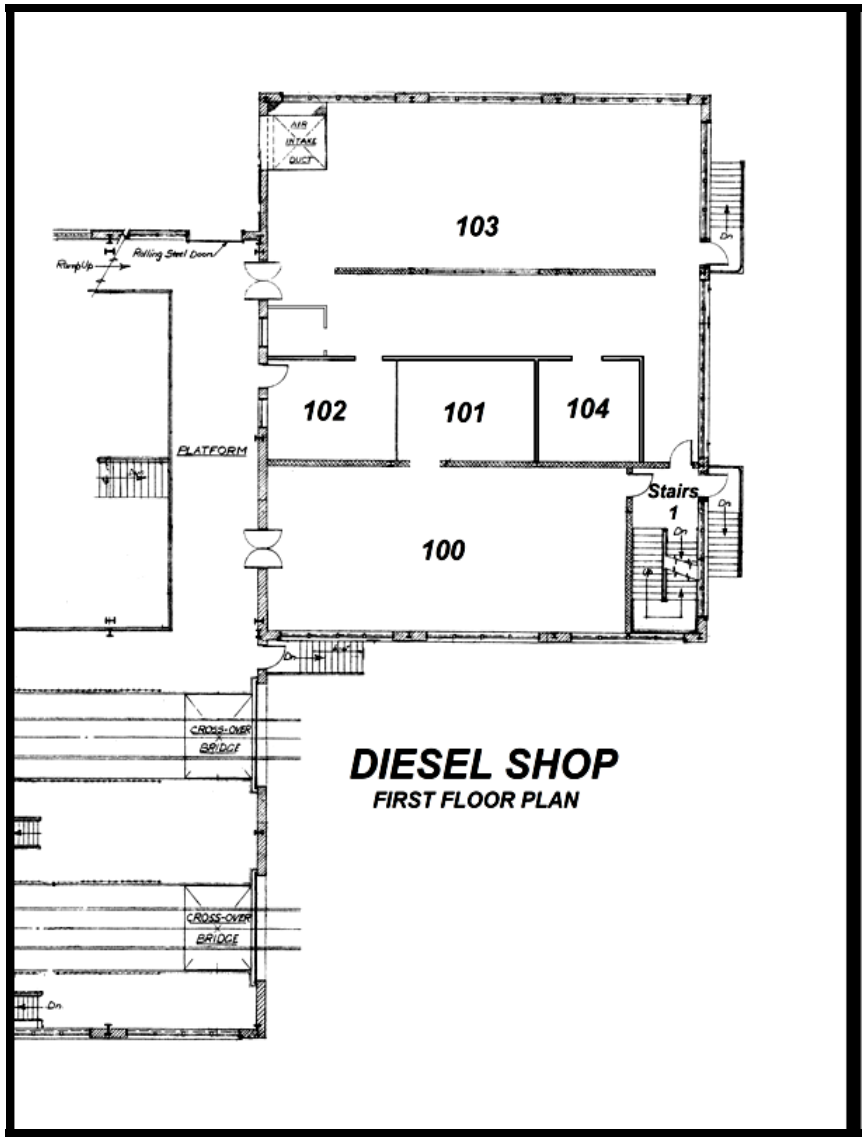
WHEEL SHOP
FLOOR PLAN

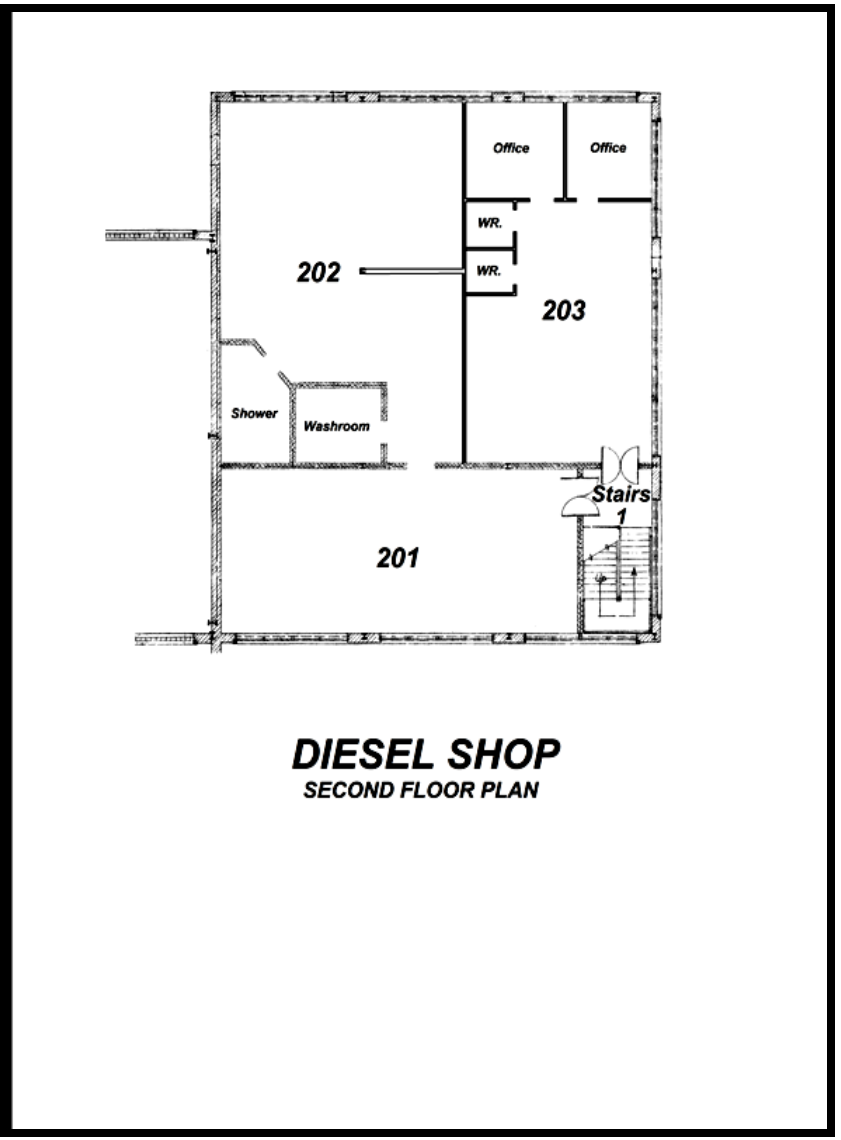

NEW PAINT SHOP
BUILD 2005
14
13
12
11
10
9
8
7
Office
16
15
6
5
17
4
18
3
Stairs 1
1
2
UPPER LEVEL
"OLD" PAINT AND GRIT SHOP
MAIN FLOOR PLAN

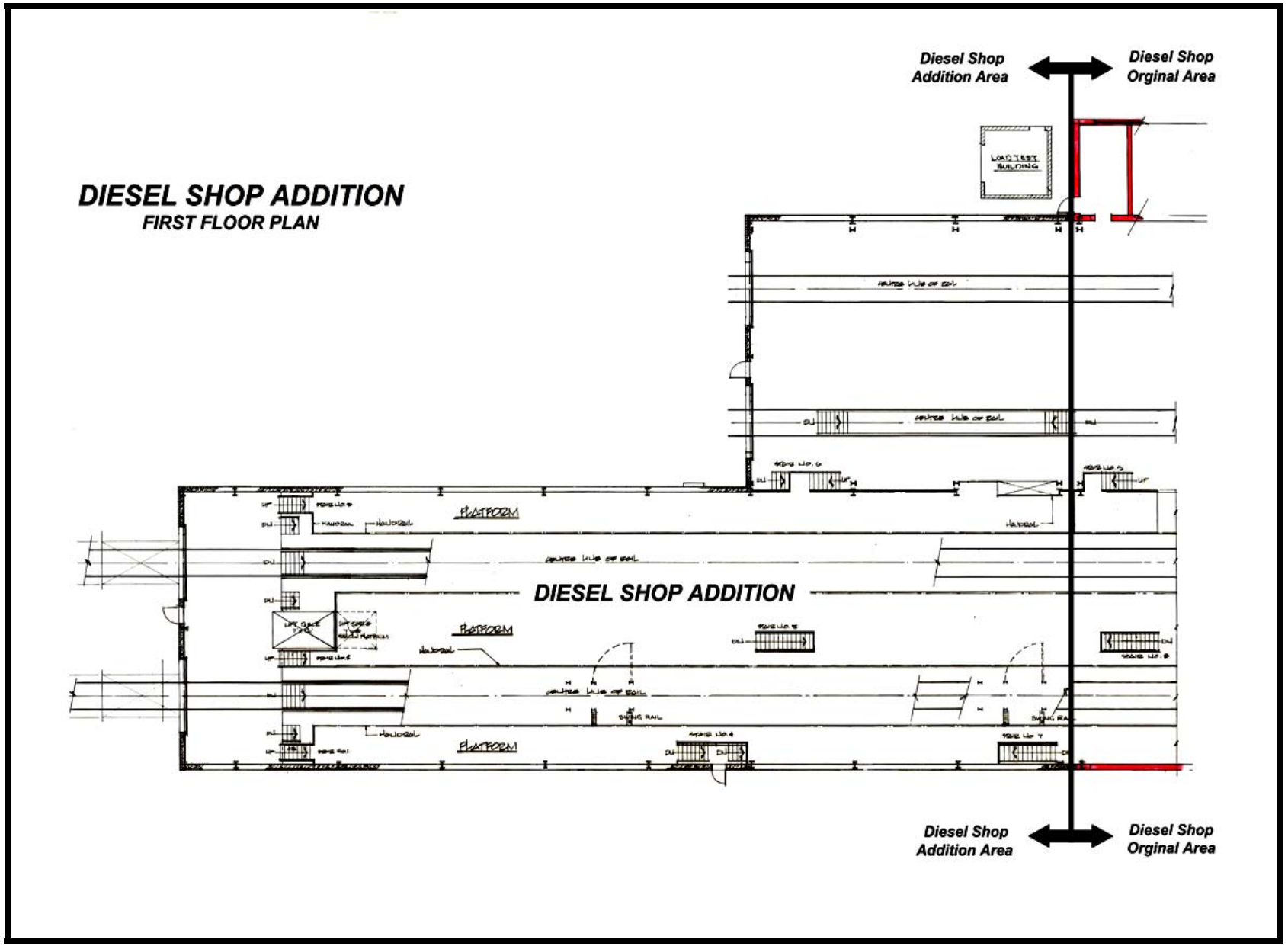


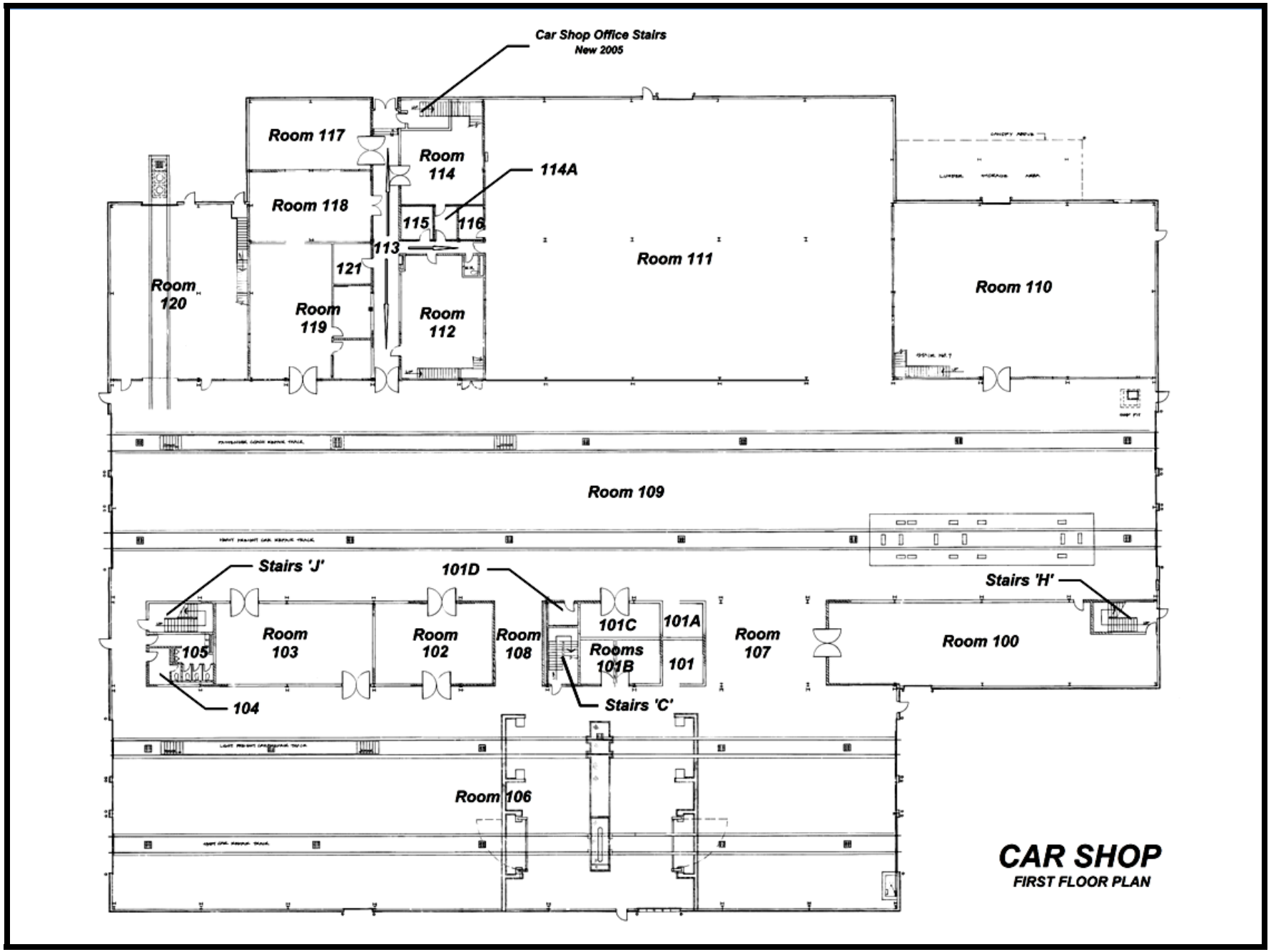
DIESEL SHOP

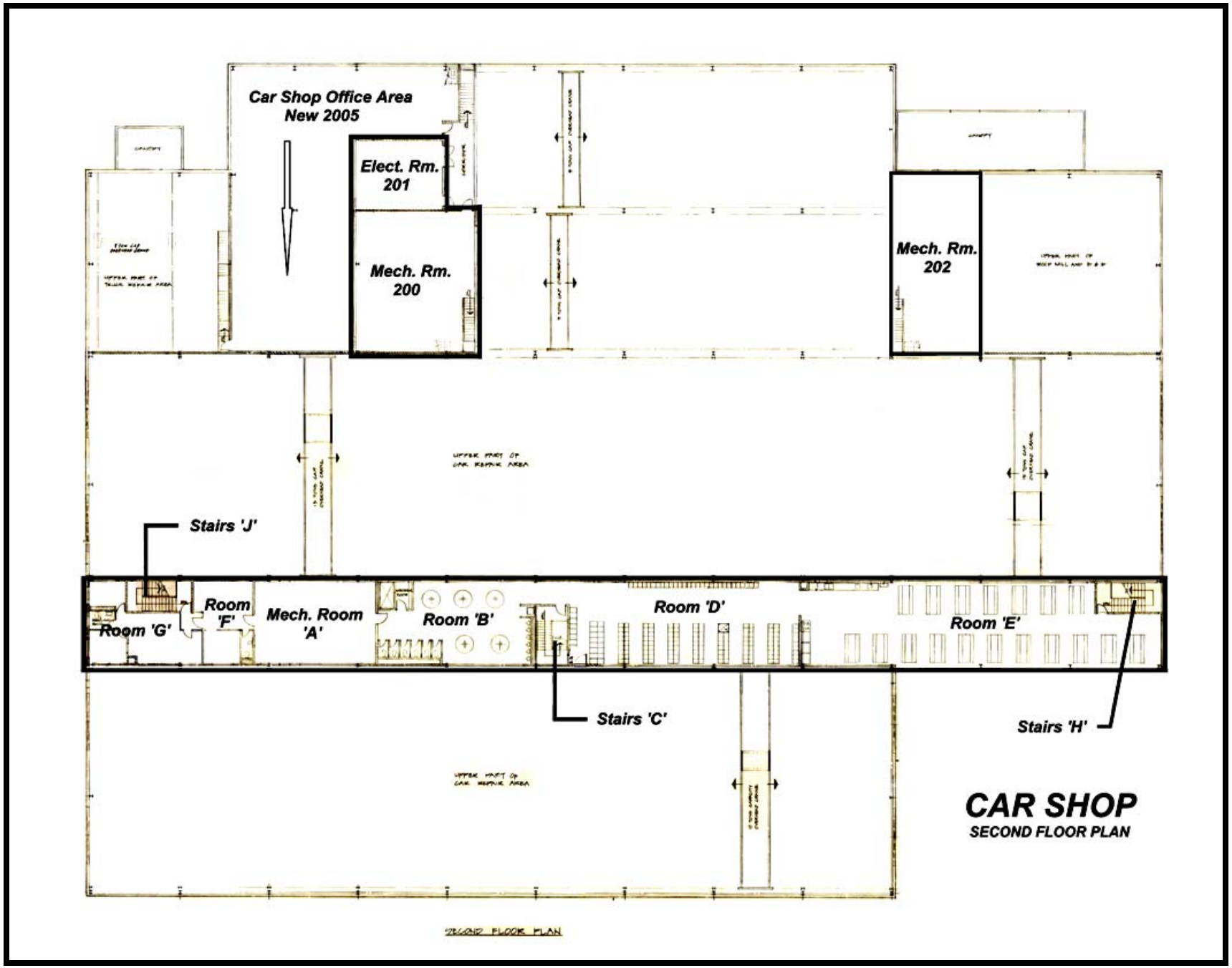
GROUND FLOOR - INCLUDING PITS AND SERVICE TUNNEL


AIR INTAKE DUCT
103
Rolling Steel Door
Ramp Up
102
101
104
PLATFORM
Stairs 1
100
CROSS-OVER BRIDGE
CROSS-OVER BRIDGE
DIESEL SHOP
FIRST FLOOR PLAN


Office
Office
WR.
WR.
202
203
Shower
Washroom
Stairs 1
201
DIESEL SHOP
SECOND FLOOR PLAN


Diesel Shop
Addition Area
Diesel Shop
Orginal Area
DIESEL SHOP ADDITION
FIRST FLOOR PLAN
LOAD TEST
BUILDING
PLATFORM
DIESEL SHOP ADDITION
PLATFORM
PLATFORM
Diesel Shop
Addition Area
Diesel Shop
Orginal Area


Car Shop Office Stairs
New 2005
Room 117
Room 114
114A
Room 118
115
116
113
121
Room 120
Room 119
Room 112
Room 111
Room 110
Room 109
Stairs 'J'
101D
Stairs 'H'
Room 103
Room 102
Room 108
101C
101A
Rooms 101B
101
Room 107
Room 100
105
104
Stairs 'C'
Room 106
CAR SHOP
FIRST FLOOR PLAN


Car Shop Office Area
New 2005
Elect. Rm.
201
Mech. Rm.
200
Mech. Rm.
202
Stairs 'J'
Room
'F'
Mech. Room
'A'
Room 'G'
Room 'B'
Room 'D'
Room 'E'
Stairs 'C'
Stairs 'H'
CAR SHOP
SECOND FLOOR PLAN

Geotechnical Investigation and Design Report

Ontario Northland Transportation Commission

Type of Document:
Report

Project Name:
ONTC Blast Bay & Store Ramp Loading Dock Rehabilitation
915 McIntyre Street
North Bay, Ontario

Project Number:
SUD-25004529-A0

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Date Submitted:
2025-04-30

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Further to our Proposal No. 25/032/GP_Rev.2, dated March 20, 2025, and your subsequent authorization to proceed, EXP Services Inc. (EXP) has completed the field investigation and geotechnical engineering evaluation for the proposed rehabilitation projects. Our comments and recommendations, based on the results of the field investigation and our understanding of the project scope, are provided in this report.

1. Introduction

It is understood by EXP that rehabilitation works are proposed at Ontario Northland Transportation Commission's (ONTC) facility located at 915 McIntyre Street in North Bay, Ontario. Proposed works include floor slab-on-grade reconstruction at the Blast Bay facility, as well as repairs to the Store Ramp Loading Dock (the dock).

In order to assist with the design of the proposed works, EXP has completed a geotechnical investigation at the site, with the results of the investigation and associated recommendations included within this report.

Recommendations have been provided for the proposed floor slab-on-grade reconstruction within the Blast Bay. For the Store Ramp Loading Dock, only factual subsurface details have been provided as it is understood that geotechnical/foundation recommendations are not required for the dock.

2. Field Investigation

The field investigation for this project consisted of four (4) sampled boreholes through the existing blast bay floor slab. Along the dock, five (5) boreholes were originally proposed, however, as coring procedures were required to penetrate encountered cobbles at Borehole BH-D3, the scope was reduced to four (4) boreholes in order to complete the project within the proposed timeframe. The boreholes were advanced on April 2 to 4, 2025 at the approximate locations shown on Dwg. Nos. A-1 and A-2, included in Appendix A. The advancement of the boreholes was supervised on a full-time basis by a geotechnical representative from EXP. The retained soil samples were logged in the field and then carefully packaged and transported to our laboratory for detailed examination and testing.

The borehole and test pit locations were laid out in the field by EXP at accessible locations, free of buried services. Private buried services, and rebar within the slab-on-grade, were cleared by RG Sutton Inspection Services. The boreholes were advanced using a trailer mounted Dietrich D25 drill rig equipped with 200 mm diameter Hollow Stem Augers (HSA). Bedrock and cobbles were cored at noted locations using NW casing and NQ core barrels.

Each borehole was advanced to refusal on suspected bedrock or cobbles at the depths shown on the attached logs, Figs. B-2 to B-9, in Appendix B. Bedrock was cored at one (1) borehole location.

Within the boreholes, Standard Penetration Tests (ASTM D1586) were completed at depths noted on the attached borehole logs in Appendix B. The Standard Penetration Test (SPT) "N" values were recorded and used to provide an assessment of the in-situ compactness condition of the encountered soils. The boreholes were backfilled with auger cuttings and sealed with bentonite. Boreholes through the existing slab-on-grade were patched using non-shrink concrete. Boreholes through asphalt surface were patched with asphalt cold patch.

The borehole locations and elevations were determined in the field using and hand-held GPS unit. For the interior boreholes within the Blast Bay, the finished floor elevation (FFE) was unknown, as such, an FFE of 100.0 m was utilized for the borehole surface elevations. Along the dock, the borehole elevations were determined using the hand-held GPS. The locations and elevations of the boreholes should be considered accurate only to the degree implied by the method used for purposes of this geotechnical report. The elevations and locations noted should not be utilized for detailed design purposes.

3. Laboratory Testing

A laboratory testing program was performed on representative soil samples and consisted of moisture content determinations and grain/particle size analyses. One Unconfined Compressive Strength (UCS) test was also completed on a representative bedrock core sample. The laboratory test results are summarized on the attached logs in Appendix B, with detailed results included in Appendix C.

4. Subsurface Conditions

Details of the soils encountered during the field investigation are summarized on the attached logs in Appendix B. The logs include textural descriptions of the subsoil and indicate the soil boundaries inferred from non-continuous sampling and observations during the field investigation. These boundaries reflect approximate transition zones for the purpose of geotechnical design and should not be interpreted as exact planes of geological change. When reading this report, the explanatory notes and definitions provided in Figures B-1A and B-1B in Appendix B should be referenced.

4.1 Blast Bay Floor (BH-1 to BH-4)

Boreholes BH-1 to BH-4 were advanced within the interior of the existing Blast Bay. Details of the boreholes are summarized on the attached borehole logs, Figs. B-2 to B-5, included in Appendix B. Borehole locations are shown on Dwg. No. A-1, included in Appendix A.

In general, the boreholes encountered the concrete slab overlying sand fill and suspected bedrock.

The concrete slab was cored at the surface of each borehole. Concrete Slab thicknesses varied at each borehole and are summarized on Table 4-1 below.

Table 4-1: Concrete Core Summary – Blast Bay Boreholes

Borehole No.	Approx. Slab Thickness (mm)
BH-1	508
BH-2	508
BH-3	330
BH-4	330

Below the concrete at each borehole, sand fill was encountered. The sand fill was brown to grey in colour, moist, and contained some gravel and some silt. Uncorrected SPT “N” values within the sand fill ranged from 8 to 9 blows per 300 mm classifying the fill as loose in compactness condition. Measured moisture contents within the fill ranged from 10.2 to 15.3%. A grain size analysis completed on a representative sample of the sand fill indicated the material generally met the gradation requirements of a Granular B Type I (OPSS 1010), however the fill contained too many fines (15.8% material passing a 75 µm sieve). As such, the sand fill is classified as a Select Subgrade Material in accordance with Ontario Provincial Standards and Specifications (OPSS) 1010.

Auger refusal on suspected bedrock was encountered at 0.7 m depth at each borehole location.

Groundwater was not encountered within the boreholes upon completion.

4.2 Store Ramp Loading Dock (BH-D1 to BH-D4)

Boreholes BH-D1 to BH-D4 were advanced along the Store Ramp Loading Dock. Details of the boreholes are summarized on the attached logs, Figs. B-6 to B-9, included in Appendix B. Borehole locations are shown on Dwg. No. A-2, included in Appendix A.

Asphalt was encountered at the surface of each borehole and was approximately 130 mm thick at Boreholes BH-D1 to BH-D3. At BH-D4, the dock was elevated above the ground surface. At this location, 15 mm of asphalt was encountered over a 265 mm thick concrete slab. Approximately 0.7 m of open space was encountered between the slab and underlying ground surface.

Fill materials were encountered below the asphalt at BH-D1 to BH-D3, and at the ground surface of BH-D4. At BH-D1, the fill materials extended to refusal on suspected bedrock at 2.0 m depth below the dock surface. At BH-D2, BH-D3, and BH-D4, the fill materials extended to 2.3 m, 2.9 m, and 4.6 m depth, respectively, below the top of the dock. The fill materials consisted of sand fill with some to and gravel and trace to some silt. The sand fill was brown to black in colour and moist to wet. Uncorrected SPT “N” values within the sand fill ranged from 6 to 38 blows per 300 mm, classifying the sand fill as loose o dense in compactness condition. Measured moisture contents within the sand fill ranged from 4.9 to 13.4%. Grain size analyses completed on representative samples of the sand fill indicated the materials generally met the gradation requirements of a Granular B Type I (OPSS 1010), however the fill contained too many fines (11.1 to 24.7% material passing a 75 µm sieve). As such, the sand fill is classified as a SSM (OPSS 1010).

Native gravelly sand was encountered below the fill materials at BH-D2 and BH-D4. At BH-D2, the gravelly sand extended to auger refusal on suspected bedrock at 2.7 m depth below the dock surface. At BH-D4, the gravelly sand extended to auger refusal on suspected cobbles at 5.8 m depth below the dock surface. The gravelly sand was rusty red, brown, and grey in colour. The soil was moist to wet. One SPT performed within the gravelly sand resulted in an uncorrected “N” value of 22 blows per 300 mm, classifying the soil as compact in compactness condition. Measured moisture contents within the gravelly sand ranged from 12.8 to 15.6%.

Cobbles were encountered below the fill materials at BH-D3 and extended to bedrock at 4.8 m depth below the dock surface. Coring procedures were utilized to penetrate the cobbles and no samples were returned.

Bedrock was cored at BH-D3 and core recovery was 100%. Water return was poor (no return). Rock Quality Designation (RQD) values ranged from 33% in the upper 1 m to 69% below, indicating a poor-quality bedrock near surface, becoming fair below. The results of UCS testing completed on a sample of the bedrock indicated a compressive strength of 200.0 MPa.

Groundwater was not encountered within the dock boreholes upon completion.

5. Blast Bay Floor Reconstruction Recommendations

In summary, the existing concrete slab-on-grade ranged in thickness from 330 to 508 mm at the borehole locations. Underlying the slab was a layer of loose sand fill with greater than 10% silt, extending to suspected bedrock at 0.7 m depth. No groundwater was encountered within the fill soils.

Based on the encountered conditions, reconstruction of the blast bay floor slab-on-grade should be relatively straight forward. If any new foundations are proposed to support equipment, the new foundations can be founded on spread footings bearing directly on the shallow suspected bedrock encountered.

5.1 Floor Slab-on-Grade Reconstruction

Prior to placing any engineered fill or concrete, the existing slab, all in-situ fill or other deleterious materials should be removed down to bedrock. Exposed bedrock surfaces are to be reviewed by EXP and should be cleaned of all loose debris and rock shatter using air hose procedures. There should be a minimum 300 mm clearance between any bedrock surface and the underside of the floor slab. Once the subgrade is prepared, all required up-fill material is to consist of Granular "A" (OPSS 1010) combined with an appropriate moisture barrier such as a polyethylene membrane, if required. All fill material below the floor slab-on-grade should be placed in maximum 150 mm thick lifts and be compacted to 100% of the SPMDD within 1.5% of the optimum moisture content.

For the floor slab-on-grade, a Modulus of Subgrade Reaction, k_{v1}, of 50 MPa/m can be used for the new engineered fill overlying bedrock. Corrections for the modulus of subgrade reaction for size and shape shall be in accordance with the Canadian Foundation Engineering Manual.

With the recommendations herein, anticipated settlements of the new slab should not exceed typical accepted limits (25 mm total, 20 mm differential).

5.2 Conventional Spread Footings on Bedrock

If any new structures are proposed within the Blast Bay, they can be founded on conventional spread footings bearing directly on bedrock. Shallow foundations bearing on sound bedrock can be designed with a factored geotechnical resistance at Ultimate Limit States (ULS) of 1.0 MPa. A geotechnical resistance factor of 0.5 has been applied to determine this value. Serviceability Limit States (SLS) design does not apply for footings bearing directly on bedrock as failure of the concrete would occur before unacceptable settlement of the foundation. For footings bearing directly on bedrock, settlements will be negligible.

The recommended geotechnical resistance above assumes that all foundation concrete is established on sound unweathered rock, which has been cleaned of all loose debris and rock shatter using air hose or water jetting procedures. Footings should be placed on fairly level bedrock (i.e. sloping less than 10° from the horizontal). In some instances, lightly loaded spread footings may be placed on bedrock sloping up to 25° to 30° from the horizontal as long as rock dowels are incorporated into the design to ensure sufficient resistance against sliding. As an alternative to levelling the bedrock surface by mechanical or blasting techniques, where the bedrock is irregular with erratic changes in profile, ledges, crevices, etc., the footing beds may be levelled by benching over these areas with mass concrete (min. 20 MPa compressive strength), anchored into the bedrock where the overall slope of the bedrock across the base of the foundation exceeds 10°. Typically, this decision is made on-site, depending on site specific bedrock conditions. Any rock dowels are to be designed by the structural engineer.

All bedrock surfaces must be reviewed by EXP prior to pouring foundation concrete. This is necessary to verify the assumed foundation bearing conditions and review the foundation construction procedures, bedrock slope, etc.

All imported backfill material used to backfill foundations should consist of Granular "A" (OPSS 1010) material placed in lifts no greater than 150 mm in thickness and must be compacted to 98% of the SPMDD. Care must be taken to ensure damage to the foundation does not occur during backfilling.

Spread footing widths must comply with the Ontario Building Code minimum requirements as applicable.

5.3 Frost Considerations

It is assumed that the interior of the existing building is heated continuously. As such, frost would not be a concern for the floor slab-on-grade. Furthermore, frost would not be a concern for shallow foundations bearing directly on bedrock.

5.4 Re-Use of Excavated Material

The in-situ fill materials met the requirements of a Select Subgrade Material (SSM) in accordance with OPSS 1010 and as such, have too high of a silt content to be reused as free draining engineered fill on this project.

As such, excavated soils will need to be disposed of off site, or can be used outside of the building for general landscaping purposes provided the environmental characterization results meet the site criteria for reuse. Excavated soils to be removed off site are considered Excess Soils and disposal of such soils should follow O.Reg. 406/19. Once the final excavation plan has been determined, and the known volume of soils to be excavated and removed off site is known, additional excess soil field studies can be completed. EXP would be pleased to complete the additional studies and provide all recommendations required.

6. Excavations

The in-situ fill and native soils may be classified as Type 3 soils for excavations terminating above the groundwater level in conformance with the Ontario Occupational Health and Safety Act (OHSA). Excavation side slopes in Type 3 soils should remain stable at a slope of 1H:1V. The need to excavate flatter side slopes if excessively wet or soft/loose materials or concentrated seepage zone are encountered, should not be overlooked. Water (i.e. surface water runoff) should not be permitted to enter and/or pond within the construction area.

Excavations must be completed so as not to undermine the foundations/slabs of existing structures. If the existing structures may be undermined by proposed excavations, temporary shoring will be required to support the existing structure. Temporary shoring design will be the responsibility of the Contractor.

All excavations must be completed in accordance with the most recent regulations in the Ontario Occupational Health and Safety Act. The contractor should be aware that slope height, slope inclination, or excavation depths, should in no case, exceed those specified in local, provincial, or federal safety regulations. Such regulations are strictly enforced and, if not followed, the owner, the contractor or earthwork or utility subcontractor could be liable for substantial penalties.

It is important to note that soils and groundwater conditions encountered in the construction excavations may vary significantly across the site. Our preliminary soil classifications are based solely on the materials encountered in widely spaced explorations. The contractor should verify that similar conditions exist throughout the proposed area of excavation prior to construction. If different subsurface conditions are encountered at the time of construction, we recommend that EXP be contacted immediately to evaluate the conditions encountered.

7. Dewatering

Groundwater was not encountered within the boreholes upon completion. As such, significant dewatering is not anticipated. Any potential perched groundwater should be possible to remove using conventional construction pumps.

Dewatering requirements will be governed by the time of the year the construction is performed. It is the responsibility of the Contractor to propose a suitable dewatering system based on the time of construction and groundwater levels. The method used should not undermine any adjacent structures or buried services. The dewatering method is the responsibility of the Contractor and the Contractor should submit his proposal to the Prime Consultant for review and approval prior to construction.

8. Construction Constraints Under Cold Weather Conditions

For all construction activities at this site, the following applies:

- During excavations, all subgrade soils must be maintained at a minimum temperature of 5° C.
- No granular material may be placed under frozen conditions, with all fill material maintained at a minimum temperature of 5° C prior to and during installation.
- Soils and granular fill material that are in direct contact with fresh concrete must be at a minimum temperature of 5° C prior to pouring the concrete and must be free of snow and ice fragments.
- All granular fill, prior to placement of concrete, must be reviewed by this office to ensure that it is free of frost, buried ice and snow.
- All reinforcing steel in the concrete forms must be free of ice and snow, and must be maintained at a minimum temperature of 5° C.
- During the placement of concrete in cold weather conditions, a field cured cylinder should be placed beside the heated form for a period of 6 days. The field cured cylinder should be returned to a designated laboratory on the sixth day for 7-day compressive strength testing.
- All heated and tarped areas should be monitored for temperature using a max/min thermometer.
- All concrete is to have a minimum of 6% to 8% air entrainment to prevent cracking and shall be maintained at a minimum temperature of 10° C for a period of 4 to 7 days.

The 6% to 8% air entrained concrete during cold weather placement is to prevent significant strength loss of concrete as a result of freezing and thawing. The air entrainment will provide the capacity to absorb stresses during freeze/thaw action.

9. Construction Quality Control

Construction quality control of the “earthworks” should be provided throughout the project by a representative of EXP to verify all design assumptions, recommendations and confirmation of the subsurface soil conditions. This includes inspection of the excavation and subgrade prior to the placement of any structural fill and foundations, to ensure that any and all deleterious materials have been removed and to ensure that the actual conditions are not markedly different from those on which the recommendations made herein are based. Compaction control of structural fill is also recommended as standard practice, as is sampling and testing of aggregates and concrete.

10. Design Review

The recommendations made in this report are in accordance with our present understanding of the project and are provided solely for the design team responsible for the project. If there are any changes, such as relocation of any structures or other features which may affect our analysis, the information obtained during this investigation may be inadequate and additional field work and reporting may be required.

EXP Services Inc. should be retained to review the final design and specifications to confirm that we are in general agreement with the assumptions on which our recommendations are based. If not accorded the privilege of making this review, EXP Services Inc. will assume no responsibility for interpretation of the recommendations in this report.

11. Limitations

A subsurface investigation is a limited sampling of a site. Should any conditions at the site be encountered that differ from those reported at the test locations, we require that we be notified immediately in order to allow reassessment of our recommendations.

Whereas this investigation has estimated the groundwater level at the time of the fieldwork, and commented on general construction problems, the presence of conditions, which would be difficult to establish from our test holes, may affect the type and nature of dewatering procedures which should be used in practice. These conditions include local and seasonal fluctuations in the groundwater table, erratic changes in the soil profile between the tests, and thin layers of soil with large or small permeabilities compared with the general soil mass, etc.

The comments given in this report are intended only for the guidance of the design team responsible for the project. The number of test holes required to determine the localized underground conditions between test holes affecting construction costs, techniques, sequencing, equipment, scheduling, etc. could be greater than has been carried out for preliminary design purposes. Contractors bidding on or undertaking the works should, in this light, decide on their own investigations, as well as their own interpretations of the factual test hole results, so that they may draw their own conclusions as to how the subsurface conditions may affect them.

The investigation and comments are necessarily ongoing as new information of underground conditions becomes available. For example, more specific information is available with respect to in-situ subsurface conditions between test locations once construction is underway. Subsurface soil interpretation between test holes, as well as the recommendations of this report, should be verified through field inspections provided by EXP to validate the current information for use during the construction stage.

Virtually no scope of work, no matter how exhaustive, can identify all contaminants or all conditions above or below ground. For example, conditions elsewhere on the property may differ from those encountered, and conditions may change with time. Therefore, no warranty is provided that the entire site condition is represented by those identified at specific borehole locations.

This report in no way reflects any on-site environmental considerations.

12. Closure

We trust that these comments provide you with sufficient information to proceed with design. Should you have any questions, please do not hesitate to contact this office.

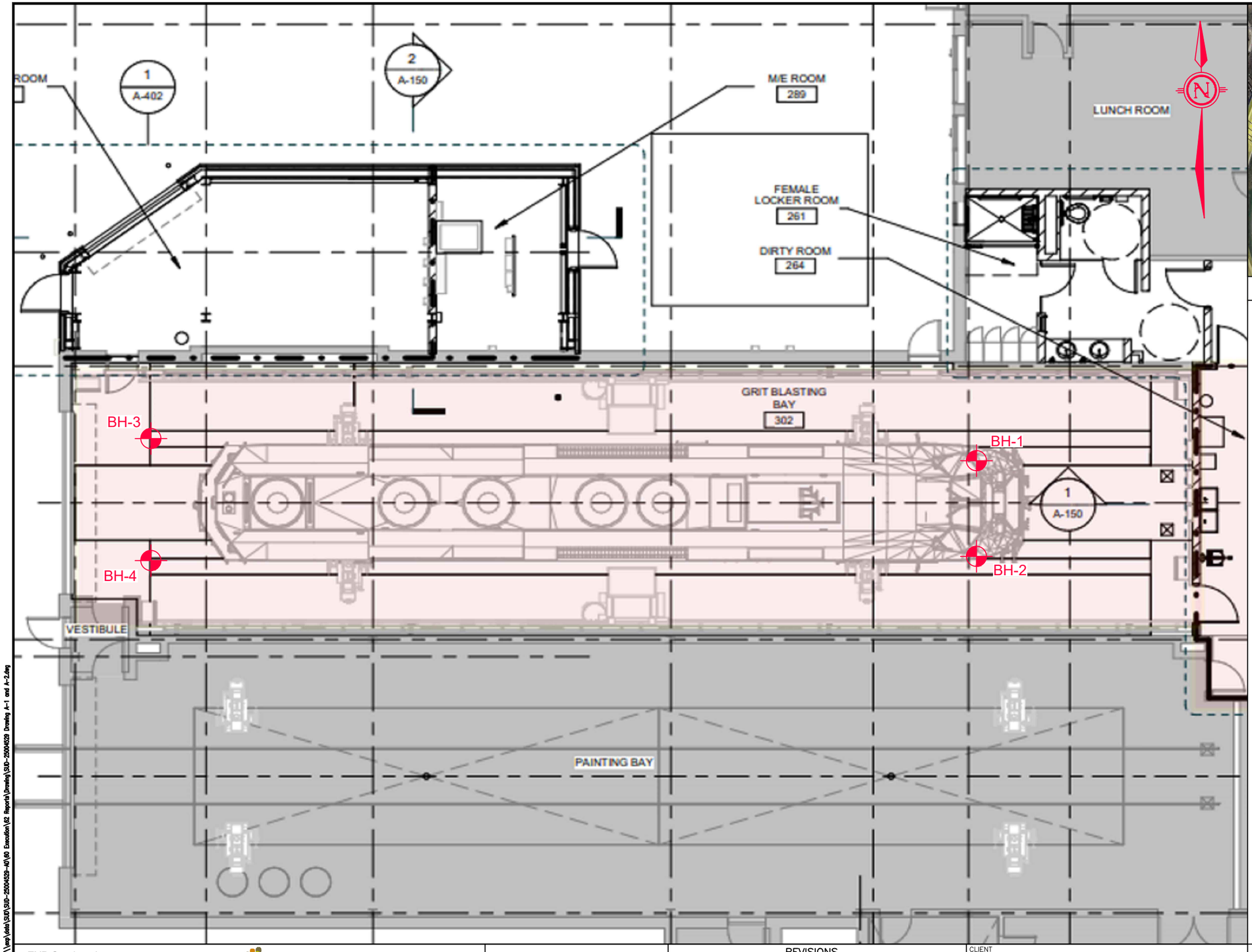
Yours truly,

EXP Services Inc.

Ian MacMillan, P.Eng.
Project Manager, Earth & Environmental Services
Northeastern Ontario Northeastern Ontario

Yves Beauparlant, P.Eng.
Manager, Earth & Environmental Services
Northeastern Ontario

Appendix A – Drawings



KEYPLAN - N.T.S.

LEGEND

EXP BOREHOLE

— NOTES —

1) The boundaries and soil types have been established only at Test Hole locations. Between Test Holes, they are assumed and may be subject to considerable error.
2) Do not use Test Hole elevations for design purposes.
3) Soil samples will be retained in storage for 3 month and then destroyed unless client advises that an extended time period is required.
4) Quantities should not be established from the information provided at the Test Hole locations.
5) This drawing forms part of the report, project number as referenced, and should be used only in conjunction with this report.

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REVISIONS

No.	DESCRIPTION	DATE

CLIENT: ONTARIO NORTHLAND TRANSPORTATION COMMISSION

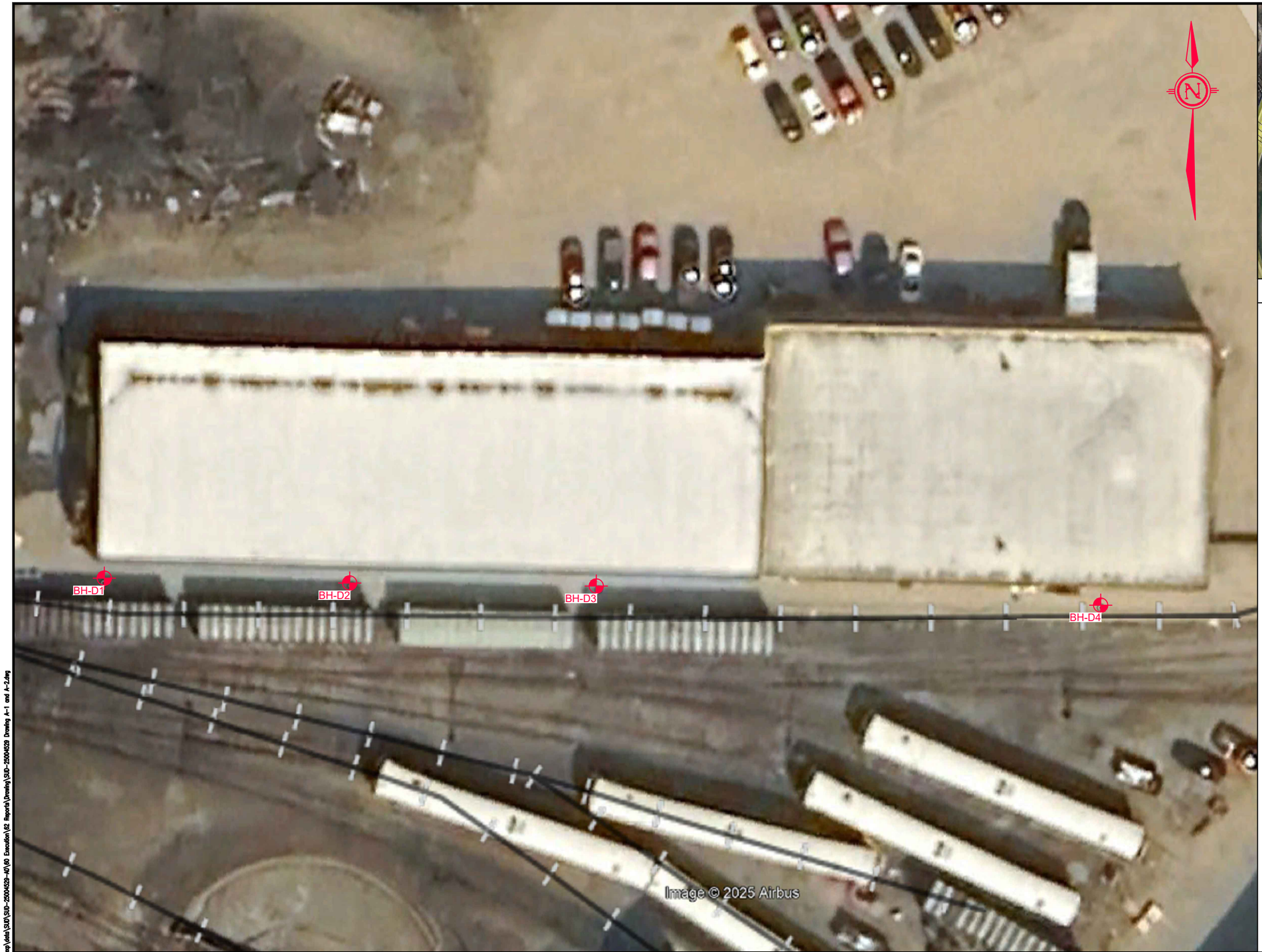
PROJECT: BLAST BAY & STORE RAMP LOADING DOCK
915 MCINTYRE STREET, NORTH BAY, ONTARIO

PROJECT NO.: SUD-25004529-A0

TITLE: BOREHOLE LOCATION PLAN
BLAST BAY

DATE	SCALE:	DWG NO.
APRIL 2025	NTS	A-1

Apr 30, 2025 - 10:10am \\exp.local\SUD\SUD-25004529-A0\60 Execution\62 Reports\Drawing\SUD-25004529 Drawing A-1 and A-2.dwg



KEYPLAN - N.T.S.

LEGEND

EXP BOREHOLE

— NOTES —

1) The boundaries and soil types have been established only at Test Hole locations. Between Test Holes, they are assumed and may be subject to considerable error.
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3) Soil samples will be retained in storage for 3 month and then destroyed unless client advises that an extended time period is required.
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REVISIONS		
No.	DESCRIPTION	DATE

CLIENT: ONTARIO NORTHLAND TRANSPORTATION COMMISSION

PROJECT: BLAST BAY & STORE RAMP LOADING DOCK
915 MCINTYRE STREET, NORTH BAY, ONTARIO

PROJECT NO.: SUD-25004529-A0

TITLE: BOREHOLE LOCATION PLAN
STORE RAMP LOADING DOCK

DATE	SCALE:	DWG NO.
APRIL 2025	NTS	A-2

Apr 30, 2025 - 10:11am \\exp\data\SUD\SUD-25004529-A0\60 Execution\62 Reports\Drawing\SUD-25004529 Drawing A-1 and A-2.dwg

Appendix B – Borehole Logs

Notes on Sample Descriptions

1. All sample descriptions included in this report follow the International Society for Soil Mechanics and Foundation Engineering (ISSMFE), as outlined in the Canadian Foundation Engineering Manual. Note, however, that behavioral properties (i.e. plasticity, permeability) take precedence over particle gradation when classifying soil. Please note that, with the exception of those samples where a grain size analysis has been made, all samples are classified visually. Visual classification is not sufficiently accurate to provide exact grain sizing or precise differentiation between size classification systems.

UNIFIED SOIL CLASSIFICATION

CLAY (PLASTIC) TO	FINE	MEDIUM	CRS.	FINE	COARSE
SILT (NONPLASTIC)	SAND			GRAVEL	

EQUIVALENT GRAIN DIAMETER IN MILLIMETRES

ISSMFE SOIL CLASSIFICATION

CLAY	SILT			SAND			GRAVEL			COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE		

2. Fill: Where fill is designated on the borehole log it is defined as indicated by the sample recovered during the boring process. The reader is cautioned that fills are heterogeneous in nature and variable in density or degree of compaction. The borehole description may therefore not be applicable as a general description of site fill materials. All fills should be expected to contain obstruction such as wood, large concrete pieces or subsurface basements, floors, tanks, etc., none of these may have been encountered in the boreholes. Since boreholes cannot accurately define the contents of the fill, test pits are recommended to provide supplementary information. Despite the use of test pits, the heterogeneous nature of fill will leave some ambiguity as to the exact composition of the fill. Most fills contain pockets, seams, or layers of organically contaminated soil. This organic material can result in the generation of methane gas and/or significant ongoing and future settlements. Fill at this site may have been monitored for the presence of methane gas and, if so, the results are given on the borehole logs. The monitoring process does not indicate the volume of gas that can be potentially generated nor does it pinpoint the source of the gas. These readings are to advise of the presence of gas only, and a detailed study is recommended for sites where any explosive gas/methane is detected. Some fill material may be contaminated by toxic/hazardous waste that renders it unacceptable for deposition in any but designated land fill sites; unless specifically stated the fill on this site has not been tested for contaminants that may be considered toxic or hazardous. This testing and a potential hazard study can be undertaken if requested. In most residential/commercial areas undergoing reconstruction, buried oil tanks are common and are generally not detected in a conventional geotechnical site investigation.

3. Till: The term till on the borehole logs indicates that the material originates from a geological process associated with glaciation. Because of this geological process the till must be considered heterogeneous in composition and as such may contain pockets and/or seams of material such as sand, gravel, silt or clay. Till often contains cobbles (75 to 200 mm) or boulders (over 200 mm). Contractors may therefore encounter cobbles and boulders during excavation, even if they are not indicated by the borings. It should be appreciated that normal sampling equipment cannot differentiate the size or type of any obstruction. Because of the horizontal and vertical variability of till, the sample description may be applicable to a very limited zone; caution is therefore essential when dealing with sensitive excavations or dewatering programs in till materials.

Notes On Soil Descriptions

4. The following table gives a description of the soil based on particle sizes. With the exception of those samples where grain size analyses have been performed, all samples are classified visually. The accuracy of visual examination is not sufficient to differentiate between this classification system or exact grain size.

Soil Classification		Terminology	Proportion
Clay and Silt	<0.060 mm	"trace" (e.g. Trace sand)	1% to 10%
Sand	0.060 to 2.0 mm	"some" (e.g. Some sand)	10% to 20%
Gravel	2.0 to 75 mm	adjective (e.g. sandy, silty)	20% to 35%
Cobbles	75 to 200 mm	"and" (e.g. and sand)	35% to 50%
Boulders	>200 mm		

The compactness of Cohesionless soils and the consistency of the cohesive soils are defined by the following:

Cohesionless Soil		Cohesive Soil		
Compactness	**Standard Penetration Resistance "N" Blows / 0.3 m**	**Consistency**	**Undrained Shear Strength (kPa)**	**Standard Penetration Resistance "N" Blows / 0.3 m**
Very Loose	0 to 4	Very soft	<12	<2
Loose	4 to 10	Soft	12 to 25	2 to 4
Compact	10 to 30	Firm	25 to 50	4 to 8
Dense	30 to 50	Stiff	50 to 100	8 to 15
Very Dense	Over 50	Very Stiff	100 to 200	15 to 30
		Hard	>200	>30

5. **ROCK CORING**

Where rock drilling was carried out, the term RQD (Rock Quality Designation) is used. The RQD is an indirect measure of the number of fractures and soundless of the rock mass. It is obtained from the rock cores by summing the length of the core covered, counting only those pieces of sound core that are 100 mm or more length. The RQD value is expressed as a percentage and is the ratio of the summed core lengths to the total length of core run. The classification based on the RQD value is given below.

RQD Classification	RQD (%)
Very Poor Quality	<25
Poor Quality	25 to 50
Fair Quality	50 to 75
Good Quality	75 to 90
Excellent Quality	90 to 100

$$\text{Recovery Designation \% Recovery} = \frac{\text{Length of Core Per Run}}{\text{Total Length of Run}} \times 100$$

Log of Borehole BH-1

Project No. SUD-25004529-A0 | Figure No. B-2

Project: ONTC Blast Bay & Store Ramp Loading Dock Rehabilitation | Sheet No. 1 of 1

Location: 915 McIntyre Street, North Bay, Ontario

Blast Bay Interior

Date Drilled: April 2, 2025

Drill Type: Diedrich D-25 Trailer Mount

Datum: Non-Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH	N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Sample Number
		CONCRETE, ~508 mm thick	100.00	0				
			99.5					
		FILL, sand, some gravel, some silt, brown to grey, moist, loose	99.3				SS1	
		BOREHOLE TERMINATED AT ~0.7 m DEPTH DUE TO AUGER REFUSAL ON SUSPECTED BEDROCK						

N Value: 20 40 60 80
Shear Strength kPa: 50 100
Combustible Vapour Reading (ppm): 25 50 75
Natural Moisture Content % / Atterberg Limits (% Dry Weight): 10 20 30

SUDBURY GEO SUD-25004529-A0 - ONTC BLAST BAY AND DOCKS.GPJ NEW.GDT 4/30/25

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Borehole data requires interpretation assistance from EXP before use by others.

See Figures B-1A and B-1B for Notes on Sample Description

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	Dry	Open

Log of Borehole BH-2

Project No. SUD-25004529-A0 | Figure No. B-4

Project: ONTC Blast Bay & Store Ramp Loading Dock Rehabilitation | Sheet No. 1 of 1

Location: 915 McIntyre Street, North Bay, Ontario

Blast Bay Interior

Date Drilled: April 2, 2025

Drill Type: Diedrich D-25 Trailer Mount

Datum: Non-Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH	N Value / Shear Strength (kPa)	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Sample Number
		CONCRETE, ~508 mm thick	100.00	0				
		FILL, sand, some gravel, some silt, brown to grey, moist, loose	99.5				SS1	SS1
		BOREHOLE TERMINATED AT ~0.7 m DEPTH DUE TO AUGER REFUSAL ON SUSPECTED BEDROCK	99.3					

N Value: 20 40 60 80 | Shear Strength: 50 100 kPa

Combustible Vapour Reading (ppm): 25 50 75 | Natural Moisture Content % / Atterberg Limits (% Dry Weight): 10 20 30

SUDBURY GEO SUD-25004529-A0 - ONTC BLAST BAY AND DOCKS.GPJ NEW.GDT 4/30/25

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See Figures B-1A and B-1B for Notes on Sample Description

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	Dry	Open

Log of Borehole BH-3

Project No. SUD-25004529-A0 | Figure No. B-5

Project: ONTC Blast Bay & Store Ramp Loading Dock Rehabilitation | Sheet No. 1 of 1

Location: 915 McIntyre Street, North Bay, Ontario

Blast Bay Interior

Date Drilled: April 2, 2025

Drill Type: Diedrich D-25 Trailer Mount

Datum: Non-Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH	N Value / Shear Strength (kPa)	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Sample Number
		CONCRETE, ~330 mm thick	100.00	0				
		FILL, sand, some gravel, some silt, brown, moist, loose	99.7		9		SS1	
		BOREHOLE TERMINATED AT ~0.7 m DEPTH DUE TO AUGER REFUSAL ON SUSPECTED BEDROCK	99.3					

N Value: 20 40 60 80
Shear Strength: 50 100 kPa
Combustible Vapour Reading (ppm): 25 50 75
Natural Moisture Content % / Atterberg Limits (% Dry Weight): 10 20 30

SUDBURY GEO SUD-25004529-A0 - ONTC BLAST BAY AND DOCKS.GPJ NEW.GDT 4/30/25

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Borehole data requires interpretation assistance from EXP before use by others.

See Figures B-1A and B-1B for Notes on Sample Description

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	Dry	Open

Log of Borehole BH-4

Project No. SUD-25004529-A0 | Figure No. B-3

Project: ONTC Blast Bay & Store Ramp Loading Dock Rehabilitation | Sheet No. 1 of 1

Location: 915 McIntyre Street, North Bay, Ontario

Blast Bay Interior

Date Drilled: April 2, 2025

Drill Type: Diedrich D-25 Trailer Mount

Datum: Non-Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH	N Value / Shear Strength (kPa)	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Sample Number
		CONCRETE, ~330 mm thick	100.00	0				
		FILL, sand, some gravel, some silt, brown, moist, loose	99.7		8		SS1	
		BOREHOLE TERMINATED AT ~0.7 m DEPTH DUE TO AUGER REFUSAL ON SUSPECTED BEDROCK	99.3					

N Value: 20 40 60 80
Shear Strength: 50 100 kPa
Combustible Vapour Reading (ppm): 25 50 75
Natural Moisture Content % / Atterberg Limits (% Dry Weight): 10 20 30

SUDBURY GEO SUD-25004529-A0 - ONTC BLAST BAY AND DOCKS.GPJ NEW.GDT 4/30/25

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Borehole data requires interpretation assistance from EXP before use by others.

See Figures B-1A and B-1B for Notes on Sample Description

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	Dry	Open

Log of Borehole BH-D1

Project No. SUD-25004529-A0 | Figure No. B-6

Project: ONTC Blast Bay & Store Ramp Loading Dock Rehabilitation | Sheet No. 1 of 1

Location: 915 McIntyre Street, North Bay, Ontario

5128490 m N, 619011 m E

Date Drilled: April 3, 2025

Drill Type: Diedrich D-25 Trailer Mount

Datum: Non-Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH	N Value / Shear Strength (kPa)	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Sample Number
		ASPHALT, ~130 mm thick	204.00	0				
		FILL, sand, some gravel, trace silt, brown, moist	203.9					
		FILL, gravelly sand, some silt, brown, moist to wet, loose to dense	203.2	1	6, 38			AS1, SS2, SS3
		BOREHOLE TERMINATED AT ~2.0 m DEPTH DUE TO AUGER REFUSAL ON SUSPECTED BEDROCK	202.0					

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Borehole data requires interpretation assistance from EXP before use by others.

See Figures B-1A and B-1B for Notes on Sample Description

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	Dry	Open

Log of Borehole BH-D2

Project No. SUD-25004529-A0 | Figure No. B-7

Project: ONTC Blast Bay & Store Ramp Loading Dock Rehabilitation | Sheet No. 1 of 1

Location: 915 McIntyre Street, North Bay, Ontario

5128490 m N, 619033 m E

Date Drilled: April 3, 2025

Drill Type: Diedrich D-25 Trailer Mount

Datum: Non-Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH
		ASPHALT, ~130 mm thick	204.00	0
		FILL, sand and gravel, trace silt, brown, moist	203.9	
		FILL, sand, some gravel, some silt, brown and black, moist to wet, loose to compact	203.7	
		GRAVELLY SAND, some silt, rusty red to brown, moist to wet, compact	201.7	
		BOREHOLE TERMINATED AT ~2.7 m DEPTH DUE TO AUGER REFUSAL ON SUSPECTED BEDROCK	201.3	2

N Value (20, 40, 60, 80) — Shear Strength (50, 100 kPa)

Combustible Vapour Reading (ppm) (25, 50, 75) — Natural Moisture Content % Atterberg Limits (% Dry Weight) (10, 20, 30)

SAMPLES	Sample Number	N Value
	AS1	
	SS2	7
	SS3	15
	SS4	100

SUDBURY GEO SUD-25004529-A0 - ONTC BLAST BAY AND DOCKS.GPJ NEW.GDT 4/30/25

EXP Services Inc.
885 Regent Street
Sudbury, ON P3E 5M4
CANADA
t: +1.705.674.9681
f: +1.705.674.5583

Borehole data requires interpretation assistance from EXP before use by others.

See Figures B-1A and B-1B for Notes on Sample Description

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	Dry	Open

Log of Borehole BH-D3

Project No. SUD-25004529-A0 | Figure No. B-8

Project: ONTC Blast Bay & Store Ramp Loading Dock Rehabilitation | Sheet No. 1 of 1

Location: 915 McIntyre Street, North Bay, Ontario

5128490 m N, 619055 m E

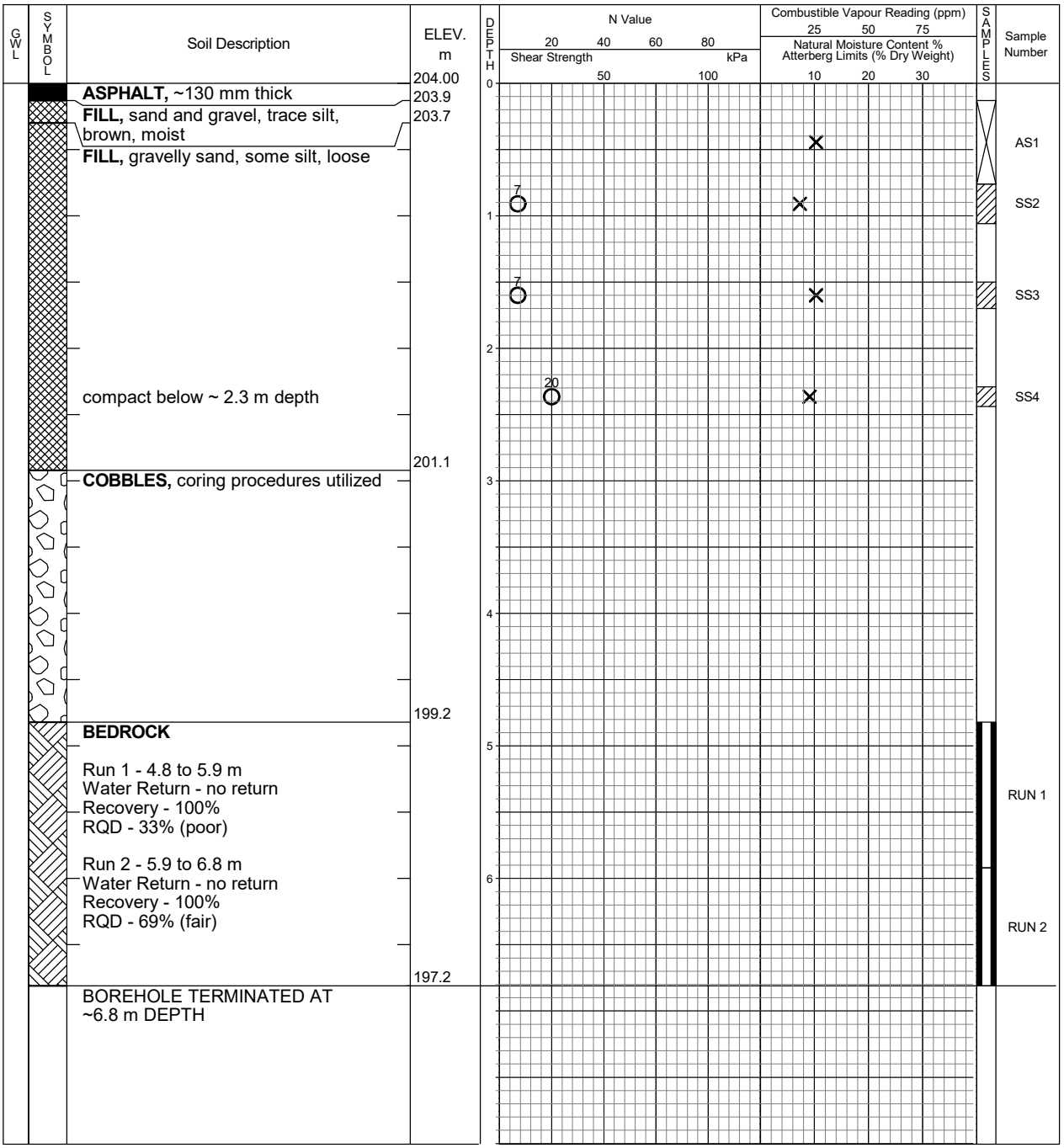
Date Drilled: April 3, 4, 2025

Drill Type: Diedrich D-25 Trailer Mount

Datum: Non-Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer



SUDBURY GEO SUD-25004529-A0 - ONTC BLAST BAY AND DOCKS.GPJ NEW.GDT 4/30/25

EXP Services Inc.
885 Regent Street
Sudbury, ON P3E 5M4
CANADA
t: +1.705.674.9681
f: +1.705.674.5583

Borehole data requires interpretation assistance from EXP before use by others.

See Figures B-1A and B-1B for Notes on Sample Description

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	N/A	N/A

Log of Borehole BH-D4

Project No. SUD-25004529-A0 | Figure No. B-9

Project: ONTC Blast Bay & Store Ramp Loading Dock Rehabilitation | Sheet No. 1 of 1

Location: 915 McIntyre Street, North Bay, Ontario

5128486 m N, 619099 m E

Date Drilled: April 4, 2025

Drill Type: Diedrich D-25 Trailer Mount

Datum: Non-Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH	Sample Number
		ASPHALT, ~15 mm thick	204.00	0	
		CONCRETE, ~265 mm thick	204.0		
		Open space below dock	203.7		
		FILL sand, some gravel, some silt, brown and black, moist to wet, loose to compact	203.0	1	AS1
					SS2
				2	SS3
				3	SS4
		GRAVELLY SAND, some silt, trace clay, grey, wet, compact	199.4	4	SS5
		BOREHOLE TERMINATED AT ~5.8 m DEPTH DUE TO AUGER REFUSAL ON SUSPECTED COBBLES	198.2	5	

N Value: 9, 11, 9, 22

Shear Strength (kPa): 20, 40, 60, 80; 50, 100

Combustible Vapour Reading (ppm): 25, 50, 75

Natural Moisture Content % / Atterberg Limits (% Dry Weight): 10, 20, 30

SUDBURY GEO SUD-25004529-A0 - ONTC BLAST BAY AND DOCKS.GPJ NEW.GDT 4/30/25

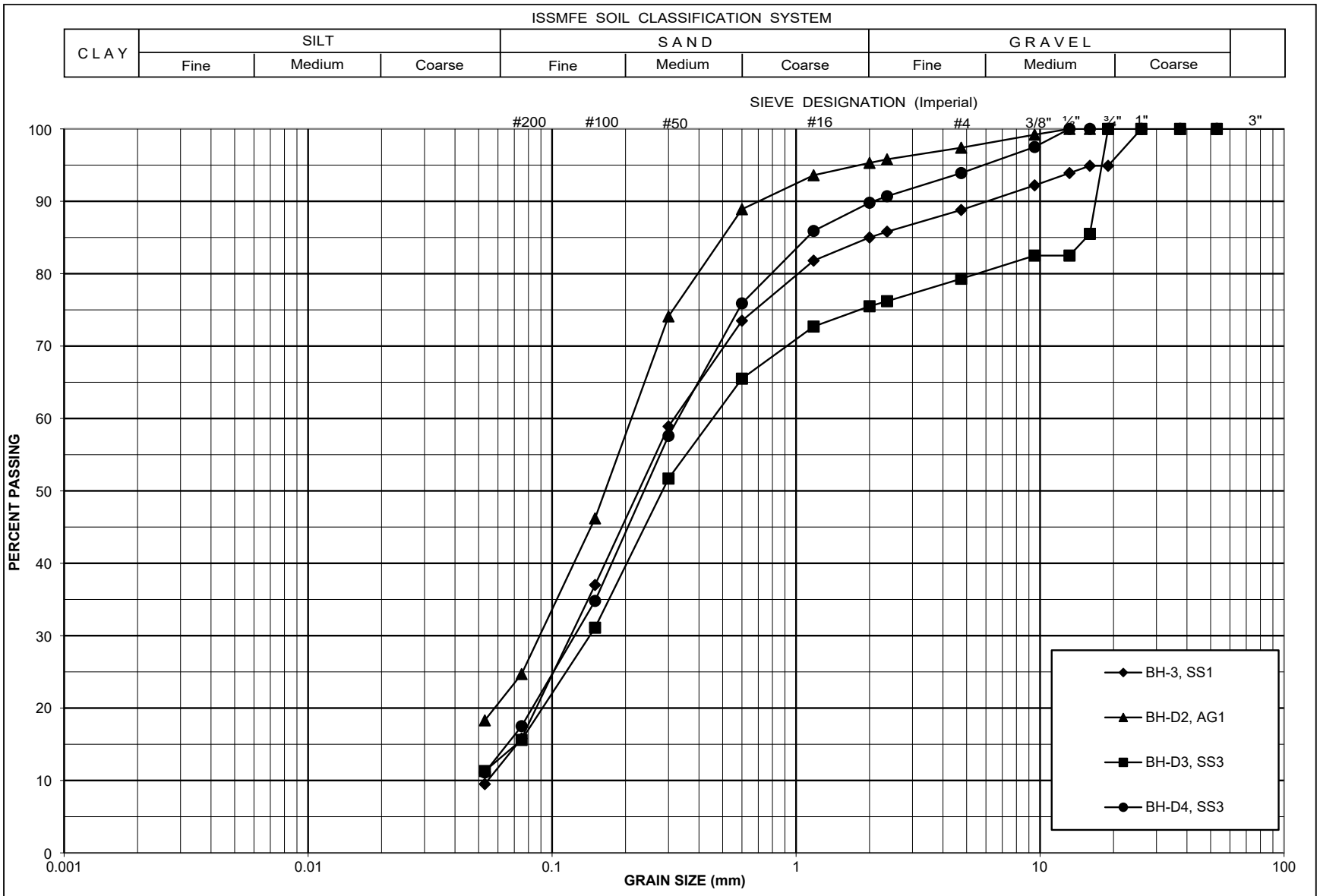
EXP Services Inc.
885 Regent Street
Sudbury, ON P3E 5M4
CANADA
t: +1.705.674.9681
f: +1.705.674.5583

Borehole data requires interpretation assistance from EXP before use by others.

See Figures B-1A and B-1B for Notes on Sample Description

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	Dry	4.27

Appendix C – Laboratory Test Results



GRAIN SIZE DISTRIBUTION

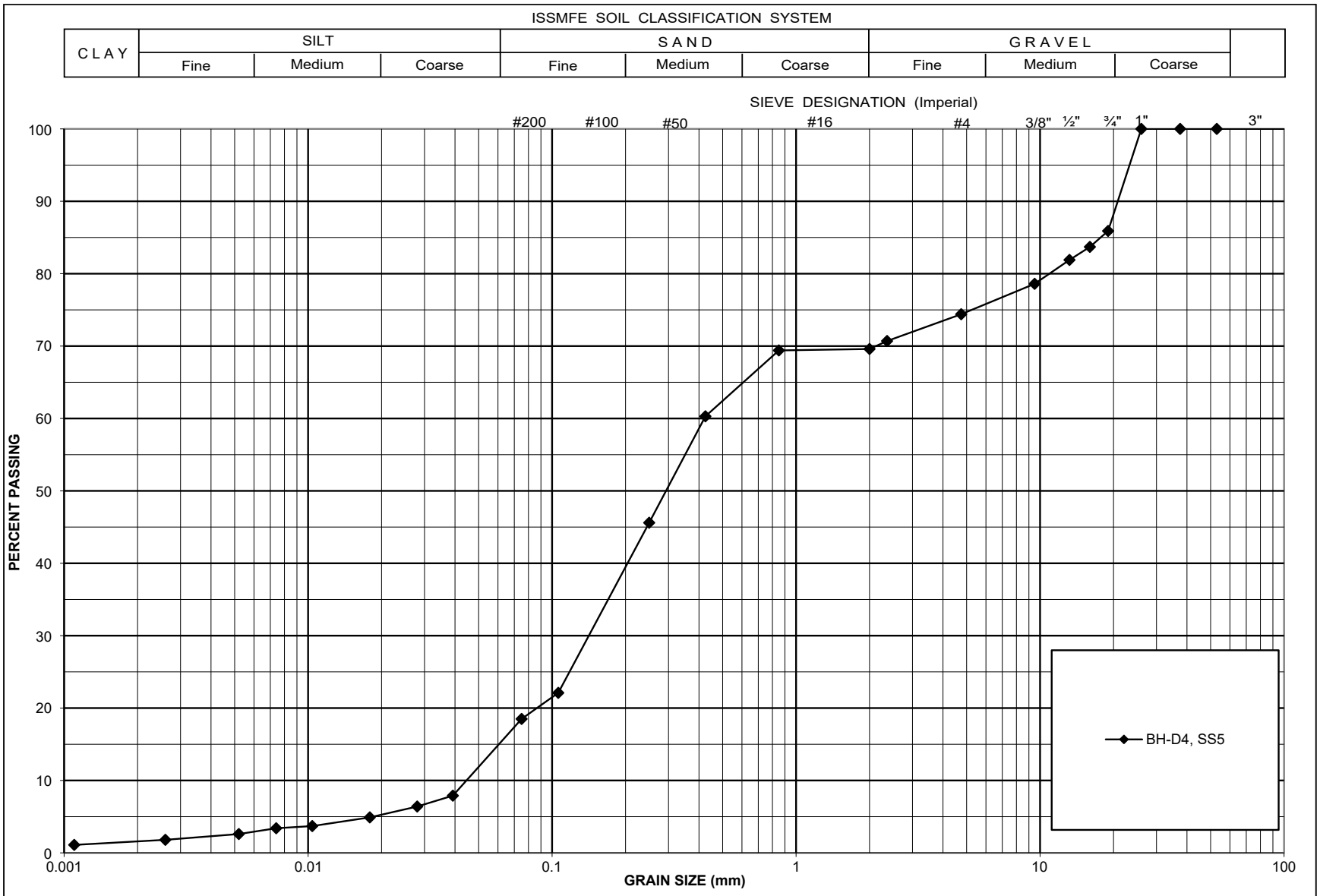
ONTC Blast Bay & Store Ramp Loading Dock Rehabiliation

915 McIntyre Street, North Bay, Ontario

FIGURE: C-1

PROJECT No: SUD-25004529-A0

DATE: April 2025



exp.

GRAIN SIZE DISTRIBUTION

ONTC Blast Bay & Store Ramp Loading Dock Rehabiliation

915 McIntyre Street, North Bay, Ontario

FIGURE: C-2

PROJECT No: SUD-25004529-A0

DATE: April 2025

EXP Services Inc.
885 Regent Street
Sudbury, Ontario
P3E 5M4
Telephone: (705) 674-9681
Facsimile: (705) 674-8271

SUMMARY OF ROCK CORE TEST DATA

ASTM D7012 - 14e1 Method C

CLIENT: Ontario Northland

JOB NUMBER: SUD-25004529-A0

JOB NAME: ONTC Blast Bay Floor Replacement

DATE: April 30, 2025

LAB No.	**23073**
CORE LOCATION	BH-D3 Run 2
DEPTH	21'-4"-21'-10"
DATE TESTED	30-Apr-25
LENGTH (mm)	93.0
DIAMETER (mm)	47.0
DENSITY (kg/m^3)	**2659**
COMPRESSIVE STRENGTH (MPa)	200.0
TYPE OF FRACTURE	**SHEAR**
CONDITION AT TIME OF TESTING	**DRY**

COMMENTS:

DISTRIBUTION:

PART 3 – RFP SPECIFICATIONS
SCHEDULE 3-A-5
POLOCIES AND PROCEDURES

The Successful Respondent will be required to adhere to the following ONTC Policies and Procedures while under contract with ONTC, and which are attached to this Schedule 3-A-5.

TITLE
Contractors working on ONTC Property Near Railway Tracks
Blue Signals Flags Procedure
ONTC Electrical Safety Policy and Program
Hot Work Program
Contractor / Subcontractor Policy

CONTRACTORS WORKING ON ONTC PROPERTY NEAR RAILWAY TRACKS

The following procedure is to be followed when it is necessary for a Contractor to work on Ontario Northland Transportation Commission (ONTC) property near railway tracks.

- The Contractor, through the Contract Administrator, shall contact the District Manager for the Ontario Northland Railway (ONR) to coordinate and schedule their operations on or near ONR property.

  Contact: **Mr. Chad Martin**
  District Manager - District # 1
  Englehart, Ontario
  Office Phone No. (705) 544-2292, Extension 125
  Cell No. (705) 545-0725

  Contact: **Mr. Dave Lallier**
  District Manager - District # 2
  Cochrane, Ontario
  Office Phone No. (705) 272-4610, Extension 632
  Cell No. (705) 272-9588

- The Contractor shall fully comply with all requirements of ONR in the planning, scheduling and control of his works within the ONR right-of-way.

- The Contractor shall plan and carry out his work in a manner that does not interfere with rail traffic, or cause clearance restrictions.

- Flagging protection for railway traffic will be provided by the ONR upon notification as outlined herein. However, flagmen provided shall not relieve the Contractor from liability for damages to Railway facilities caused by the Contractor's operation.

- The Contractor shall have a responsible person present at all times to whom the Contract Administrator will issue instructions regarding work on ONR right-of-way.

- All communications with ONR shall be done through the Contract Administrator. ONR will not deal directly with the Contractor.

- All instructions from flagmen shall be obeyed immediately by all personnel on site.

- A flagman will be required when any personnel or equipment is working within 15 metres of the centerline of the nearest track, or protective devices where the work, in the opinion of the Contract Administrator or the Railway, may be exposed to or interfere with the operation of the Railway tracks.

- When a flagman is required, the Contractor, through the Contract Administrator, shall provide a written notice at least one week in advance to ensure the availability of flagmen.

If prior to work commencing, the Contractor, through the contract Administrator, receives confirmation that such flagmen are not available, the Contractor, through the Contract Administrator, shall reschedule the proposed work to a date and time when such flagging protection will be available.

- In no case shall the Contractor or any of his equipment or personnel work closer than 15 metres from the centerline of the nearest track without prior consent of the Contract Administrator.

- No construction equipment, materials, or debris shall be permitted to be used, stored, dropped, or allowed to accumulate within 15 metres of overhead cable and posts.

- All equipment must stop working on the approach of any train when said equipment is on ONR right-of-way or within 15 metres of the centerline of the nearest track.

- The Contractor shall ensure that both rails of the same tracks are never connected with any conductor of electricity, such as steel measuring tapes or metal traction equipment.

Fiber Optic Cable

Along much of ONR's right-of-way lies buried fiber optic cable. A cable locate must be done prior to any work taking place. A locate request can be completed online at https://www.ontarioonecall.ca/portal/ or by calling 1-800-400-2255.

ONR Railway Flagging Policy and Costs

The Contractor shall be responsible for payment of flagman protection costs. Flagging protection will be billed out by the ONR in accordance with the following:

Any occupation or crossing of the operating railway right-of-way not covered under a license of occupation or private crossing agreement **MUST** be protected by a railway flagman.

Arrangements for flagging protection are to be made by the Contractor, through the Contract Administrator, at least one week in advance by contacting the appropriate District Manager at the numbers provided above.

Flagging protection will be billed out as per the attached "Railway Flagging Protection Policy".

ONTARIO NORTHLAND TRANSPORTATION COMMISSION
RAILWAY FLAGGING PROTECTION POLICY

Work or other activity (on, over or under) or within 15 metres of ONTC's track may impact upon the safe use of the track. Consequently, it is essential that qualified ONTC personnel provide flagging protection when personnel, equipment or vehicles are going to be (on, over or under) or within 15 metres of the track for any purpose. Workers must follow the directions and instructions of the ONTC personnel providing the flagging protection, at all times.

Emergency Situations
There is no exception made to the requirement for flagging protection even when a condition arises where the reliability or safety of an installation or of equipment or the safety of personnel is at risk.

Grade Crossing Exemption
All crossings, equipment or structures encroaching onto railway lands require approval by ONTC, a signed licence agreement with ONTC and (in some cases) proof of insurance. If a person or business has fulfilled the requirements and has obtained a licence agreement for a grade crossing from ONTC, they are permitted to cross the track over their approved crossing – if the way is clear and safe.

Snow removal and brush clearing are subject to specific exemptions and requirements.

Procedure
Arrangements for flagging protection are to be made at least one week in advance by contacting the appropriate District Manager at one of the following numbers:

District # 1	Chad Martin	(705) 545-0725
District # 2	Dave Lallier	(705) 272-9588

Unless otherwise authorized by the Director of Rail Infrastructure, all fees, as listed below, are to be paid by the applicant. The applicant is to provide a Purchase Order number at the time the arrangements are made with the District Manager.

Billing is based on an hourly rate including travel time, rounded up to the nearest full hour – plus applicable taxes. Rates are provided below.

Service ($ per hour)	**ONTC Fiscal Year**					
	2023-24		2024-25		2025-26	
	Regular	Overtime	Regular	Overtime	Regular	Overtime
Flagging - hirail included	$146.50	$202.00	$150.00	$206.7	$153.00	$210.85
Flagging - hirail operator only	$111.00	$166.50	$113.40	$170.10	$115.70	$173.55

Office of the Director of Rail Infrastructure
March 2023

FOR RAIL EMERGENCIES CALL: 1-800-558-4129 Ext. 141

Blue Signals/ Flags Procedure

Procedure No. HSP-007 **Date Issued: February 7, 2014**	**Revision:** **Date:**
Approved By: **H&S Mgmt Co-chair**	**Approved By:** **CMO/ VP**

PURPOSE AND SCOPE

Signals are used to ID equipment undergoing repair or maintenance on live tracks. Blue signals are required when working between, underneath and on top of equipment outside of shops, but can be used anywhere when safety may be in doubt. These blue signals are used by shop employees, contractors and customers.

RESPONSIBILITIES

The Supervisor is responsible for ensuring this procedure is adhered to. Employees are to follow the instructions included in this safe operating procedure as well as any additional instructions given by his or her supervisor.

PROCEDURE

Transport Canada Operating Rules (RAC)

- Recommended Blue Flag Specifications:
  a. Blue flags shall be blue in color and clearly distinguishable from both sides.
  b. The dimension of the blue flag should be a minimum of 14 inches by 10 inches. Blue flag should be at a minimum height of 18 inches from the top of the rail to the bottom of the flag.
  c. The blue flag must be maintained in good condition
- Supervisor may appoint a competent person to set up and remove blue signal protection.
- Blue signal to be placed between the switch and first car ensuring it is far away from the switch as to not interfere with said switch. When blue flagging equipment, where possible place flag a minimum of one car length from equipment and refer to C.R.O.R. Rule 26 on placing equipment in front of a blue signal
- When working in yards or high traffic areas, employees should be in communication with persons responsible for switching and carry a radio to monitor traffic.
- Repair work is any work performed in the red zone between, underneath, and on top.
- Adjoining track may be blue-flagged also if there is a hazard while performing duties and also if the employee will foul said track.

REFERENCES

RAC - Best Practice Circular No. 12- Blue Flag April 1, 2010
Rule 40 - Collective Agreement between ONTC and UNIFOR

REVISION RECORD

Description of Change	*Date*
Original Issue	2/7/14

DATE FORMALIZED April 6, 2023 REVISED	Electrical Safety Policy

POLICY STATEMENT

In keeping with our values of Safety Full Stop, Go Beyond, Lead the Way and Never Stop Caring Ontario Northland Transportation Commission (ONTC) commits to ensuring that all employees who may be exposed to electrical hazards associated with their work have the knowledge, skill, tools, and equipment needed to ensure their safety.

In our efforts to Go Beyond our minimal requirements, ONTC commits to continuously improving our safe work practice by striving to incorporate the Workplace Electrical Safety standard, CSA Z462.

All authorized employees will ensure the power supply to electrical installations, equipment, or conductors is disconnected, locked out of service, connected to ground, and tagged before any work is done. **It is a requirement that, where possible, all hazardous energy sources are reduced to and maintained at a ZERO ENERGY state before starting any electrical work.** Should it become necessary that maintenance, cleaning, or adjustments need to be performed on any piece of equipment while it is in operation, safe work procedures for this type of work shall be made available and easily accessible. Only authorized employees shall be allowed to perform such work.

PURPOSE

To ensure employee safety by allowing only **Authorized Employees, Qualified Persons**, **Certified Electricians** or **Electricians in Training (EIT's)** who are under direct supervision of a **Certified Electrician** to do electrical work such as connect, maintain, or modify electrical equipment or installations at ONTC work locations.

To ensure that all ONTC employees or contractors working for ONTC comply with the Canada Labour Code, Occupational Health and Safety Act, associated regulations and ONTC procedures.

APPLICATION AND SCOPE

This procedure applies to all ONTC workers and contractors at all workplace locations. The procedure applies whenever exposure to a hazardous energy may occur while servicing, installing or maintaining, machinery or equipment.

DEFINITIONS

Affected employee – persons who are not directly involved in the work requiring the hazardous energy control, but who are (or may be) located in the work area.

Authorized employee – a qualified person who, in their duties or occupation, is obliged to approach or handle electrical equipment; or a person who, having been warned of the hazards involved, has been instructed or authorized by a qualified Supervisor or management member.

Certified Electrician – Electricians who have obtained a 442A Industrial or a 309A Construction certificate of qualification.

Control Device – means a device that will safety disconnect electrical equipment from its source of energy.

Electrical Equipment – means equipment for the generation, distribution, or use of electricity.

Electrician in Training (EIT's) – Aspiring electrician's registered with Skilled Trades Ontario who must complete specific criteria, a set number of hours, and a final test to be eligible to become a **Certified Electrician.**

Isolated – means separated or disconnected from every source of electrical, hydraulic, pneumatic, or other kind of energy that is capable of making electrical equipment dangerous.

Qualified Person – One who has demonstrated skills and knowledge related to the construction and operation of electrical equipment and installations and has received safety training to identify hazards and reduce the associated risk.

RESPONSIBILITIES

Employer is responsible to:

1. Provide training and instruction on the Electrical Safety Policy and LOTO program.
2. Properly implement and periodically audit the Electrical Safety Policy and LOTO program.
3. Provide single key locks and tags as well as other LOTO equipment and maintain records of issuance of lock.
4. Provide all relevant PPE to ensure staff are performing their tasks in a safe manner.
5. Prequalify and approve contractors who work at any ONTC location.
6. Discipline, ensuring authorized and affected personnel perform their duties within the requirements of the LOTO Procedure.

Managers/Supervisors are responsible to:

1. Communicate any actual and potential hazards of which they are aware;
2. Apply and enforce the LOTO Program for all personnel in the workplace.
3. Identify those personnel who are authorized and affected and trained in accordance with this policy.
4. Periodically inspect the work area to ensure compliance with this policy;
5. Ensure that only authorized workers perform LOTO, and that work is performed in compliance to the procedure.
6. Provide written instructions as required; and
7. Provide to workers, company supplied LOTO equipment and PPE as required.

Workers and contractors of ONTC are responsible to:

1. Comply with the Electrical Safety Policy and LOTO Procedure.
2. Notify their supervisor or contact person of any questions or concerns with respect to LOTO.
3. Participate in electrical safety training as required.
4. Provide input on the effectiveness of the LOTO Procedure and participate in annual reviews of the electrical safety policy and LOTO Procedure as required.

5. Achieve a zero-energy state where hazardous energy may harm a person and ensure proper LOTO is achieved.
6. Ensure all power sources remain locked out before resuming work after a temporary absence.
7. Ensure only single keyed locks are used. The key must remain in the direct possession of the authorized person engaged in lockout.
8. remove only the locks that have been assigned by ONTC; and
9. avoid using a Point of Operation switch or controller for the sole Lockout of a device or piece of equipment unless it has been designed to accommodate an energy isolating device.

ELECTRICAL SAFETY RULES

1. A sign warning of the danger, and forbidding entry by unauthorized persons will be posted at the entrance to a room or similar enclosure containing exposed live electrical parts.
2. Any piece of equipment or tool found to be damaged or have defective electrical components or found to pose a safety or health hazard to any employee will be disconnected and removed from service without delay and must be tagged appropriately.
3. Any tool or piece of equipment that is capable of conducting electricity and/or endangering the safety of any worker will not be used around or close to any live electrical installation or equipment that might cause electrical contact with the live conductor.
4. Flammable materials/liquids shall not be stored anywhere near electrical equipment.
5. Eye protection must be worn when carrying out a work assignment.
6. Consider all electrical equipment to be live until you have properly tested it to confirm it's dead.
7. Do not work on "live" equipment unless it is absolutely necessary. If it is necessary, a safe work procedure must be in place.
8. If it is necessary to work on "live" equipment wear rubber gloves and work from a dry location.

9. Do not close any switch without knowledge of the circuit and the reason the switch was left open.
10. Notify the persons affected before the power on any circuit is shut off.
11. All electrical equipment of 110 volts or over must be grounded. Circuits sometimes retain a charge.
12. Portable electrical equipment used outdoors or in damp locations must be equipped with a ground fault circuit interrupter installed at the receptacle or on the circuit at the panel.
13. Specially authorized persons and electricians are the only ones permitted to change fuses.
14. Rubber gloves, tools and equipment must be maintained in good condition.
15. Do not handle “live” wires while standing in water or on moist or steel surfaces.
16. Electrically driven machinery and controls should normally be locked out before servicing. However check with your Supervisor to be sure.
17. Only persons authorized to do so may enter any electrical room and/or enclosure containing live parts. The entrance to any electrical and/or enclosure containing live parts will be marked by conspicuous warning signs stating that entry by unauthorized persons is prohibited.

TRAINING

Employees exposed to an electrical hazard when the risk associated with that hazard is not adequately reduced by the applicable electrical installation requirements shall be trained to understand the specific hazards associated with electrical energy.

- Safety-related work practices and procedural requirements necessary to provide protection from the electrical hazards associated with their job or task assignments; and
- They shall be trained to identify and understand the relationship between electrical hazards and possible injury.

Qualified persons shall be trained in and knowledgeable about the construction and operation of equipment or a specific work method and trained to identify and avoid the electrical hazards that might be present with respect to that equipment or work method. The training required shall meet the requirements of the CSAZ462.21 and may include classroom, on-the-job, electronic, or web-based training methodologies with interactive components.

Employees involved in or affected by the lockout procedure must be trained in the lockout procedure and their responsibility in the execution of the procedures.

Retraining in the lockout procedure shall be performed:

- When the procedures are revised;
- At intervals not to exceed 3 years; and
- When supervision or annual inspections indicate that the worker is not complying with the lockout procedure.

Employee training must be documented to confirm that each employee has received the training and retained for the duration of the employee's employment. The documentation must include

- when the employee demonstrates proficiency in the work practices involved
- contain the content of the training, each employee's name, and date of the training.

REFERENCES

Part II Canada Labour Code R.S.C, 1985, c. L-2
Published by the Minister of Justice at the following address:
http://laws-lois.justice.gc.ca

Implementing an Occupational Health and Safety (OH&S) program November 2017 DSS Catalogue Number CC273-2/17-1E Canadian Centre for Occupational Health and Safety (CCOHS): www.ccohs.ca

Occupational Health and Safety Act (R.S.O. 1990, c. 0.1) Consolidated Edition, Carswell

Workplace electrical safety, CSAZ462:21 CSA Group., July 20214

DATE FORMALIZED June 21, 2018 REVISED April 13, 2022	HOT WORK PROGRAM

POLICY STATEMENT

In keeping with our values of safety, accountability, and continuous improvement Ontario Northland Transportation Commission (ONTC) is committed to the safety and health of all its employees by ensuring that all hazards associated with hot work is properly recognized, assessed and controlled.

PURPOSE

To establish the minimum requirements for the safe performance of hot work when conducting hot work at any ONTC location, and to ensure that all measures are taken to eliminate any risk that is generated by welding, cutting, grinding, soldering, or blazing.

APPLICATION AND SCOPE

This policy applies to any ONTC division, department, and employee who is required to perform hot work at any time during their work.

POLICY

All hot work jobs or projects are to be authorized by a manager, supervisor, designate or identified in daily work schedules and/or job descriptions.

All hot work must be performed by a competent worker who has the knowledge and training in the work being performed as per the identified risks associated with the work.

A competent person will be designated to monitor all hot work activities ensuring all procedures are being followed, and to conduct a fire watch for dangerous sparks.

When hot work is required on a rail car that contains a commodity or residue that is either a flammable gas, flammable liquid, or a liquid with a flash point below the ambient temperature or the temperature in the rail car, the work is to be conducted outside (provide location) and is only permitted when all safety precautions outlined in this procedure have been met and adhered to by personnel who have been trained to assess and control the hazards associated with hot work.

DEFINITIONS

Flammable Commodity:
A commodity that is a flammable gas, a flammable liquid or a liquid that has a flash point below the ambient temperature or temperature inside the rail car.

Flammable Gas:
A gas that has an LEL of less than 13 percent by volume in air or flammable range of more than 12 percent.

Flammable Liquid:
A liquid having a flash point below 37.8^{o}C (100^{o}F), also known as an NFPA Class I liquid.

Flash Point:
The temperature at which a liquid produces enough vapour to ignite in the presence of a suitable source of ignition.

Gas Tester:
Person assigned to perform required testing on/in a confined space, restricted space, railcar, etc. to ensure the area is safe to work on and/or identify control measures required to eliminate risk.

Hot Work:
For the purposes of this procedure, refers to any operation, process, or the use of anything that creates a source of ignition. Hot work includes, but is not limited to: welding, cutting torches, gouging, and the use of tools and equipment that are not intrinsically safe.

Lower Explosive Limit (LEL):
The minimum concentration of a flammable gas mixed with air, where an explosion or deflagration may occur in the presence of a suitable ignition. This concentration is expressed in percent by volume, where 1 percent represents 10,000 parts per million.

Tester:
A competent person who is responsible for making determinations of the conditions in or around the area of work, and has completed appropriate training on the measurement instruments and procedures used to perform the evaluation.

Vapour:
A gas given off by a substance that is normally a liquid at room temperature.

MATERIAL REQUIRED

Hot Work Hazard Assessment and Full task Observation Sheet
Norfalco Acid Tank Car Hazard Safety Inspection Sheet
Personal Protective Equipment
Fire Extinguisher
Testing Equipment – PH Test Paper, Gas Monitoring Equipment
Communication Devices

HAZARDS

This procedure describes some of the potential health hazards associated with welding fumes and gases. It also discusses the control and management of these hazards.

Welding produces metal fumes and gases that can make you sick. The risk depends on:

- The welding method (such as MIG, TIG, or stick)
- What the welding rod (electrode) is make of
- Filler metals and base metals (such as mild steel and stainless steel)
- Paints and other coatings on the metals being welded
- Ventilation

In confined spaces, welding can be much more dangerous. With less fresh air, toxic fumes and gases can be much stronger. Shielding gases, like argon, can displace the oxygen and kill you.

The two most common types of welding used are:

- The electric arc welding of metal using a flux-coated electrode (manual metal arc welding, MMAW, SMAW); and
- The electric arc welding of metal using a gas-shielded wire electrode (gas metal arc welding, GMAW).

Welding Fumes
Cadmium – may be present as a coating in certain materials being welded. Cadmium oxide fume on inhalation may cause acute irritation of the respiratory passages, bronchitis, chemical pneumonia or excessive fluid in the lung tissues (pulmonary oedema). There may be a latent period of several hours between exposure and onset of symptoms. The effects of overexposure to cadmium fumes may resemble metal fume fever initially. A single exposure to a very high concentration of cadmium oxide fume may be fatal. Chronic cadmium poisoning results in injury to lungs and kidneys.

Manganese – potential exposure to manganese occurs whenever this metal is used in electrode cores and coatings or in electrode wire. Acute poisoning from oxides of manganese is very rare in welders, although respiratory tract irritation from the fume may occur. Exposure to fume from welding on manganese steel may give rise to acute

inflammation of lungs. Metal fume fever is also a possibility after exposure to manganese fume. Chronic manganese poisoning, characterized by severe disorder of the nervous system, has been reported in welders working in confined spaces on high manganese steels.

Zinc – may be present as a surface coating on steel products, that is, galvanized steel. Exposure to freshly formed zinc oxide fume may produce a brief acute self-limiting illness known as metal fume fever, zinc chills or brass founder's ague. The symptoms, which resemble those of an acute attach of influenza, usually occur several hours after exposure to fume and usually with complete recovery within about 24 to 48 hours. Freshly formed oxide fume from several other metals has also been reported to cause metal fume fever. Leucocytosis, a transient increase in white blood cell counts, is reported to be a common finding in metal fume fever, but is not known to be common among welders.
Iron – most welding involves ferrous materials. The most abundant constituent of ferrous alloy welding fume is iron oxide. Long, continued exposure to such welding fume may lead to deposition of iron oxide particles in the lungs. When present in sufficient quantities, the deposition is demonstrable on chest x-ray films as numerous fine discrete opacities (nodulation and stripping) resembling silicosis. The technical name for this is sierosis and it is a benign form of pneumoconiosis. Siderosis tends to clear up when the exposure to metallic particles stops.

Molybdenum – Molybdenum is found in some steel alloys. Molybdenum fumes may produce bronchial irritation and moderate fatty changes in the liver and kidneys.

Fluorides – Welders may be exposed to fluoride dust, fume and vapours from certain MMAW and GMAW operations. Fluoride fumes may produce irritation of the eyes, throat, respiratory tract and skin. Chronic fluorosis is a syndrome characterized by an increased density of bones and ligaments due to fluoride deposition. However, no corroborating data are available which identify a relationship between exposure to fluoride-containing welding fumes and disorders of bones or ligaments.

Other Metals – Welding may produce fume from other metals, including aluminium, copper, magnesium, tin, titanium and tungsten. Within the confines of the current information available, no serious health disorders in welders are known to occur from exposure to fume from these metals but, under certain conditions, copper, aluminium and magnesium may give rise to metal fume fever and others to irritation of the respiratory tract.

Beryllium is a volatile and toxic component that may be present in many copper alloys being welded, that is, in the work piece itself. Beryllium oxide fume is very toxic to the respiratory tract, lungs and skin, and is quick acting. Beryllium is suspect human carcinogen. Note that beryllium may also be present in some aluminium or magnesium brazing alloys.

Gases
Oxides of nitrogen – The oxides of nitrogen, nitric oxide and nitrogen dioxide, are frequently formed by the direct combination of oxygen and nitrogen in the air surrounding

the arc or flame, as a result of heat from the electric arc or gas torch (oxidizing flames). In outdoor or open shop welding, hazardous abnormal concentrations are unlikely, except perhaps for short periods. In confined spaces, hazardous concentrations of nitrogen oxides may rapidly build up in welding operations. High concentrations of nitrogen oxides have also been found during gas tungsten-arc cutting of stainless steel.

Exposure to oxides of nitrogen may not always produce immediate effects but may result in fatal excessive fluid in the lung tissues (pulmonary oedema) some hours after the exposure stops.

Ozone – is formed only in small amounts in MMAW and in gas welding. It is however, produced in significant amounts in GMAW when welding with argon, especially when high amperages are used. High ozone concentrations are especially a problem when welding on reflective surfaces, such as aluminum and its alloys and stainless steel, and with high-energy processes such as plasma arc welding.

Phosphine – Phosphine is generated when steel coated with a rust proofing compound is welded. High concentrations of phosphine gas are irritating to the eyes, nose and skin. There may also be serious effects on the lungs and other organs.

Insufficient – oxygen in GMAW, the presence of inert gases (argon, helium) in confined work environments may reduce the oxygen content of the atmosphere to dangerous levels, with the threat of asphyxiation. See also the section on carbon dioxide in this procedure.

Pyrolytic products of resins used in primers / paints – the main products of thermal decomposition of resins used in primers and paints are carbon monoxide and carbon dioxide. Specific toxic or irritant chemicals given off from the resins used in priming materials include such hazardous substances as phenol, formaldehyde, acrolein, isocyanates and hydrogen cyanide. Usually, a very complex mixture of organic gases is formed.

HEALTH EFFECTS

SHORT TERM

Metal fume fever – Metal fume fever occurs in welders who inhale zinc oxide fumes, although other components, for example, copper, aluminum and magnesium, may also produce this condition. Symptoms of metal fume fever, which resemble influenza, usually occur several hours after exposure and include a metallic or sweet taste, chills, thirst, fever, muscle aches, chest soreness, fatigue, gastro-intestinal pain, headache, nausea and vomiting. The symptoms usually subside within one to three days of exposure with no residual effect.

Exposure to ozone – Exposure to ozone generated in GMAW and plasma arc welding may produce excessive mucus secretion, headache, lethargy, eye irritation and irritation and inflammation of the respiratory tract. In extreme cases, excess fluid and even hemorrhage may occur in the lungs. The irritant effects of the gas on the upper respiratory tract and the lungs may be delayed.

Exposure to nitrogen oxides – Nitrogen oxides produce somewhat similar respiratory tract effects to ozone. Inhalation of nitrogen oxides does not always produce immediate irritant effects but may result in excessive fluid in the lung tissues (pulmonary oedema) some hours after exposure ceases.

Control Measures

Where there is a likelihood of worker exposure to welding fumes and gases, steps should be taken to minimize that exposure. A thorough examination of work practices is essential. Procedures should be adopted to ensure that workers are not exposed to the hazard. Control measures include, but are not limited to the following, which are ranked in priority of their effectiveness:

Elimination/Substitution

- Remove the hazard from the workplace, or substitute (replace) hazardous materials or machines with less hazardous ones

Engineering Controls

- includes designs or modifications to equipment, ventilation systems, and processes that reduce the hazard at the source of exposure

Administrative Controls

- altering the way the work is done we can reduce the exposure along the path i.e. policies, and **work practices** such as standards and operating procedures (including training, housekeeping, equipment maintenance, and personal hygiene practices)Conduct pre-assessment of work to identify all hazards

Personal Protective Equipment

- Equipment worn by individuals to reduce exposure such as contact with chemicals or exposure to noise

The control measures in this procedure are intended to assist anyone conducting hot work with identifying and controlling all hazards associated with the nature of the work. All hazards identified in the hazard assessment not identified in the procedure shall be controlled using this hierarchy first always looking to eliminate.

PROCEDURE

Welding, cutting, grinding, soldering and brazing in construction, maintenance, and fabricating activities present a significant opportunity for fire and injury.

Hot work presents an increased risk of fire and explosion hazard when it is performed in a confined and enclosed space. If performing Hot Work in a confined space, please refer to the confined space policy and procedure.

The following procedures are the minimum standard that ONTC anticipates its workers and contractors to achieve for all hot work performed.

1. Inspect the work area and consider the following:
   - Ensure that all equipment is in good operating order before work starts.
   - Ensure that all appropriate personal protective devices are available at the site.
   - Look for combustible materials.
   - Move all flammable and combustible materials away from the work area.
   - Sweep clean any combustible materials on floors around the work zone.
   - Remove spilled grease, oil, or other combustible liquid.

If combustible materials can't be moved:

2. If combustibles cannot be moved, cover them with fire resistant blankets or shields. Protect gas lines and equipment from falling sparks, hot materials, and objects.
3. Secure, isolate, and vent pressurized vessels, piping and equipment as needed before beginning hot work.
4. Post a trained fire watch within the work area, including lower levels if sparks or slag fall during welding, including during breaks, and for at least 30 minutes after work has stopped. Depending on the work done, the area may need to be monitored for longer (up to 3 or more hours) after the end of the hot work until fire hazards no longer exist.
5. Inspect the area following work to ensure that wall surfaces, studs, wires, or dirt have not heated up.
6. When work is completed ensure all compressed gas valves are closed and the cylinders are properly stored and secured safely.

Hot Work on Residue/Loaded Rail Cars

Before performing any work on a rail car ensure the following:

Before performing any work on a car containing acid caution must be given to the following risks:

1) The tank is still under pressure – highest risk
2) The tank will release acid gases/mists when opened and previously checked for pressure

The first time the tank is opened workers should wear a full face shield and protective clothing (e.g. polycoated Tyvek and gloves), and a ½ mask respirator equipped with a stacked P100/acid gas cartridges (or a full face respirator in lieu of the face shield).

Subsequent access if necessary may be limited to respiratory protection for acid gases/mists and gloves, but should not occur unless necessary.

1. The Manager of Quality Assurance shall determine the last contents and, where possible, the paint system used on the car to be worked on. This shall include, as applicable, the review of shipping documents and/or any other documentation or information as appropriate to verify the last contents or the paint system used.

   Identification by the commodity stencilled on the car is not sufficient for content determination.

2. Where the car is found to contain an acid commodity a **Hazard/Safety Inspection Assessment Nor Falco Acid Tank Car** form must be completed by the Quality Assurance inspector to indicate if the car has passed or failed.

3. Prior to engaging in any hot work the person conducting the testing shall:
   a. Identify and record the contents of the tank on the **Hot Work Hazard Assessment and Task Observation** sheet.
   b. Test for oxygen and then LEL at and around the manways, valves, or other potential sources of flammable gases that are within the distances outline in Section 3.
   c. Stop any leaks as practicable prior to continuing and record this on the Hot Work Hazard Assessment and Task Observation form.
   d. Record the final results of the testing on the Hot Work Hazard Assessment and Task Observation sheet.
   e. Where a car's last commodity contains an acid perform PH testing on the car to ensure there is no acid residue remaining on or in the car

4. When a car contains a flammable commodity, no welding, gouging, flame cutting or similar operation is permitted within 15.4 meters (50 feet) and any other type of hot work is not permitted within 4.6 meters (15 feet) until the identified hazards on the **Hot Work Hazard Assessment and Task Observation** sheet have been controlled.

5. Once safe work condition is met, hot work may proceed only after the assigned worker(s):
   a. Examines the Hot Work Hazard Assessment and Task Observation sheet and identifies the following items before commencing work:

- Car Number: verify that the number on the car is the same as that identified on the Hot Work Hazard Assessment and Task Observation sheet
- Test results: verify that the air test meets the Hot Work Hazard Assessment and Task Observation sheet condition, also verify that the test results were conducted on the same shift and date the hot work is to be performed.

b. Ensure that no other processes or operations are being performed in the area that could contaminate the work area with a significant amount of flammable gas, or that continuous monitoring occurs.
c. Ensure that if a combustible insulation is present, a suitable means to extinguish a fire is immediately available.
d. Ensure that all equipment to be used is inspected, in good condition and properly used and this is documented on the **Hot Work Hazard Assessment and Task Observation** sheet.
e. Ensure that required personal protective equipment is inspected, in good condition, used properly and is documented on the **Hot Work Hazard Assessment and Task Observation** sheet.
f. Ensure you print your name and initials on the **Hot Work Hazard Assessment and Task Observation** sheet.
g. Ensure that continuous monitoring is in place.

6. Hot work may normally only proceed when the LEL is zero, except where the source of flammable gas is clearly known and continuous monitoring is performed to ensure that the levels do not exceed 10 percent of the LEL.

7. The tests conducted are valid for no more than the present shift, including overtime hours where applicable.

8. Welding on the tank car shell of an uncleaned car containing a flammable commodity or residue is strictly prohibited. Welding on reinforcing pads of rail cars which are directly attached to the shell is permitted providing:
   - The welder is qualified and certified
   - No part of the weld is deposited on the tank shell
   - Continuous monitoring in the location of the hot work

9. The ground connection for welding is to be attached directly to the part to be welded whenever practicable or as near as possible to the weld area

10. A fully charged 20lb ABC fire extinguisher shall be readily available to the hot work area. In remote locations where work will be performed on a car containing a flammable commodity or residue, it is mandatory to have two (2) fully charged 20lb ABC fire extinguishers. One (1) in close proximity to the hot work site and the other one in an easily accessible location close by.

11. Where individuals are performing hot work on an uncleaned railcar radios must be available to ensure an effective means of communicating during an emergency. This process must be included in the site emergency response plan.

12. If a combustible insulation is present, a suitable means to extinguish a fire must be immediately available when welding, gouging, flame cutting or a similar operation is being performed.

13. When welding, gouging, flame cutting or a similar operation is to be performed, significant quantities of highly combustible materials (paper, wood chips, textile fibres, grass, etc.) must not be within 10 meters (35 feet) of the welding operation. If you are unable to relocate the highly combustible materials, they must be covered with a flame resistant tarp.

14. When welding, cutting, gouging or a similar operation is to be performed on the surface that has a paint system applied to it, using the hierarchy of controls appropriate precautions shall be taken to ensure that the person is not exposed to airborne concentrations above the applicable exposure limits established by the ACGIH or Provincial Legislation, whichever is most restrictive. This may include, but is not limited to:
    - Blasting the area clean prior to the performance of the work
    - Using stripping products to remove coatings, making sure to remove any residue before welding
    - Use wet slurry vacuum removal techniques for removing very toxic coatings
    - Do not grind coatings. Grinding dust may be toxic.
    - The use of engineering controls (e.g., ventilation)
    - The use of appropriate respiratory protection

15. Prior to performing hot work on the jacket of a car containing flammable commodity or residue the following must be completed:
    a. Test the jacket space for any flammable gas local to the work area, through:
    b. an existing access point to in the jacket space
    c. or by creating an access point, local to the work area, into the interstitial space between the shell and jacket using a pneumatic or intrinsically safe drill and keeping the drill bit and work area cool with a suitable coolant.

16. Where any amount of flammable gas is found, the source shall be determined, and if the source is from inside the jacket space it shall be eliminated or controlled

prior to any hot work being performed. Record this on the **Hot Work Hazard Assessment and Task Observation** sheet.

17. If it is reasonably believed that the jacket space may become contaminated with a flammable gas during performance of the work (e.g. product leaks from a tank) then the jacket space shall be continuously monitored.

18. Where contamination is found in the jacket space other than a flammable gas (e.g. sulphur), an assessment of the hazards shall be made and appropriate precautions taken to protect the health and safety of the worker.

19. If the **Hot Work Hazard Assessment and Task Observation** condition is violated, or there is reasonable cause to believe that it may be violated during the performance of the work (e.g. product leaks from a tank into the area of hot work, leaks from a nearby process), the work shall stop immediately while the source is investigated. Retesting must be performed to ensure that the conditions are safe before continuing. The new findings shall be recorded on the **Hot Work Hazard Assessment and Task Observation** sheet.

RESPONSIBILITIES

Employer:

- Ensure that a written program for hot work is developed and maintained in accordance with all relevant legislation.
- Ensure that the hot work program is developed and maintained in consultation with the workplace health and safety committee and/or policy health and safety committee.
- Ensure that the hot work program and associated documentation is current and available to all workers and contractors (as required) performing any hot work.
- Ensure that an adequate assessment of the hazards related to the hot work being performed has been carried out before any worker begins hot work.
- Appoint a person with adequate knowledge, training, and experience to carry out the assessment and maintain a record containing details of the person's knowledge, training, and experience.
- Ensure all workers are given adequate training in recognition of hazards and safe work practices associated with hot work.
- Maintain adequate training records showing who provided the training, who received the training, and the date the training was provided.
- Provide all personal protective equipment (PPE) required to ensure safe work.

Site Supervisor:

- Ensure a full hazard assessment is completed and any hazards are identified and controlled before hot work begins.

- Where rail car contains a flammable commodity or acid base commodity ensure that the Hot Work Hazard Assessment and Task Observation sheet completed.
- Inspect and monitor all hot work jobs to ensure procedures are being followed, and adequate fire protection is provided for a fire watch on site
- Ensure that all work does not begin until all conditions identified have been met.
- Ensure that all personnel follow this policy and procedure.
- Assign an Observer to watch for dangerous sparks in the area above and below the work being completed.

Manager of Quality Assurance Department:

- When hot work is to be performed on a rail car determine the last contents of the rail car and if possible determine the paint system.
- Perform/delegate required testing on the car to ensure the car is safe to work on and/or identify control measures required to eliminate risk.
- Place an ONTC pass or fail sticker on the car to indicate quality assurance testing compete.

Observer:

- Ensure all conditions, precautions and controls are followed.
- Watch for sparks in the area above and below the work being completed.
- Conduct fire watch at all times including any coffee breaks or lunch breaks for 60 minutes after any hot work has been completed. Maintain a fire watch at thirty min intervals to monitor area for 4 hours after work has been completed, in case of flare ups.

Workers:

- Comply with this program and be fully aware of the contents of relevant assessments.
- Notify the site supervisor of any questions or concerns with the hot work being performed or the hot work program.
- Notify the site supervisor of any contraventions of Part 2 of the Canada Labour Code, H&S regulations, and or any ONTC policies and procedures.
- Ensure all required PPE is in worn when conducting hot work.
- Participate in all required training.
- Inspect all cutting torches, and welding equipment for wear, defective parts and any other safety hazard before beginning any hot work and as often as required by the manufactures instructions.

Workplace/Policy Health and Safety Committee:

- Conduct regular audits to ensure the hot work procedures are being adhered to.
- Participate in policy review and provide recommendations to the employer if required

SWITCHING

1. A car that has been dropped off by a switching company (CN, CP, Railserve, etc.) and contains a flammable commodity, is not to be moved with a Trackmobile or similar equipment until an assessment is made to ensure that it is not leaking excessively.
2. Where a car that is leaking to the point where the airborne concentration of gas is likely to exceed 10 percent of the LEL at the coupler, a buffer car shall be positioned between the leaking car and the Track mobile, or similar equipment.
3. The distance set out in Section 3 of Hot Work on Residue/Loaded Rail Cars shall be considered when a car is to be moved such that the car does not enter an area where the requirements of this procedure would be violated (e.g. welding)
4. A car that contains a flammable commodity shall not be brought indoors unless it is confirmed that it is not leaking and it is being brought into an area that meets the requirements of NFPA 497.

Hot Work Hazard Assessment and Task Observation – RECORD RETENTION

When the work has been completed on Residue/Loaded Rail Cars:

1. Quality Assurance Tags to be removed from the car and the hot work hazard assessment and task observation sheets are filed and maintained for a minimum of 2 years.
2. Records for the testing must be kept for a minimum of three years.

TESTING EQUIPMENT

1. The gas monitoring equipment used for this standard is the VENTIS MX4.
2. Where available, the unit is to be set in the PPM mode for all tests.
3. A functional (“bump”) test must be performed on every instrument prior to each day’s use. A functional test is defined as a brief exposure of the monitor to known concentration of gas(s) for the purpose of verifying sensor and alarm operation. It is not intended to be a measure of accuracy of the instrument. The bump test shall be recorded on the bump test form.
4. A full instrument calibration must be performed monthly using certified concentrations of calibration gas(s) and recorded. Each gas-monitoring unit must have a calibration form, which will be maintained with the unit. Record the unit’s model and serial number, date calibrated and the name of the individual performing the calibration. Enter the full span reading for each sensor and the calibration has used.
5. The recommended calibration gas for the LEL sensor is Pentane.
6. The unit shall have the alarm set at 10 percent for LEL.

TRAINING

Any personnel performing hot work on residue/loaded rail cars must receive applicable training including but not limited to Hazard Assessment, WHMIS, and in some

circumstances Transportation of Dangerous Goods. Employees performing the tasks described in the procedure must also be aware of the commodity present in the particular car they are working on.

Personnel performing calibrations, bump testing, or other gas testing must be trained on the specific use and limitations of the particular gas detection devices they are using.

REFERENCES

1. Canada Labour Code R.S.C., 1985, c. L-2, Part II – Occupational Health and Safety
2. Canada Occupational Health & Safety Regulations (SOR/86-304)
3. PSP-S-03 - PROCOR Limited Standard Responsible Care Standard for Hot Work On Residue/Loaded Rails Cars
4. NFPA 51B - Fire prevention in the use of cutting and welding Processes
5. CSA W117.2-12 Safety in Welding, cutting, and allied processes
6. ANSI Z49.1:2012 Safety in Welding, Cutting, and Allied Processes
7. Canadian Centre for Occupational Health & Safety http://www.ccohs.ca/oshanswers/safety_haz/welding/hotwork.html

Ontario Northland

DATE FORMALIZED February 2019 REVISED September 2021	**Contractor/Subcontractor**

POLICY STATEMENT

In keeping with our values of safety, accountability, and continuous improvement, Ontario Northland Transportation Commission (ONTC) adheres to the requirements of the Canada Labour Code and all applicable Regulations, by ensuring that all selected contractors and subcontractors meet the set health and safety standards associated with each project.

All work shall be done safely no matter how urgent the job is and ONTC will assure that all contractors and subcontractors working on any ONTC property and/or project will following this guideline, adhering to all health and safety legislation and working in a manner that puts the safety of each employee/worker and the environment as the top priority.

PURPOSE

The purpose of this policy is to ensure that the health and safety of all Ontario Northland Transportation Commission (ONTC) employees, equipment, property and the environment are protected when work is being performed by an outside agency.

To ensure that all contractors retained by the ONTC are compliant with ONTC policies, procedures, standards, and applicable legislation.

To ensure that all contractor employees and ONTC employees are provided with a safe and healthy work environment.

To eliminate or minimize the risk of loss to employees, equipment, property and the environment.

To minimize corporate liabilities.

APPLICATION AND SCOPE

This procedure applies to all ONTC divisions and departments that require the services of an outside agency to perform work at any level.

DEFINITIONS

Adequate: in relation to procedure, plan, material, device, object or thing, means

a) Sufficient for both its intended use and actual use, and
b) Sufficient to protect a worker from occupational illness or occupational injury

Competent Person: a person who is,

a) Qualified because of knowledge, training, and experience to organize the work and its performance
b) Is familiar with the Occupational Health and Safety Act and/or the Canada Labour Code and the regulations that apply to the work, and
c) Has knowledge of any potential or actual danger to health or safety in the workplace

Construction: includes erection, alteration, repair, dismantling, demolition, structural maintenance, painting, land clearing, earth moving, grading, excavating, trenching, digging, boring, drilling, blasting, or concreting, the installation of any machinery or plant, and any work or undertaking in connection with a project, but does not include any work or undertaking in a mine.

Constructor: a person who undertakes a project for an owner and includes an owner who undertakes all or part of a project by himself/herself or by more than one employer.

Contractor: any person or entity contracted to provide service to ONTC.

Employer: a person who employs one more workers or contracts for the services of one or more workers and includes a contractor or subcontractor who performs work or supplies services and a contractor or subcontractor who undertakes with an owner, constructor, contractor or subcontractor, to perform work or supply services.

Prescribed: means prescribed by a regulation made under the Occupational Health and Safety Act or Canada Labour Code

Project: a construction project whether public or private, including

a) The construction of a building, bridge, structure, industrial establishment, mining plant, shaft, tunnel, caisson, trench, excavation, highway, railway, street, runway, parking lot, cofferdam, conduit, sewer, watermain, service connection, telegraph, telephone or electrical cable, pipeline, duct or well, or any combination thereof,
b) The moving of a building or structure, and
c) Any work or undertaking, or any lands or appurtenances, used in connection with construction

Project Administrator: a person who leads/coordinates work project.

Regulation: the regulations made under the Occupational Health and Safety Act or the Canada Labour Code.

MATERIAL REQUIRED

Contractor Safety Checklist and Orientation Form
ONTC Contractors Safety Requirements & Liability Release Form
Project Hazard Assessment
Contractor Orientation Training Package

PROCEDURE

Before Contractors/Subcontractors begin work/project ensure the following is adhered to:

- Ensure that all contractors on the property are compliant and current with all legislative licensing requirements.
- Ensure that all contractors provide a valid WSIB Clearance Certificate and/or liability insurance before beginning any work on ONTC property.
- Provide orientation training to contractors prior to commencement of work.
- Ensure contractors understand their contractual obligations under this standard.
- Provide a designated ONTC contact person to ensure contractors compliance to ONTC policies, procedures and standards through ongoing work site inspections, communications and reported safety concerns.
- Ensure that application of this standard is delivered and used consistently throughout ONTC operations.

Responsibilities

The responsibility of health and safety can become complex when contractors/subcontractors are procured to conduct work for any ONTC project.

To ensure clarity of responsibility, where a contractor is hired to conduct work for ONTC and the Provincial Occupational Health and Safety Act applies in respect of that work, the Contractor will be deemed the Constructor.

No ONTC employee will be assigned to work on the same project as the general contractor, unless there is an agreement between the Contractor and ONTC determining the contractor as the Constructor.

Where a project requires more than one employer, ONTC may enter into an agreement before the commencement of the project to determine control over the project identifying who will be the constructor.

Employer

The employer is responsible to:

- Ensure contractors, employees, supervisors and managers are adequately aware of the provisions and requirements of the POL Purchasing Policy and Procedure.

- Ensure that contractors, subcontractors and project worker companies are adequately prequalified in accordance with the Contractor Safety Prequalification Form for large projects or projects where the combined value of the project exceeds $50,000.00 and where ONTC is the Constructor.
- Ensure contractors, subcontractors and project worker companies have agreed with and endorsed in writing, the terms of the Contractor Health and Safety Responsibility Agreement.
- Properly implement and periodically audit the contractor prequalification and safety procedure.
- Ensure that authorized staff comply within the Contractor Prequalification and Safety Procedure.
- Discipline and or remove from the authorized contractors list any contractor that fails to comply with this procedure.

Procurement

The Procurement Department is responsible to:

- Conduct prequalification in conjunction with the Project Administrator for consultants and service providers and ensure the completion of the Contractor Health and Safety Responsibility Agreement and the Contractor Prequalification Form (as required) before any work is initiated on any of the ONTC properties;
- Maintain a list of all service agreements, memorandums of understanding, service contracts; and
- Obtain a current copy of WSIB Clearance Certificates and Insurance Certificate for pre-qualified consultants and service providers.

Project Administrator

The Project Administrator is responsible to:

- Contract a pre-qualified contractor;
- Ensure contractors, subcontractors and project worker companies are prequalified in accordance with the Contractor Safety Prequalification Form;
- Ensure the contractor completes the Contractor Orientation Training with the contractor's workers prior to the beginning of a project;
- Complete with the contractor and maintain the Project Hazard Assessment;
- Request applicable training records, certificates, licenses, and written procedures and measures from the contractor as required;
- Ensure the Contractor Health and Safety Responsibility Agreement is completed by the contractor prior to the beginning of work;
- Conduct Safety briefings with the contractors prior to the work beginning and as required by the project;
- Periodically view the work areas to ensure compliance with the Act, associated regulations and the relevant ONTC safety procedures;
- Respond to safety concerns from contractors and others impacted by a project; and
- Ensure all relevant ONTC safety procedures are being implemented at the project.
- Ensure all contractor has provided SDS for all hazardous product used and that the SDS are readily available if stored on ONTC property.

Where a Contractor is hired to perform work for ONTC and the work is subject to the requirements of the Occupational Health and Safety Act, the Contractor will be the Constructor. The aforementioned duties or similar must be completed by the contractor. **Note:** the Contractor – Constructor will be required to utilize their own prequalification and safety contract documents for any and all subcontractors hired to perform work on the project.

Contractors

Contractors are responsible to:

- Employ competent Supervisors and Workers;
- Comply with the Contractor Prequalification and Safety Procedure;
- Complete the ONTC Project Hazard Assessment and Contractor Health and Safety Responsibility Agreement;
- Furnish the ONTC with hard copies of applicable training records, certificates, licenses and written procedures and measures as required;
- Ensure that the Contractor Safety Checklist and Orientation form completed and signed;
- Notify the project administrator of any questions or concerns with Contractor Prequalification and Safety Policies;
- Notify the project administrator of any contraventions of the Act or ONTC's Procedures; and
- Participate in required safety training
- Provide WSIB documentation confirming the contractor is registered and their account is in good standing.
- Provide proof of liability insurance.
- Have all products used in their process evaluated by ONTC personnel prior to the products being brought onto ONTC property. This will be done through the evaluation of Safety Data Sheets (SDS) provided by the contractor/subcontractor.
- Ensure copies of all SDS are readily available.
- Immediately inform designated ONTC contact person of any changes in their process or products used in their operation.
- Prior to entering ONTC property, register with Security, appropriate supervisor or designated ONTC contact person for direction.
- Ensure that all equipment and vehicles are properly maintained and meet prescribed safety standards for that piece of equipment, e.g. no loose pins on backhoe extensions or arms, safety pins and safety features are working properly.

Workplace/Policy Health and Safety Committees

The WHSC/PHSC are responsible to:

- Participate in the development and review of the contractor subcontractor policy, procedure, and applicable forms; and
- Provide a resource to employees in regards to the contractor subcontractor policy, procedure, and applicable forms

Manager Health and Safety

The Manager of Health and Safety is responsible to:

- Provide assistance if needed with prequalification process of contractors as requires by the Purchasing Department and/or the Project Administrator;
- Approve/disapprove exceptions of the Contractor Safety Prequalification process.
- Facilitate in the development and review of the contractor subcontractor policy, procedure, and applicable forms; and
- Apply, audit and discipline compliance specific to the contractor subcontractor policy, procedure, and applicable forms.

TRAINING:

ONTC is responsible to ensure that those ONTC personnel who have duties and responsibilities to act under this procedure are adequately trained in these duties as applicable.

The training shall reinforce the hazard control hierarchy as follows:

- **Elimination**: activities or practices that involve the complete removal of the hazard from the worker in the workplace.
- **Substitution**: involves the replacement of high hazard task or workplace circumstance with a lower hazard task or workplace circumstance.
- **Engineering Controls**: involve creating and using designed infrastructure or equipment to minimize a hazard.
- **Administrative Controls**: involves creating protocols, involving stated obligations and prohibitions that change the way people work.
    - **Warning Signs**: are postings and placards that communicate the presence of a hazard as well as hazard control directives.
- **Personal Protective Equipment (PPE)**: involves the use of gear that is worn by the worker to create a barrier between the hazard and the worker. PPE can include gloves, respirators, hard hats, safety glasses, high-visibility clothing, and safety footwear.

The Manager of Health and Safety will ensure that the training is refreshed at adequate frequency.

Retraining will be provided for all authorized workers or contractors whenever there is a change in their job assignments, a change in condition, equipment or processes that present a new hazard, or when there is a change in the Contractor Safety Prequalification Process.

Additional retraining shall also be conducted whenever a periodic inspection reveals, or whenever there is reason to believe, that there are deviations from or inadequacies in the worker's knowledge or use of the Contractor Safety Prequalification Process. The Project Hazard Assessment will be updated to add any additional hazards and corresponding controls, as required.

PROCEDURE:

General Information

The Project Administrator shall establish practices so that all contractors, subcontractors, or contract workers perform their work in a safe and effective manner and meet all the requirements of the Occupational Health and Safety Act, the Canada Labour Code and the Construction Regulations. The Project Administrator must be adequately familiar with all applicable laws, codes and regulations and be capable of applying them.

Where ONTC retains a "Contractor to act as Constructor"

- ONTC is not responsible for ensuring that the requirements of the applicable regulations are met for contractor activities on site, where ONTC has retained a "Contractor who fulfils the role of the constructor" who fully controls all work at a construction site. (Pre-award, ONTC should ask what a candidate Contractor-Constructor company does to prequalify contractors (and subcontractors) to determine how the Constructor proposes to maintain adequate safety on site. Once the project is awarded, ONTC should not involve itself in the project in any way that could be interpreted as "material control" that is strictly the Constructor's duty).
- When ONTC retains the "contractor to act as constructor" for construction project: The ONTC does not have the health and safety responsibilities for this type of construction project, as long as the constructor completely controls all work and the ONTC workers are not intermingling in the project and ONTC is not controlling the project in any way.

ONTC will ensure that all contractors/subcontractors are properly trained, ensure that contractors/subcontractors are monitored and that requirements for safety are observed by the contractor, and that procedures for safe conduct of the work are in place and known to contractor employees.

The Project Administrator shall direct the contractor in completion of all applicable documentation, as described by the Contractor Safety Prequalification Procedure. The Project Administrator shall ensure that the constructor maintains full responsibility for safety on the particular job.

If the work is Non-Construction work where ONTC is acting as the "Employer"
The Project Administrator shall review the ONTC's applicable policies and procedures with the contractors/subcontractors. It is recommended that all contractor/subcontractor workers undergo this training orientation, but it is mandatory that at lease the contractor's supervisor or site superintendent receive the training orientation and then have a method to ensure that this information is passed on to all employees under their direct control. Please note that the requirement of "Lead Employer" must be fulfilled if the work is Confined Space Entry work.

It is the responsibility of the Project Administrator to ensure that the contractor is aware that project specific training is to be conducted.

The Project Hazard Assessment form shall be completed by the Project Administrator and reviewed with all contractors prior to commencement of work.

Contractors/subcontractors that regularly perform services at ONTC must complete a Contractor Training Orientation on annual basis or whenever there is a change in personnel or applicable and safety conditions which may affect the contractor's/subcontractors workers. For project contracts, a Hazard Safety Assessment form will be completed each time the contractor performs a new project, unless the same contract personnel had performed project work of a similar nature within the previous 12 months.

Prequalification

Pre-Qualification of a contractor is designed to ensure that the contractor has:

- Appropriate current and sufficient insurance;
- WSIB Coverage;
- An appropriate and compliant health and safety policy;
- Competent supervisors; and
- A program to completely undertake and control the construction work being conducted at ONTC

When pre-qualifying a contractor who will not act as "Constructor" ONTC shall determine whether the contractor has the specific policies, procedures, training and supervision to perform the job safely and in compliance with all provisions of the OHSA and the applicable regulations. Use the Contractor Safety Prequalification form to fulfill this policy obligation.

If the procurement department is completing the prequalification procedure, input may be required from the Manager of Health and Safety or the Project Administrator if there are specific requirements for a project.

The following items must be submitted by the contractor for prequalification:

- Certificates of insurance – general liability insurance (Minor projects $2,000,000 minimum, Major Projects $5,000,000 minimum)
- WSIB Safety Record – submit a copy for the last 3 years or equivalent accident/injury data.
- Current Clearance certificate – Confirms contractor has met reporting and payment obligations to WSIB. ONTC will be required to receive a copy of the clearance certificate every 2 months and before the final payment on the contract has been made.
- Contractor's Health and Safety Policy.
- Past Environmental, Health and Safety Records – a copy for the last 2 years.
- Training and Certification Records – Contractor must provide documentation verifying all workers have received the necessary safety training required for the specific job.
- Hazardous material list – the contractor must submit a list of all hazardous materials that will be brought onto ONTC property.
- ONTC may require a separate work plan detailing higher hazard work activity or any tasks that may tend to produce adverse.

The Project Administrator will ensure that the Contractor Health and Safety Responsibility Agreement has been completed by the contractor.

The Project Administrator will ensure current copies of insurance, and WSIB clearance certificates, and annual safety reviews are maintained for pre-qualified contractors.

Contractors that have already been pre-qualified should be reasonably favoured and used for OTNC projects.

Project Management
In all circumstances except where a Contractor has formally taken on the role of Constructor, the Project Administrator is responsible for the health and safety on the project, and must halt the project if there are health and safety concerns. The Project Administrator must maintain communication with the contractor throughout the project.

The Project Administrator will be responsible to ensure that all health and safety documentation for the project is completed and maintained.

The Project Administrator is responsible to obtain an ONTC Project Assessment Folder and complete it with Contractor prior to any work beginning.

- Signed Contractor Safety Responsibility Agreement;
- Certificates of Insurance – General Liability Insurance;
- WSIB Safety Record;
- Current Clearance Certificate;
- Contractor's health and safety policy and procedures applicable to the work being conducted;
- Training, licensing and certification records;
- Hazardous materials list and current SDS for material brought onto ONTC property and already onsite that will be used during or encountered during the project;
- Completed Contractor Orientation Training Records;
- And copies of any applicable ONTC procedures that have been reviewed; and
- Completed Contractor Prequalification form.

The Project Hazard Assessment form must be filed once the project has been completed and made available for review if required for auditing purposes.

The Project Administrator must ensure that the Contractor Orientation Training is completed for all workers on the project.

On-Site Safety – All ONTC safety procedures (Fall protection, Confined Space Entry, Lockout/Tagout, Ladder Safety, WHMIS, Personal Protection Equipment, Respiratory Protection, etc.) apply at all construction on ONTC projects.

The Project Administrator shall review all applicable safety procedures with contractors/subcontractors at the site. Copies of the ONTC procedures can be obtained through the Project Administrator.

The Project Administrator will ensure that daily safety briefings are conducted prior to the beginning of each project work day, as well as regularly inspect the work site as the project requires.

If the contractor or subcontractor has a question or concern regarding safety on the project, they should speak to the Project Administrator or their immediate supervisor.

All contractor(s) or subcontractor(s) supervisors must report to the Project Administrator:

- Any unsafe actions or conditions,
- Contraventions of the OHSA/CLC and regulations or any ONTC safety procedure, or
- Existence of any hazard at the project.

Any incident (first aid, near miss, etc.) on the project must be immediately reported to the Project Administrator.

NOTE: Workers and their supervisors shall be held accountable for violations of health and safety rules, regulations, and procedures. Disciplinary action, where necessary, will be dictated by the ONTC disciplinary procedure and will be based on the merits of the specific case.

APPENDICES/EDUCATIONAL MATERIAL:

- Contractor Safety Prequalification Form
- Contractor health and Safety Responsibility Agreement
- Contractor Orientation Training Checklist
- Project Hazard Assessment

REFERENCES:

- Ontario Occupational Health and Safety Act R.S.O 1990
- O.Reg 213/91 Construction Projects
- Canada Labour Code R.S.C., 1985 c L-2
- Canada Occupational Health and Safety Regulations SOR/86-304
- Contractors Subcontractors Safety NBRHC OH&S4-017

PART 4

REQUEST FOR PROPOSALS

FORM OF PROPOSAL

Note: Respondent is required to complete Part 4 in its entirety in order to be considered as having submitted a complete Proposal. Part 4 will be provided in Word format to Respondents who return Schedule 2-B – Participation Registration Form.

PART 4 – FORM OF PROPOSAL
PROPOSAL FORM 1
PROPOSAL SUBMISSION FORM

RFP Number: RFP 2025 083

Description: Grit Blast Upgrade

Submitted To: ONTARIO NORTHLAND TRANSPORTATION COMMISSION

We, _____
(*Name of Respondent)*

having carefully examined, understood, and completed the Request for Proposals Documents as described in Section 2 – The RFP Documents, and Addenda No. ___to No. __, inclusive, and having familiarized ourselves thoroughly with local conditions, hereby agree to supply the services associated with the Grit Blast Upgrade as outlined on the following Proposal Form 1-A.

Each Respondent shall select **one** of the options identified below. The price submitted in Proposal Form 1-A must align exclusively with selected option and encompass all associated costs to complete the specified Scope of Work.

Contractor shall use the lowest price (Option 1 or Option 2) as their base price.

Option 1: AECOM Design Provided ☐

Option 2: BlastOne or Equivalent Turnkey System for Blast Booth & Dust Collector ☐

- **Blast Booth & Dust Collector System**

The contractor has the option to price the Dust Collector and the Blast Booth System as per AECOM's Design or Propose a Turnkey System equivalent to BlastOne System (See attached BlastOne Specs); If the contractor chooses to propose a Turnkey System, their price should include any additional work, design and adjustment required. **All other items should be priced as per drawings**.

The price set out in Proposal Form 1 shall include any specified allowance, and all taxes (**excluding HST)** except as may be otherwise provided in the RFP Documents, and to furnish all materials, labour, equipment and transportation to perform the entire Work described in the RFP Documents, in the manner prescribed therein, and in accordance with the specifications.

PRICING FOR CHANGE ORDERS / CHANGE DIRECTIVES:

Please quote overhead and profit percentage based on the following project cost ranges:

Project Costs	Overhead %	Profit %
$0 up to $9,999		
$10,000 up to $49,999		
$50,000 up to $99,999		
$100,000 up to 149,999		
$150,000 up to $200,000		
$200,000 and higher		

PART 4 – FORM OF PROPOSAL
PROPOSAL FORM 1 *cont'd*
PROPOSAL SUBMISSION FORM

Please note that these project cost ranges apply to the *aggregate* price of all change orders and not on a per change order basis. Any OH&P applied shall be calculated against the subtotal of the applicable change order only. ONTC reserves the right to not accept the percentage values provided in the table above and any future change order markups will be reviewed and agreed upon by ONTC and contractor.

Please provide the hourly rate of pay for the following (add an additional page for any Positions not listed below):

Position	Hourly Rate
Project Manager	
Estimator	
Scheduler	
Civil Engineering	
Site Supervisor	
Carpenter	
Electrician	
Mechanical Engineer	
Mechanical HVAC technician	
Masonry/Concrete Labour	
General Labour	

The award of the Contract is subject to budgetary approval.

ONTC reserves the right, in its sole discretion, to disqualify any Respondent that is a U.S. Business as defined in Proposal Form 2.

ONTC reserves the right in its sole discretion to sub-divide and/or bundle the Goods and/or Services which are the subject of this RFP and award one or any number of separate contracts for the Goods and/or Services.

Proposal Forms:

The information contained in the Proposal Forms, as listed in the Request for Proposals and attached hereto, forms an integral part of this Proposal.

Declarations:

We hereby declare that:

(a) We will execute the Agreement within ten (10) Working Days of receipt of the Final Agreement;

(b) We agree to perform and fully complete the Work on or before the agreed upon schedule;

(c) The Work is to start no later than the agreed upon start date in the schedule;

(d) Work is deemed to be complete when Work has achieved Substantial Performance as defined in the *Construction Act*;

(e) The statutory holdback pursuant to the Construction Act will be 10% and a warranty holdback of 2.5%;

(f) We will provide the required evidence of insurance, as specified in the ONTC – Supplementary Conditions – CCDC 2 - 2020 included in Part 5 of the RFP Documents, with our execution of the Agreement;

(g) For the General Liability Insurance, Ontario Northland Transportation Commission is to be included as an additional insured;

(h) Coverages and limits of insurances will be provided and maintained by all Subcontractors in accordance with subsection (f) above;

(i) No person, corporation or other legal entity other than the undersigned has any interest in this Proposal or in the proposed Contract for which this Proposal is made;

(j) This Proposal is irrevocable for a period of ninety (90) days from the Submission Deadline;

(k) It is understood and agreed that if this Proposal is accepted, we will not commence the Work until we have executed the Final Agreement and delivered it to ONTC and/or we are advised in writing by ONTC to proceed with the Work;

(l) All copies of plans and specifications and other said RFP Documents furnished to us for the purpose of this Proposal are the property of ONTC and shall be kept confidential and not divulged in any manner by us. They will not be used on other work by us and will be returned to the issuing office when requested or promptly when not bidding; and,

(m) We have no right to reimbursement by ONTC for expenses, both direct and indirect, which may have been incurred by us in preparing this Proposal or otherwise participating in the RFP Process.

PART 4 – FORM OF PROPOSAL
PROPOSAL FORM 1 *cont'd*
PROPOSAL SUBMISSION FORM

Signed and submitted for and on behalf of:

Contractor: _____
(Company Name)

_____
(Street Address or Postal Box Number)

_____
(City, Province and Postal Code)

Signature: _____
I have authority to bind the corporation.

Name and Title: _____

_____

Email: _____

Date at _____ this _____ day of _____, 2025

PART 4 – FORM OF PROPOSAL
PROPOSAL FORM 1-A
PROPOSAL SUBMISSION FORM
SCHEDULE OF PRICES

Please refer to the separate Schedule A – Schedule of Prices excel worksheet. This form must be completed as part of the Proposal.

PART 4 – FORM OF PROPOSAL
PROPOSAL FORM 2
RESPONDENT'S GENERAL INFORMATION

The Respondent must complete this document and submit it as part of their Proposal.

Name *Please indicate the complete legal name of the firm*	
Tax Registration # (HST)	
Tax Registration # (GST)	
Tax Registration # (QST)	
Address	
Telephone Number	
Web Address	
Please indicate any other name(s) under which the firm operates *(if applicable)*	

Owner ☐ Partnership ☐ Corporation ☐

Relationship *(if applicable)*

Parent Company	
Subsidiaries	
Affiliates	

Ontario Business ☐ Yes ☐ No

"Ontario Business": A supplier, manufacturer or distributor of any business structure that conducts its activities on a permanent basis in Ontario. The business either has its headquarters or a main office in Ontario or has at least 250 full-time employees in Ontario at the time of this RFP.

Canadian Business ☐ Yes ☐ No

"Canadian Business": A supplier, manufacturer or distributor of any business structure that conducts its activities on a permanent basis in Canada. The business either has its headquarters or a main office in any province or territory within Canada or has at least 250 full-time employees in any one province or territory within Canada at the time of this RFP.

Canadian Trade Partner Country: ☐ Yes ☐ No

"Canadian Trade Partner Country": A country that is signatory to one or more of the following trade agreements:

- Comprehensive Economic and Trade Agreement (CETA);
- World Trade Organization's Agreement on Government Procurement (WTO-GPA);
- Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP); or,
- Canada-UK Trade Continuity Agreement (Canada-UK TCA).

PART 4 – FORM OF PROPOSAL
PROPOSAL FORM 2 *cont'd*
RESPONDENT'S GENERAL INFORMATION

U.S. Business: ☐ Yes ☐ No

"U.S. Business": A supplier, manufacturer or distributor of any business structure (including a sole proprietorship, partnership, corporation or other business structure) that (i) has its headquarters or main office located in the U.S., and (ii) has fewer than 250 full-time employees in Canada at the time of the applicable procurement process. If a Respondent is a subsidiary of another corporation, part 1 of the definition above is met if that Respondent is controlled by a corporation that has its headquarters or main office located in the U.S.

If the Respondent has not demonstrated eligibility with a "No" response to being a U.S. Business, ONTC reserves the right, in its sole discretion, to disqualify the Respondent.

Bill S-211:

ONTC adheres to, and reports under the Government of Canada's Bill S-211 Fighting against Forced Labour and Child Labour in Supply Chains Act.

1. Is your company required to report under the Government of Canada's Bill S-211 Fighting against Forced Labour and Child Labour in Supply Chains Act? Yes ☐ No ☐

2. Is your company compliant with the Government of Canada's Bill S-211 Fighting against Forced Labour and Child Labour in Supply Chains Act? Yes ☐ No ☐

3. Has your company been involved in forced and/or child labour in the past? Yes ☐ No ☐
   If yes, please provide details including the date and action taken to mitigate.

_____
_____
_____
_____
_____

Main Contact Person *(for the purposes of this Proposal)*

Name	
Title	
Telephone #	Fax #
E-mail address	

Indicate below your company/business' invoice terms:

_____

PART 4 – FORM OF PROPOSAL
PROPOSAL FORM 2 *cont'd*
RESPONDENT'S GENERAL INFORMATION

Does your company/business have the capability to handle Electronic Funds Transfers?

YES_____ NO_____

If yes, please provide the necessary banking information as part of your submission.

If available, please provide your Dunn & Bradstreet Reference Number:

_____

How many years of experience does your company have in the provision of goods or services proposed herein? ☐

Subcontractors

The Respondent must indicate where they will use subcontractors for specific services.

Description of Services	Subcontractor's Name	% Contract Value	Telephone Number

PART 4 – FORM OF PROPOSAL
PROPOSAL FORM 3
ACKNOWLEDGMENT TO COMPLY WITH PART 3 - REQUEST FOR PROPOSALS SPECIFICATIONS

ONTC is committed to procuring goods and services through a process that is conducted in a fair and transparent manner, providing equal opportunity to vendors.

ONTC endeavors to provide specifications that meet the requirements of the procurement without naming specific brands. However, there may be instances where a third-party consultant prepares a specification on behalf of ONTC, and a specific brand is named. In these instances, alternatives may be used if deemed equal by ONTC and/or the third-party consultant. Respondents shall submit proposed deemed equivalents as a clarification item to be considered while the procurement remains open in accordance with the requirements of Part 1, Section 3, item 3.2 Questions and Communications Related to the RFP Documents.

Respondent acknowledges that they can fully comply with Part 3 – Request for Proposals Specifications.

(Check one) YES_____; NO_____

If the Respondent indicates “NO”, they shall provide details as an attachment to this Proposal Form 3, indicating how they will deviate from the requirements identified in Part 3 – Requests for Proposals – Specifications.

PART 4 – FORM OF PROPOSAL
PROPOSAL FORM 4
REFERENCES

The Respondent must supply here the reference information of three (3) relevant customers for which they have provided similar services within the last five (5) years. **ONTC is NOT to be listed as a Reference.**

Reference #1

Company name	
Location	
Description of services provided	
Start and end dates	
Value of the contract	
Contact person name and title	
Phone	E-mail

Reference #2

Company name	
Location	
Description of services provided	
Start and end dates	
Value of the contract	
Contact person name and title	
Phone	E-mail

Reference #3

Company name	
Location	
Description of services provided	
Start and end dates	
Value of the contract	
Contact person name and title	
Phone	E-mail

PART 4 – FORM OF PROPOSAL
PROPOSAL FORM 5
COMPLIANCE WITH CONTRACT DOCUMENTS

The Respondent may suggest changes to the Supplementary Conditions included in Part 5 of this RFP using the table below. ONTC does not have any obligation to accept any proposed changes to the Supplementary Conditions and will do so in its sole discretion. Significant material proposed changes to the Supplementary Conditions may impact the evaluation of the Respondent's proposal. ONTC will not accept any material changes to the clauses in the Supplementary Conditions relating to Confidentiality, Personal Information, Intellectual Property ownership and infringement, Indemnification, Limitation of Liability or rights of ONTC on termination. ONTC, as an Ontario Crown corporation, is unable to provide indemnities pursuant to s.28 of the *Financial Administration Act* (Ontario).

Exception	Supplementary Conditions, ONTC Schedule, Article, or Sub-Clause	Existing Wording	Respondent's Proposed Wording	Reason for Proposed Change
1				
2				
3				
4				
5				
6				
7				
8				
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10				
11				
12				
13				
14				
15				
16				
17				
18				

PART 4 – FORM OF PROPOSAL
PROPOSAL FORM 6
RESPONDENTS' SITE VISIT REGISTRATION FORM

Reference Number: RFP 2025 083

Title: Grit Blast Upgrade

Submitted To: ONTARIO NORTHLAND TRANSPORTATION COMMISSION

Please confirm that you plan to attend the Mandatory Respondents' Meeting by emailing a completed copy of this Registration Form, together with the Release of Liability, to brinda.ranpura@ontarionorthland.ca, prior to Tuesday, September 23, 2025 at 4:00 p.m.

Failure to submit this form by the time required may result in ONTC not being able to accommodate your attendance. PROPOSALS SUBMITTED BY RESPONDENTS THAT FAILED TO ATTEND THE RESPONDENTS' MANDATORY MEETING WILL BE DECLARED NON-COMPLIANT AND WILL BE REJECTED.

Date of Meeting: Wednesday, September 24, 2025

Time of Meeting: 10:00 a.m.

Location: 916 McIntyre Street E, North Bay, ON P1B 1G3
Registered Respondents are required to meet at the Security Trailer.

COMPANY NAME: _____

CONTACT NAME: _____

ADDRESS: _____

_____

TELEPHONE: _____

EMAIL: _____

NUMBER OF PERSONS ATTENDING: _____

PLEASE BRING THE FOLLOWING PERSONAL PROTECTIVE EQUIPMENT:
SAFETY BOOTS, REFLECTIVE VEST, HARD HAT, AND SAFETY GLASSES WITH SIDE SHIELDS

ACCOMMODATION: ONTC IS AN EQUAL OPPORTUNITY ORGANIZATION. ACCOMMODATION IS AVAILABLE FOR RESPONDENT'S WITH DISABILITIES THROUGHOUT THE PROCUREMENT PROCESS. IF ACCOMMODATION IS REQUIRED, PLEASE CONTACT brinda.ranpura@ontarionorthland.ca.

NOTE: THE ATTACHED RELEASE OF LIABILITY WILL BE REQUIRED TO BE EXECUTED BY ANY PERSONS ATTENDING THE SITE MEETING PRIOR TO ATTENDANCE.

RELEASE OF LIABILITY
IN RESPECT OF ENTERING AND WORKING UPON
ONTARIO NORTHLAND TRANSPORTATION COMMISSION PROPERTY

The undersigned applicant requests permission of Ontario Northland Transportation Commission (hereinafter referred to as "ONTC") to enter on ONTC property to attend a mandatory site meeting commencing at 10:00 a.m. on Wednesday, September 24, 2025, in North Bay, Ontario, associated with RFP 2025 083.

In consideration of ONTC permitting the Applicant and his/her/its employees, servants and agents to enter ONTC property for the purpose of the site meeting, the Applicant agrees it shall:

1. follow all instructions and directions from ONTC representatives while on ONTC property;
2. be liable for any and all damages to persons or property which may arise out of or be connected with the Applicant's entry on ONTC property, and the Applicant agrees to indemnify ONTC against any and all actions, suits, claims, damages, costs, liability and expenses which may arise by reason of the Applicant's operations while on ONTC property.
3. fully indemnify and save harmless ONTC, its officers, directors, employees, consultants, sub consultants, contractors, and agents (collectively “ONTC Indemnitees”) from any kind of liability, suit, claim, demand, fine, action, loss, damage, legal cost and disbursement, or for which ONTC or ONTC Indemnities may become liable or suffer in connection with the Applicant’s entry on ONTC property. For the purposes of this indemnity, ONTC is acting as the trustee of the ONTC Indemnitees. This indemnity section will survive the expiry of this permission;
4. enter on ONTC property at the sole cost, risk and expense of the Applicant; and,
5. release and discharge ONTC, its employees, servants and agents of and from any and all claims and demands of whatever nature and howsoever caused by reason of any loss, damage or injury to person or property which the Applicant or its employees, servants and agents may sustain or suffer while on ONTC property.

DATED AT_____THIS _____ DAY OF_____, 2025.

Applicant_____Witness _____

PART 4 – FORM OF PROPOSAL
PROPOSAL FORM 7
HEALTH, SAFETY AND ENVIRONMENT

Respondents shall review the attached Health and Safety Policy Statement and include the following with their Proposal:

1. Submit a copy of the most recent version of your Health, Safety, and Environmental Protection Policies. Include any documentation/policies for working around active rail.

2. Provide evidence of compliance with the Occupational Health and Safety Act (OHSA), Construction Projects Regulation (O. Reg. 213/91), Environmental Protection Act (EPA), and ONTC's Technical Specifications. For example, include a comprehensive health and safety plan, provide Certificate of Recognition (COR) for the Infrastructure Health and Safety Association (IHSA) or equivalent, demonstrate experience and training in relevant areas, such as working at heights, confined space entry, etc. Include a plan for managing environmental impacts during the project, such as waste disposal, noise control, dust suppression, etc.

3. Submit the attached Contractor Health and Safety Responsibility Agreement.

4. Submit the attached Contractor Safety Pre-Qualification Form and associated supporting documents. The following items must be submitted by the contractor for prequalification:

    - WSIB Safety Record – submit a copy for the last 3 years or equivalent accident/injury data.
    - Current Clearance certificate – Confirms Contractor has met reporting and payment obligations to WSIB. ONTC requires the Contractor to submit a copy of the clearance certificate every 2 months and before the final payment on the contract has been made.
    - Past environmental, Health and Safety Records – a copy for the last 2 years.
    - Training and Certification Records – Documentation verifying all workers have received the necessary safety training required in relation to the scope of the RFP.
    - Hazardous material list – List of all hazardous materials that will be brought onto ONTC property, if applicable.
    - ONTC may require a separate work plan detailing higher hazard work activity or any tasks that may tend to produce adverse consequences.

    Respondents must pass the Contractor Safety Pre-Qualification. Failure to pass will result in disqualification from the procurement process.

DATE FORMALIZED April 2016 REVISED February 2023	**Health and Safety Policy**

POLICY STATEMENT

In keeping with our value of *Safety. Full Stop*. Ontario Northland Transportation Commission (ONTC) / Nipissing Central Railway (NCR) is committed to providing a safe and healthy work environment. Safety is core to everything we do. We don't settle for less, for our people or our customers, even when operating pressures make it difficult to do so.

As part of developing a safety culture, we will collectively strive to prevent accidents and incidents through a risk-based approach with the goal to continuously improve. Employees are required to report safety concerns immediately and can do so without fear of reprisal, while management ensures all employees receive quick follow-up.

We will adopt the latest in systems to improve the reporting, investigation, and implementation of corrective actions, close-out, and trend analysis of accidents and incidents. We will communicate safety and encourage engagement at all levels of the organization, such as during tailgates, briefings, and meetings.

The success of ONTC/NCR safety programs will be ensured through the collective and cooperative efforts of all, including management, employees, unions, and Workplace Health and Safety Committees. All ONTC/NCR members will jointly participate in safety, health and loss prevention initiatives to ensure a safe and healthy workplace for all employees.

Chad Evans
President and CEO

CONTRACTOR HEALTH AND SAFETY RESPONSIBILITY AGREEMENT

In submitting this Proposal, I/We, on behalf of, _____

(legal name of company)

certify the following:

(a) I/We have a health and safety policy and will maintain a program to implement such policy as required by clause 25(2) (j) of the *Occupational Health and Safety Act*, R.S.O. 1990, c.O.1, as amended, (the "OHSA").

The requirements in (a) do not apply to employers with five (5) or less employees.

(b) With respect to the Services being offered in this Proposal, I/We and on behalf of our proposed sub-consultants, acknowledge the responsibility to, and shall:

(i) fulfill all of the obligations under the OHSA and ensure that all work is carried out in accordance with the OHSA and its regulations;

(ii) ensure that adequate and competent supervision is provided as required under the OHSA to protect the health and safety of workers; and

(iii) provide information and instruction to all employees to ensure they are informed of the hazards inherent in the work and understand the procedures for minimizing the risk of injury or illness.

(c) I/We agree to take precautions reasonable in the circumstances for the protection of worker health and safety, as required under the OHSA.

Dated at _____ this ____ day of _____, 202__

An Authorized Signing Officer _____

(Key Contact)

(Title) _____

(Telephone Number) _____

(Firm's Name) _____

(Firm's Address) _____

Ontario Northland

Contractor Safety Pre-Qualification Form

1. Company Identification:				ONTC Use
Company Name:		Telephone:		
Mailing Address:		Fax:		
		E-mail:		
2. Form of Business:				
☐ Sole Proprietor	☐ Partnership:	☐ Corporation		
3. Officers:			Years with the Company	
President / CEO				
Vice President				
Treasurer				
Who is the manager most responsible for health and safety?				
Name:		Title:		
4. How many years has your business operated under its current name?				
5. Under Current Management Since (Date)				
6. Parent Company Information				
Parent Name:				
City:	Province / State:	Postal / Zip Code:		
Subsidiaries:				
7. Insurance Contact Information				
Title:	Telephone:	Fax:		
8. Insurance Carriers:	Type of Coverage:	Telephone		

9. Organization:				
Describe the nature of the work your company specialized in:				
☐		☐		
☐		☐		
☐		☐		
☐		☐		
☐		☐		
10. Are any of the above services that you perform normally subcontracted to others?		☐ Yes	☐ No	

11. Health and Safety Performance

a)	Are any of the above services that you perform normally subcontracted to others?	☐ Yes	☐ No
b)	Can you provide a Workplace Safety & Insurance Clearance Certificate?	☐ Yes	☐ No
c)	Is your company experience rated (CAD-7, NEER)? If yes attach CAD-7 reports for the last 3 years and go to item e). If no, complete item d).	☐ Yes	☐ No
d)	Has an employee of your company suffered a fatal accident or "critical injury" as defined by the *Ontario Occupational Health & Safety Act*? Please provide for the last 3 years: i) total number of lost time accidents by rate group, ii) total number medical aid accidents, iii) total number of hours worked by each rate group	☐ Yes	☐ No
e)	Has your company ever been subjected to a Workwell Audit? If yes, what was your final score? ___	☐ Yes	☐ No
f)	Are there judgements, claims or suits pending or outstanding against your company?	☐ Yes	☐ No
g)	Have you received any regulatory (MOL, MOE, etc.) orders and/or prosecutions in the last 3 years? If yes, provide details of all prosecution and fines for the past 3 years on a separate sheet.	☐ Yes	☐ No
h)	Do you have involvement in provincial safety associations such as the Infrastructure Health & Safety Association (IHSA) and/or Workplace Safety & Prevention Services (WSPS)? If yes, please name:	☐ Yes	☐ No

_____

_____

12. Health and Safety Program and Procedures:

a)	Do you have a written health and safety policy? If yes, include a copy.	☐ Yes	☐ No
b)	Do you have a written health and safety program?	☐ Yes	☐ No
c)	If so, are the following elements addressed?	☐ Yes	☐ No
	i. Participation by all levels in the organization	☐ Yes	☐ No
	ii. Accountabilities & responsibilities for managers, supervisors and employees	☐ Yes	☐ No
	iii. Adequate resourcing for meeting health and safety requirements	☐ Yes	☐ No
	iv. Hazard identification and control	☐ Yes	☐ No
	v. Health and safety performance measurement and evaluation	☐ Yes	☐ No
	vi. Corrective actions implementation	☐ Yes	☐ No

13. Health and Safety Program: Does the health and safety program include procedures and practice documents such as:

a)	Hazardous Energy Control, Lock-out – Tag-out	☐ Yes	☐ No
b)	Confined Space Entry	☐ Yes	☐ No
c)	Working at Heights, Fall Protection	☐ Yes	☐ No
d)	Personal Protective Equipment (PPE)	☐ Yes	☐ No
e)	Portable / Electric Power Tools		
f)	Vehicle Safety	☐ Yes	☐ No

g)	Compressed Gas Cylinders	☐ Yes	☐ No	
h)	Electrical Equipment Grounding Assurance	☐ Yes	☐ No	
i)	Powered Industrial Vehicles (forklifts, cranes, etc.)	☐ Yes	☐ No	
j)	Heavy Construction Equipment (excavators, backhoes, bulldozers, etc.)	☐ Yes	☐ No	
k)	Excavation and Trenching	☐ Yes	☐ No	
l)	Housekeeping	☐ Yes	☐ No	
m)	Accident / Incident Reporting and Investigation	☐ Yes	☐ No	
n)	Hazard / Unsafe Condition Identification, Reporting and Communication	☐ Yes	☐ No	
o)	Workplace Hazardous Materials information System (WHMIS)	☐ Yes	☐ No	
p)	Emergency Action Plan / Evacuation Plan	☐ Yes	☐ No	
q)	Spill Response / Reporting	☐ Yes	☐ No	
r)	Respiratory Protection	☐ Yes	☐ No	
s)	Designated Substances Management	☐ Yes	☐ No	
t)	Waste Staging / Disposal	☐ Yes	☐ No	
u)	Traffic Control	☐ Yes	☐ No	
v)	Hearing Conservation	☐ Yes	☐ No	

14.	Do you have a policy/procedure for terminating contracts of subcontractors who do not comply with the requirements of the *Occupational Health & Safety Act,* associated regulations and / or company safety rules?	☐ Yes	☐ No
15.	Do your employees read, write and understand English to the degree that they can safely perform their tasks without the aid of an interpreter? (*If no, provide a description of your plan to assure that they can safety perform their tasks*)	☐ Yes	☐ No
16.	Do you have personnel certified in Emergency First Aid and CPR on site? If yes, provide copies of certificates of training for site personnel proposed for the project?	☐ Yes	☐ No
17.	Do you have First Aid kits available to your staff?	☐ Yes	☐ No
18.	Does your company use a formalized Health and Safety Plan for conducting large projects?	☐ Yes	☐ No
19.	Does the company conduct pre-placement medical examinations?	☐ Yes	☐ No
20.	Is task-adequate PPE provided to workers?	☐ Yes	☐ No
21.	Are employees trained in PPE care, use and maintenance?	☐ Yes	☐ No
22.	Do you have a corrective actions process for addressing individual health and safety performance deficiencies	☐ Yes	☐ No

23. Equipment and Manuals:			
a. Do you conduct inspections on operating equipment (e.g. excavators, cranes, forklifts, vehicles, etc.) as per regulatory requirements?	☐ Yes	☐ No	
b. Do you maintain operating equipment in compliance with regulatory requirements?	☐ Yes	☐ No	
c. Do you maintain applicable pre-use inspection and maintenance certification records for operating equipment?	☐ Yes	☐ No	
d. Are records available upon request	☐ Yes	☐ No	
24. Subcontractors			
a. Do you use health and safety performance criteria in the selection of contractors?	☐ Yes	☐ No	
b. Do you require your subcontractor to have a written health and safety program?	☐ Yes	☐ No	
c. Are your subcontractors included in	☐ Yes	☐ No	
i. health and safety orientation	☐ Yes	☐ No	
ii. health and safety meetings	☐ Yes	☐ No	
iii. workplace inspections	☐ Yes	☐ No	
iv. health and safety audits	☐ Yes	☐ No	
d. Does the company have a policy for the termination of contracts of subcontractors who do not comply with the Occupation Health and Safety Act, regulations under the Act, contractor rules, programs, protocols policies or procedures?	☐ Yes	☐ No	
e. Does the company have a progressive discipline policy for employees and subcontractors?	☐ Yes	☐ No	
25. Health and Safety Training			
a. Are you aware for the regulatory training requirements for your employees?	☐ Yes	☐ No	
b. Have your employees received the required health and safety training?	☐ Yes	☐ No	
c. Do you have specific health and safety training for supervisors?	☐ Yes	☐ No	
d. Do you keep records of health and safety training for employees?	☐ Yes	☐ No	
e. Are records of health and safety training available on request?	☐ Yes	☐ No	
26. Job Skills			
a. Have employees been trained in appropriate job skills?	☐ Yes	☐ No	
b. Are employee job skills certified where required by regulation or industry standard?	☐ Yes	☐ No	
c. Are certificates available upon request?	☐ Yes	☐ No	
27. Health and Safety Supervision			
a. Does the company have a health & safety coordinator?	☐ Yes	☐ No	
b. Who is the highest ranking safety professional in the company_	☐ Yes	☐ No	

I agree that the above information is true and correct to the best of my knowledge. I also agree to follow all terms and conditions of the Contractor Safety Program at all times while performing work for ONTC. I understand that supporting documentation may be requested for due diligence verification purposes.

Name: (Please print) _____ Title: _____

Signature: _____ Date: _____

PART 4 – FORM OF PROPOSAL
PROPOSAL FORM 8
SCHEDULE OF MATERIALS

SCHEDULE OF MATERIALS - VARIATIONS (AND SOURCES)

VARIATIONS:

MATERIALS SOURCES:
(ADD WHERE REQUIRED)

PART 4 – FORM OF PROPOSAL
PROPOSAL FORM 9
LIST OF EQUIPMENT

List all Equipment, owned or controlled by the Respondent for use on the Work. Such list shall show for each Unit the description of the Unit, capacity, condition, age, present location, the owner's name and all-inclusive hourly rental rates. Such equipment shall be subject to inspection by ONTC to verify the stated information.

ONTC reserves the right to perform random site inspections in order to ensure the Successful Respondent's equipment used to perform the Work coincides with the information provided below. Any deviations may be subject to the terms of the Final Agreement. Any changes to this proposed list of equipment requires prior approval from ONTC.

Quantity	Description	Capacity	Condition	Age	Location	Owner	Daily Rental Rate	Weekly Rental rates

PART 4 – FORM OF PROPOSAL
PROPOSAL FORM 10
SCHEDULE AND PROPOSED APPROACH

CONSTRUCTION SCHEDULE

Respondents shall include a schedule with their Proposal. The schedule shall be in Gantt chart format, showing all activities of the Work. The schedule shall be designed to ensure conformity with the Contract Time. The Contractor shall ensure that the schedule adheres to all contractual requirements and technical submittal requirements. The construction schedule shall reflect the milestone dates listed below:

Critical Path: Respondents are required to identify the critical path in their schedule and also describe it in their proposed approach.

Request for Proposal Close	Friday, October 17, 2025
Start Date	November 03, 2025
Kick-Off Meeting	November 07, 2025
Site Mobilization Date	April 01, 2026 (Or before depending on the procurement progress and equipment delivery)
Substantial Completion Date	January 15, 2027
Final Completion Date	February 01, 2027

Do you agree to complete the entire project by February 1, 2027?

Respondent confirms that they will complete the entire project by February 1, 2027.

(Check one) YES_____; NO_____

ONTC has established the date for Completion of the Work with consideration for strict project timelines. As such, and subject to ONTC's sole discretion, a failure to confirm that the work will be completed by the identified date may result in disqualification of the Proposal.

Note: Respondents should provide justification if they are not able to meet the deadline.

PROPOSED APPROACH

The Respondent shall provide a written narrative plan on their proposed approach for the project, demonstrating their ability to complete the project on budget and on schedule within the timelines identified. The respondent should build in any anticipated delays, supply chain timelines and other factors to provide sufficient time in the schedule to meet provided timelines and mitigate potential delays.

Evidence of a thorough review of the RFP Documents should be apparent in the Respondent's Schedule and Proposed Approach.

PART 4 – FORM OF PROPOSAL
PROPOSAL FORM 11
SCHEDULE OF PROGRESS PAYMENTS

Indicate below, the estimate of the monthly progress billings (gross before holdback) for the duration of the Agreement.

PART 4 – FORM OF PROPOSAL
PROPOSAL FORM 12
LIST OF PERSONNEL

List the names of the key personnel who will be assigned to the Work and **include their full detailed resumes.** This information shall be for the use of ONTC in assessing the Proposal. In the event of a Subcontractor(s) being listed as key personnel, the Respondent shall also include their resume(s).

Roles and Responsibilities of key personnel should include:

- A brief description identifying the role and responsibilities of each key personnel, with respect to the Services requested.
- A statement indicating whether the key personnel is an employee of the Respondent or is a Subcontractor; and,
- A resume for each key personnel, including subcontractors, that includes name, role/title, education and qualifications, professional affiliations, professional certifications, years of experience, specialties, and list of relevant project experience.

The Respondent must designate named individuals for each of the following key personnel roles:

Role	Key Responsibilities	Qualifications and Experience	Name of Individual	Actual Years of Experience
Project Manager	- Manage all project activities, including planning, coordination, communications, reporting, and ensuring adherence to quality, budget, and schedule requirements. - The Project Manager will act as the main point of contact with the Owner.	Experience: Shall have a minimum of five (5-10) years in projects of similar size and complexity in facility design and construction industry.		
Site Supervisor	- A Site Supervisor must be on-site at all times. - The Site Supervisor(s) will be directly overseeing all work, including subcontractors, safety, and quality control. - They are responsible for ensuring all labour and safety requirements are complied with and ensuring the work site is cleaned each workday.	Shall have a minimum of ten (10) years of experience in construction contracts and at least three (3) years of overall construction experience as a Site Supervisor.		

	Will be the single point of contact for the site.	
Health & Safety Site Coordinator	- Shall communicate with the owner as required to ensure work is completed with no impact on owner operations	Shall have at least five (5) years of experience in H&S related work.
Quality Coordinator	- A dedicated Site H&S Coordinator/Champion shall be assigned to make sure contractor follows all the Safety protocols, maintain site H&S rules and coordinate with ONTC when required - A dedicated Site QC Coordinator shall be assigned to make sure all the work is being completed as per contractor's Quality management plan and contract requirement	Shall have at least three (3) years of experience in the same role

Please list all applicable key personnel that will be assigned to the Work in addition to those key personnel provided above:

Roles	**Key Responsibilities**	**Qualifications and Experience**	**Name of Individual**	**Actual Years of Experience**

PART 4 – FORM OF PROPOSAL
PROPOSAL FORM 13
CURRENT LABOUR AGREEMENTS

List the current labour agreements the Respondent has in force covering this type of work in the province in which the Work is to be performed.

PART 4 – FORM OF PROPOSAL
PROPOSAL FORM 14
CONTRACTOR'S QUALIFICATION STATEMENT

1. The Respondent shall include a company profile providing a high-level overview of their company that describes the company's core business and indicates the length of time (number of years) the company has been providing similar services. Include company history, the location of head office, other offices, number of employees per location, corporate philosophy and description of the specific services offered and specialties.

   In the event that the Respondent is using a subcontractor(s) for a portion(s) of the scope of work associated with this RFP, they shall also include with this Proposal Form 14, a company profile for each subcontractor.

2. The Respondent shall supply a minimum of three (3) relevant project descriptions for similar projects. Including value, scope, materials, and construction methods, that have been completed within the last five (5) years. Provide examples of similar projects where you managed risks such as ongoing site operations.

   The project descriptions shall include:
   a) Company/Client
   b) Name of contact and contact details
   c) Project Name
   d) The scheduled project start date, date for substantial performance and the date for Ready-for-Takeover.
   e) The actual project start date, date for substantial performance and the date for Ready-for-Takeover.
   f) The project value of the Respondent's scope of work for the project at the beginning of the project
   g) The project value of the Respondent's scope of work for the project at the end of the project
   h) Detailed description of the Respondent's scope of work for the project. The description should detail if subcontractors were used to complete part of the scope.
   i) Outcomes of the project (i.e., completed on schedule and on budget etc.)

   ONTC may, in its sole discretion, confirm the Respondent's experience in the projects identified by contacting the named contacts above, in addition to the references provided as part of Proposal Form 4.

3. Local Benefit: Does your organization commit to utilizing Ontario's local workforce, vendors, manufacturers, contractors, and/or apprentices/trainees in achieving the project goals and providing the requested services? If no, please provide details.

   Yes ☐ No ☐

ONTC will consider all information submitted in the Respondent's Proposal when evaluating the Respondent's experience.

PART 4 – FORM OF PROPOSAL
PROPOSAL FORM 15
CLAIMS

Submit an up to date list of outstanding, pending or anticipated claims, proceedings, liens or other legal claims, actions or proceedings.

PART 5

REQUEST FOR PROPOSALS

CCDC 2 – 2020 SUPPLEMENTARY CONDITIONS

ONTARIO NORTHLAND - SUPPLEMENTARY CONDITIONS – CCDC 2 – 2020 – REVISED 19 SEPT 2024

AMENDMENTS TO THE AGREEMENT BETWEEN OWNER AND CONTRACTOR

1. ARTICLE A-1 THE WORK

1.1 Delete paragraph 1.3 in its entirety and replace it with the following:

"1.3 commence the *Work* by the __ day of October in the year 2025 and, subject to adjustment in *Contract Time* as provided for in the *Contract Documents,* attain *Substantial Performance of the Work* by the __ day of _____ in the year 2027, and attain *Ready-for-Takeover* by the 31st day of March in the year 2027."

2. ARTICLE A-4 CONTRACT PRICE

2.1 Delete paragraph 4.4 and replace it with the following:

"The *Contract Price* shall remain fixed for the duration of the *Contract* Time, subject only to adjustments as provided for in the *Contract Documents*. For certainty, the *Contractor* assumes all risks in connection with cost increases for Products, labour, and Construction Equipment prescribed by the *Contract Documents* for the performance of the Work, and the *Contractor* assumes all responsibility for liabilities and additional costs that may arise as a result of the *Contractor*'s inclusion of any Product, Construction Equipment, *Supplier*, or *Subcontractor* in its calculation of the *Contract Price*."

3. ARTICLE A-5 PAYMENT

3.1 Delete paragraph 5.1 in its entirety, including all subparagraphs thereunder and replace it with the following:

"5.1 Subject to the provisions of the *Contract Documents* and the *Construction Act*, the *Owner* shall:

.1 make progress payments to the *Contractor* on account of the *Contract Price* when due together with such Value Added Taxes as may be applicable to such payments,

.2 upon Substantial Performance of the Work, as certified by the Consultant, and upon the expiry of the holdback period that follows the publication of the certificate of Substantial Performance of the Work, as stipulated in the Construction Act, there being no claims for lien registered against the title to the Place of the Work and no written notices of lien delivered to the *Owner*, pay the *Contractor* the unpaid balance of the holdback, together with such Value Added Taxes as may be applicable to such payment, less any amount stated in any Notice of Non-Payment that is published by the *Owner* in accordance with the Construction Act, and

.3 after Ready-for-Takeover has been achieved in accordance with the *Contract Documents* and the Work is complete, there being no claims for lien registered against the title to the Place of the Work and no written notices of lien delivered to the *Owner*, pay the *Contractor* the unpaid balance of the *Contract Price* in accordance with GC 5.5. – FINAL PAYMENT, together with such Value Added Taxes as may be applicable to such payment."

3.2 Delete paragraph 5.2 in its entirety and replace it with the following:

"Interest on late payments, if any, will be in accordance with the *Construction Act*."

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

4.1 Delete the text of ARTICLE A-6 RECEIPT OF AND ADDRESSES FOR NOTICES IN WRITING (retaining the provisions setting out the addresses of the *Owner*, *Contractor* and Consultant) and replace it with the following:

"6.1 Notices in Writing between the parties or between them and the Consultant shall be considered to have been received by the addressee on the date of receipt if delivered by hand or by commercial courier during normal business hours or if sent during normal business hours by e-mail during the transmission of which no indication of failure of receipt is communicated to the sender, and addressed as set out below. Such Notices in Writing will be deemed to be received by the addressee on the next Working Day if sent by e-

mail after normal business hours or if sent by overnight commercial courier. Such Notices in Writing will be deemed to be received by the addressee on the fifth Working Day following the date of mailing, if sent by pre-paid registered post, when addressed as set out below. 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."

5. ARTICLE A-9 CONFLICT OF INTEREST

5.1 Add new Article A-9 as follows:

"**ARTICLE A-9 CONFLICT OF INTEREST**

9.1 The *Contractor*, all of the *Subcontractors,* and any of their respective advisors, partners, directors, officers, employees, agents, and volunteers shall not engage in any activity or provide any services where such activity or the provision of such services creates a Conflict of Interest (actually or potentially, in the sole opinion of the *Owner*) with the provision of the *Work* pursuant to the *Contract*.

9.2 The *Contractor* shall disclose to the *Owner*, in writing, without delay, any actual or potential situation that may be reasonably interpreted as either a Conflict of Interest or a potential Conflict of Interest, including the retention of any *Subcontractor* or *Supplier* that is directly or indirectly affiliated with or related to the *Contractor*."

6. ARTICLE A-10 TIME OF THE ESSENCE / LIQUIDATED DAMAGES

6.1 Add new ARTICLE A-10 TIME OF THE ESSENCE/LIQUIDATED DAMAGES as follows:

10.1 It is agreed that one of the reasons the *Contractor* was selected by the *Owner* for this *Contract* is the *Contractor*'s representation and warranty that it will attain Substantial Performance of the Work and Ready-for-Takeover within the *Contract* Time stated in Article A-1.3 of this *Contract*. The *Contractor* acknowledges that it has been advised by the *Owner* that it is critical to the *Owner* that Substantial Performance of the Work and Ready-for-Takeover is achieved within the *Contract* Time. The *Contractor* agrees that time is of the essence in the performance of the *Contractor*'s obligations under this *Contract*.

10.2 The *Contractor* further acknowledges its understanding that the *Owner* is responsible and must account to the Government of Ontario, its customers and passengers and the residents of Northern Ontario. A failure by the *Contractor* to attain Substantial Performance of the Work and Ready-for-Takeover within the *Contract* Time will result in damages to the *Owner* and to the Government of Ontario, its customers and passengers and the residents and businesses in Northern Ontario, which would be difficult or impractical to quantify but would nevertheless have a significant negative impact on the *Owner* and its ability to provide the services the *Owner* is obliged to provide to the residents and businesses in Northern Ontario.

10.3 Given the significance of the requirement for the *Contractor* to achieve Substantial Performance of the Work and Ready-for-Takeover, as described in Article A-10.2, the *Contractor* further acknowledges and agrees that, without limiting the *Owner*'s entitlement to any additional or other damages, if it fails to achieve Substantial Performance of the Work and Ready-for-Takeover within the *Contract* Time, the *Owner* will incur substantial damages and the extent of such damages shall be incapable or very difficult of accurate measurement. Nonetheless, the parties acknowledge that as of the effective date of this *Contract*, the amount of liquidated damages set forth in subparagraph 10.4 below represents a good faith estimate on the part of the parties as to the actual potential damages that the *Owner* would suffer because of late completion of the Project. It is expressly acknowledged and agreed by and between the parties that the amount of such liquidated damages does not include any penalty. Notwithstanding the foregoing, where the Project is delayed beyond the *Contract* Time, the *Owner* shall be entitled to (i) the liquidated damages as calculated pursuant to Article A-10.4, or (ii) in the event that the *Contractor* claims that this liquidated damages provision is invalid or unenforceable and the *Contractor* prevails on such a defence, the damages arising from the delay suffered by the *Owner* including, without limitation, consequential, special, incidental, and indirect damages, costs and other expenses incurred or suffered by the *Owner*.

10.4 The *Owner* shall require that the *Contractor* pay to the *Owner* (or have deducted from *Contract* payments) liquidated damages at the per diem rate set out in the *Contract Documents* for each

calendar day of delay beyond the prescribed date for Ready-for-Takeover until Ready-for-Takeover is achieved and certified, pursuant to the terms of the *Contract*. If there is no per diem rate set out in the *Contract Documents*, the *Contractor* shall pay to the *Owner* the Administration Costs incurred by the *Owner* as a result of the delay.

10.5 Liquidated damages will be assessed as incurred and reflected as deductions from amounts that may be due under any applications for payment pending at the time that such liquidated damages are assessed. All liquidated damages not deducted from payments prior to final payment shall be deducted from the final payment to be made by the *Owner* to the *Contractor* pursuant to GC 5.5 FINAL PAYMENT and any amount of liquidated damages in excess of the final payment amount, shall be paid by the *Contractor* to the *Owner*, within 30 days following a written demand by the *Owner* for such payment.

10.6 The liquidated damages payable under this paragraph are in addition to and without prejudice to any other remedy, action or any other alternative claim that may be available to the *Owner*."

AMENDMENTS TO THE DEFINITIONS

7. DEFINITIONS

7.1 Add the following new definitions:

Acceptance and *Accepted* means the *Owner* and the *Consultant* acknowledges that the work for a *Submittal* has been completed and that the *Submittal* on its face conforms to the requirements of the *Contract Documents*. *Acceptance* does not mean confirmation by the *Owner* or the *Consultant* that the *Submittal* does not contain errors or omissions, defects, deficiencies or deviations from the *Contract Documents.* Wherever the words "acceptance" and "accepted" are used in the *Contract Documents*, they shall have the meaning set out in this definition even if the words are not capitalized.

Administration Costs means those costs and expenses incurred by the *Owner* as a result of carrying out a process or activity due to a delay in the performance of the Work by the *Contractor* and include:

(a) additional fees payable by the *Owner* to the Consultant on a per diem basis according to the Consultant's personnel rates;

(b) the *Owner*'s personnel costs associated with the delay, in an amount solely determined by the *Owner*; and

(c) any additional costs or loss of revenue incurred by the *Owner* due to the delay.

Adjudication means construction dispute interim adjudication as defined under the *Construction Act*.

The *Arbitration Act* means the *Arbitration Act*, 1991, S.O. 1991, c. 17, as amended.

As-Built Drawings means a set of drawings that are marked-up during construction by the *Contractor* that show how the structures and other parts of the *Work* were actually constructed versus how the structures and other parts of the Work were originally designed and "*As-Built Record Drawings*" means the *As-Built Drawings* prepared by the *Contractor* following completion of the *Work* that are *Submitted* to the *Owner* with the *Close-Out Documentation.*

Authority Having Jurisdiction or AHJ means the federal, provincial or municipal entity that is responsible for enforcing codes, standards and regulations relating to building construction, has the power to pass regulations to direct, specify and govern elements or activities of construction projects such as codes, safety, health or standards of manufacture or installation.

Close-out Documentation has the meaning given in GC 5.5.1.2.

Confidential Information means all information of the *Owner* that is confidential by its nature or in the circumstances in which it is received, including without limitation Personal Information and all confidential information in the custody or control of the *Contractor*, regardless of whether it is identified as confidential or not, which comes into the knowledge, possession or control of the *Contractor* in connection with this Contract, but Confidential Information does not include information that:

.1 is or becomes generally available to the public without fault or breach by the *Contractor*, but only after that information becomes generally available to the public;

.2 the *Contractor* can demonstrate to have been rightfully obtained by the *Contractor* without any obligation of confidence from a third party who had the right to transfer or disclose it to the *Contractor* free of any obligation of confidence;

.3 the *Contractor* can demonstrate to have been rightfully known to or in the possession of the *Contractor*, free of any obligation of confidence, when disclosed; or

.4 is independently developed by the *Contractor* without the use of any of the *Owner*'s Confidential Information.

Conflict of Interest includes, but is not limited to, any situation or circumstance where the interests, conduct, other commitments or relationships of a *Contractor*, a *Contractor*'s family member or an officer, director or employee of the *Contractor* could or could be perceived to, directly or indirectly, compromise, impair or be in conflict with the interests of the *Owner*.

Construction Act means the *Construction Act*, R.S.O. 1990, c. C.30, as amended, including all regulations passed under it that are enforceable as of the date of execution of this *Contract*. For certainty, the first procurement process for the Project (i.e., the "improvement" as that term is defined in the *Construction Act*) was commenced on or after October 1, 2019 and Parts I.1 (Prompt Payment) and II.1 (Construction Dispute Interim Adjudication) of the *Construction Act* apply to this *Contract*.

Construction Schedule or construction schedule means the schedule for the performance of the *Work Submitted* by the *Contractor* and *Accepted* by the *Owner* pursuant to GC 3.4 – CONSTRUCTION SCHEDULE, including any amendments to the *Construction Schedule* made pursuant to the *Contract Documents*.

Dispute means all unresolved claims, disputes or controversies of any kind arising out of or in connection with this *Contract* or the carrying out of the Work.

Environmental Contaminants means any substance, material or waste defined, regulated, listed or prohibited by Environmental Laws;

Environmental Laws means all applicable federal, provincial, territorial, municipal and local laws, statutes, ordinances, by-laws and regulations, judgments, decrees, common laws and principles thereof, and orders, directives and decisions rendered or issued by any *Authority Having Jurisdiction* relating to Environmental Contaminants or the protection of human health, natural resources or the environment;

Estimate means a calculation of the quantity or cost of the Work or part of it depending on the context.

Excess Soil means "excess soil" as that term is defined under section 3 of the *Excess Soil Regulation*.

Excess Soil Regulation means O. Reg. 406/19: On-Site and Excess Soil Management to the Environmental Protection Act, R.S.O. 1990, c. E.19, as amended.

Extended Warranty means the extended warranties described in the *Specifications* and *Extended Warranty Period* means the period or periods described in the *Specifications*;

Force Majeure means an event or a cause beyond the control of a party, which may include war, interference by civil or military authorities, civil insurrection, local or national emergency, blockade, seizure, riot, sabotage, vandalism, terrorism, earthquake, flood, act of God, accident, fire, nuclear or other explosion, disease, epidemic, pandemic, quarantine restriction, strike, lockout or other labour disturbance, governmental embargo, or changes to any acts, orders, legislation, regulations, directives, or priorities of any *Authority Having Jurisdiction*; provided such event is not caused by the affected party's negligence, default, failure to exercise reasonable diligence, bankruptcy or insolvency. A *Force Majeure* event or cause does not include an inability to pay or a lack of financial resources unless it is due to a failure of the province to approve the appropriation from the Consolidated Revenue Fund for the *Project.*

Impact Assessment Reports means the impact assessment reports, if any, listed in the RFP related to the Fisheries Act; Navigable Waters Act; Lakes and Rivers Improvement Act; heritage reviews; Endangered Species

Act and Species at Risk Act; terrestrial resources (vegetation, wildlife, other features); socio-economic impacts and Indigenous consultations.

Intellectual Property means any improvement, invention or discovery, whether or not patented or patentable, any technical data, know-how or trade secret, any design, any computer software or any work subject to copyright, whether or not such design or copyright is registered or registrable and all Intellectual Property rights contained, embedded or disclosed in the *Work.*

Notice of Non-Payment means a notice of non-payment of holdback (Form 6) or a notice of non-payment (Form 1.1) under the *Construction Act*, as applicable to the circumstances.

Payment Period or 'payment period' means the fixed segments of time for which the *Contractor* shall be entitled to claim payment for *Work* performed during such period, as agreed upon by the *Owner* and the *Contractor* at the first pre-construction meeting. To be effective, such agreement must be in writing or reflected in the final and approved pre-construction meeting minutes. In the event that the *Owner* and the *Contractor* do not fix the segment of time for each *Payment Period* at the first pre-construction meeting, then each *Payment Period* shall be a one (1) month period during which *Work* was performed, with the start and end dates of each *Payment Period* deemed to be the first (1st) calendar day of the applicable month and the last calendar day of the same month, respectively.

Personal Information means information that relates to an identifiable individual or that identifies or may identify an individual as defined in section 2 of the *Freedom of Information and Protection of Privacy Act,* R.S.O. 1990, *c.*F.31, as amended.

Pre-Invoice Submission Meeting has the definition given to it under GC 5.2.1.

Proper Invoice means a "proper invoice" as that term is defined in Section 6.1 of the *Construction Act* that complies with the minimum requirements set out in Schedule A to the Supplementary Conditions.

Proper Invoice Submission Date is the date referenced in GC 5.2.2.

Restricted Period (Adjudication) means the (inclusive) period of time between November 15 in one calendar year to January 2 in the next calendar year, in any given year throughout the duration of the *Contract*.

Restricted Period (Proper Invoice) means the (inclusive) period of time between December 10 to December 28 in any given year throughout the duration of the *Contract*.

RFP means the procurement documents used by the *Owner* for the procurement of the *Contractor* for the *Project*.

Statutory Declaration means the "Ontario Northland Statutory Declaration of Progress Payment Distribution by *Contractor*" form, attached to the Supplementary Conditions as Schedule "B".

Submittal(s) means all documentation prepared by the *Contractor* and submitted to the *Owner* and/or the *Consultant* for review and *Acceptance* in accordance with the *Contract Documents*.

Third-Party Property Owner means the owner, tenant or other person having the right to use a property.

Warranty Period means the period during which the *Contractor* provides a warranty for the *Work* described in GC 12.3.

Waste Management Plan means the plan to be submitted by the *Contractor* to the *Owner* and the *Consultant* described in GC 3.11.1 and *Waste Management Report* has the meaning described in the Specifications."

7.2 Delete the definition of "*Contract Price*" and replace it with the following:

"*Contract Price* is the amount payable by the *Owner* to the *Contractor* for Work to be completed under the *Contract* in accordance with the method and manner of payment stipulated in the *Contract Documents* and the lump sum price submitted by the *Contractor* in its proposal as stipulated in Article A-4.1 as amended by any Change Orders."

7.3 At the end of the definition of "Drawings", add the following words "and a Waste Management Plan."

7.4 Delete the definition of "*Payment Legislation*".

7.5 Amend the definition of *Ready-for-Takeover* by deleting all the words after "as verified" and replacing them with "and *Accepted* by the *Owner*."

AMENDMENTS TO THE GENERAL CONDITIONS OF THE STIPULATED PRICE CONTRACT

8. GC 1.1 CONTRACT DOCUMENTS

8.1 Where a General Condition or paragraph of the General Conditions of the Stipulated Price Contract is deleted by these Supplementary Conditions, the numbering of the remaining General Conditions or paragraphs shall remain unchanged, and the numbering of the deleted item will be retained, unused.

8.2 Delete paragraph 1.1.3 and replace it with the following:

"1.1.3 "The *Contractor* shall review the *Contract Documents* and shall report promptly to the Consultant any error, inconsistency or omission the *Contractor* may discover. Such review by the *Contractor* shall comply with the standard of care described in paragraph 3.12.1 of the *Contract*. Except for its obligation to make such review and report the result, the *Contractor* does not assume any responsibility to the *Owner* or to the Consultant for the accuracy of the *Contract Documents*. Provided it has exercised the degree of care and skill described in this paragraph 1.1.3 , the *Contractor* shall not be liable for damage or costs resulting from such errors, inconsistencies, or omissions in the *Contract Documents* which the *Contractor* could not reasonably have discovered. If the *Contractor* does discover any error, inconsistency or omission in the *Contract Documents*, the *Contractor* shall immediately notify the *Owner* and shall not proceed with the work affected until the *Contractor* has received corrected or missing information from the Consultant. If the *Contractor* finds discrepancies in and/or omissions from the *Contract Documents* or has any doubt as to the meaning or intent of any part thereof, the *Contractor* must immediately notify the Consultant by means of a written Request for Information ("RFI") and the Consultant will provide written instructions or explanations. Neither the *Owner* nor the Consultant will be responsible for oral instructions."

8.3 Delete paragraph 1.1.4 and replace it with the following:

"1.1.4 Notwithstanding the foregoing, errors, inconsistencies and/or omissions shall not include lack of reference on the drawings or in the specifications to labour and/or Products that are required or normally recognized within respective trade practices as being necessary for the complete execution of the Work. The *Contractor* shall not use RFIs, issued during execution of the Work, in and of themselves to establish a change and/or changes in the Work pursuant to Part 6 – CHANGES IN THE WORK. In the event an RFI or the cumulative effect of RFIs leads to what the *Contractor* considers to be a change in the Work, then the procedure under Part 6 – CHANGES IN THE WORK shall be followed."

8.4 Delete paragraph 1.1.5.1 in its entirety and replace it with new 1.1.5.1:

"the order of priority of *Documents*, from highest to lowest, shall be:

- Special Provisions, if any
- ONTC Special Supplementary Conditions, if any
- ONTC Supplementary Conditions to CCDC 2
- Agreement between the Owner and the Contractor
- Definitions
- General Conditions
- Addenda to the Request for Proposals ("RFP")
- Schedule 2-A to the RFP – RFP Data Sheet
- Schedule 3-A-1 to the RFP – Scope of Work
- RFP Part 4 – Form 8 SCHEDULE OF MATERIALS, if accepted
- Schedule 3-A-2 to the RFP – Technical Specifications
- Schedule 3-A-3 to the RFP – Issue for Tender Drawings
- Schedule 3-A-4 to the RFP – Reference Reports
- Schedule 3-A-5 to the RFP – Policies and Procedures
- Contractor's Proposal in Part 4 of the RFP in response to the RFP"

8.5 Add a new subparagraph 1.1.5.6 as follows:

".6 Schedules of Division 01 - General Requirements of the Specifications shall form part of and be read in conjunction with the technical specification section."

8.6 Add a new sentence to the end of paragraph 1.1.9 as follows:

"The Specifications are divided into divisions and sections for convenience but shall be read as a whole and neither such division nor anything else contained in the *Contract Documents* will be construed to place responsibility on the Consultant to settle Disputes among the Subcontractors and Suppliers in respect to such divisions."

8.7 Delete paragraph 1.1.10 in its entirety and replace it with new paragraph 1.1.10:

"All *Submittals* and *Intellectual Property* rights produced by or resulting from the Work, including all Specifications, Drawings, models and copies thereof, shall vest in the *Owner* and are the sole and absolute property of the *Owner* as and when created. The *Contractor* hereby irrevocably assigns and conveys and agrees to assign and convey, without further consideration, all right, title and interest in and to the Intellectual Property rights produced or resulting from the Work, in perpetuity and throughout the world, to the *Owner* and its successors and assigns. This paragraph 1.1.10 shall survive termination of the *Contract*."

8.8 Add new paragraphs 1.1.12, 1.1.13, 1.1.14, 1.1.15, 1.1.16, and 1.1.17 as follows:

"1.1.12 The *Owner* shall provide the *Contractor*, without charge, an electronic version of the *Contract Documents*.

1.1.13 If an item is shown on one document, and it can be reasonably inferred that it was intended to include work not shown on other related documents, the *Contract Price* shall nevertheless include for the cost of the item of work, unless the Consultant agrees otherwise.

1.1.14 Where a provision in the *Contract* is made for the giving or issuing of any Notice in Writing, consent, Acceptance, approval, certificate or determination by any person, unless otherwise specified such Notice in Writing, consent, Acceptance, approval certificate or determination shall be in writing and shall not unreasonably be withheld or delayed.

1.1.15 The *Contractor* shall keep one copy of the current *Contract Documents*, Supplemental Instructions, contemplated change orders, Change Orders, Change Directives, reviewed Shop Drawings, reports and records of meetings at the Place of Work in good order and available to the *Owner* and the Consultant.

1.1.16 The *Contractor* shall keep one copy of current standards and manufacturers' literature specified in the *Contract Documents* at the Place of Work in good order and available to the Consultant and the *Owner* for the duration of the Work.

1.1.17 The Drawings are, in part, diagrammatic and are intended to convey the scope of the Work and indicate general and appropriate locations, arrangement and sizes of materials. The *Contractor* shall obtain more accurate information about the locations, arrangement and sizes from study and coordination of the *Drawings* and shall become familiar with conditions and spaces affecting these matters before proceeding with the Work. Where site conditions require minor changes in indicated locations and arrangements, the *Contractor* shall make such changes at no additional cost to the *Owner*."

9. GC 1.2 LAW OF THE CONTRACT

9.1 Delete paragraph 1.2.1 in its entirety and replace it with new paragraph 1.2.1:

"This *Contract* shall be governed by and constituted in accordance with the laws in force in the Province of Ontario excluding any conflict of laws principles. The parties hereby irrevocably attorn to the exclusive jurisdiction of the courts of the Province of Ontario for any legal proceedings arising out of this *Contract* or the performance of the obligations hereunder."

10. GC 1.4 ASSIGNMENT

10.1 Delete paragraph 1.4.1 in its entirety and replace it with new paragraph 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, in the case of the *Owner*, is at the sole discretion of the *Owner*. In the event of an assignment of the *Contract* by the *Contractor*, such assignment shall require prior written consent of the *Owner* and shall not relieve the *Contractor* from its obligations and liabilities hereunder."

11. GC 2.1 AUTHORITY OF THE CONSULTANT

11.1 Amend GC 2.1.2. by deleting the words "the *Owner*, the *Consultant* and the *Contractor*" and replacing them with "the *Owner* and the *Consultant*."

12. GC 2.2 ROLE OF THE CONSULTANT

12.1 Amend paragraph 2.2.4 by adding the words "Within 7 calendar days of receipt of the *Contractor*'s Proper Invoice," at the beginning of the paragraph.

- and -

Add to the end of the paragraph the following words "If the Consultant determines that the amount payable to the *Contractor* differs from the amount stated in a Proper Invoice, the Consultant shall immediately notify the *Owner* as provided in paragraph 5.3.1.1 and prepare a draft of the applicable Notice of Non-Payment for the amount in dispute."

12.2 Amend paragraph 2.2.5 by adding to the beginning of the paragraph:

"Except as provided otherwise in the agreement between the *Consultant* and the *Owner*,"

12.3 Amend paragraph 2.2.12 by adding the following to the end of that paragraph:

"The *Supplemental Instructions* are not a change in the *Contract Documents*. If, in the opinion of the *Contractor*, the *Supplemental Instruction* requires an adjustment in the *Contract Price* or in the *Contract* Time, it shall, within three (3) Working Days after receipt of a *Supplemental Instruction* provide the *Consultant* and the *Owner* with Notice in Writing to that effect. Failure to provide Notice in Writing within the time stipulated in this paragraph 2.2.12 shall be deemed an acceptance of the *Supplemental Instruction* by the *Contractor* without adjustment in the *Contract Price* or *Contract* Time."

12.4 Delete paragraph 2.2.18 in its entirety and replace it with the following:

"The *Consultant* shall provide the *Contractor* with editable CAD *Drawings* (the "*Consultant Supplied Drawings*") for the sole purpose of the *Contractor* developing the *As-Built Drawings* and the *As-Built Record Drawings* following submission by the *Contractor* of the release form provided by the *Consultant.* The *Contractor* shall maintain the integrity of the *Consultant Supplied Drawings* and shall ensure that no edits are made to the *Consultant Supplied Drawings*. The *Contractor* may save a copy of the *Consultant Supplied Drawings* to a new file *(the "Duplicate Drawing File")* and make edits to the *Duplicate Drawing File* as required to complete the *As-Built Drawings* and the *As-Built Record Drawings*."

13. GC 2.3 REVIEW AND INSPECTION OF THE WORK

13.1 Add new paragraph 2.3.8 as follows:

"Where inspection and testing services are specified, the service provider employed for such services shall be the service provider named by the *Owner*."

13.2 Add new paragraph 2.3.9 as follows:

"Where standards of performance are specified and the Work does not comply with the specified standard of performance, the deficiency in the Work shall be corrected as directed by the *Consultant*. Subsequent testing to ensure that the standard of performance has been attained (including re-testing by *Owner*), shall be carried out at the *Contractor*'s expense and shall not be paid from the cash allowances described in GC 4.1."

14. GC 2.4 DEFECTIVE WORK

14.1 Add new paragraphs 2.4.1.1, 2.4.1.2, 2.4.1.3 and 2.4.1.4 as follows:

".1 Without limiting the foregoing, the *Contractor* shall rectify, in a manner acceptable to the *Owner* and the *Consultant*, all defective work and deficiencies throughout the Work, whether or not they are specifically identified by the *Consultant*.

.2 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*.

.3 All such corrections of defective work and deficiencies shall be at the *Contractor*'s expense.

.4 If the *Contractor* fails to do the work to correct the defective Work or deficiencies, the *Owner* may carry out such remediation work by its own forces or by other *Contractor*s and the *Owner* shall be entitled to recover from the *Contractor* the costs thereof or may deduct the same from any monies due or that become due to the *Contractor*."

14.2 Add new paragraph 2.4.4 as follows:

"2.4.4 Neither the *Acceptance* of the *Work* by the *Consultant* or the *Owner*, nor any failure by the *Consultant* or the *Owner* to identify, observe or warn of defective *Work* or any deficiency in the *Work* shall relieve the *Contractor* from the sole responsibility for rectifying such defect or deficiency at the *Contractor's* sole cost, even where such failure to identify, observe or warn is negligent."

15. GC 2.5 EMERGENCY SITUATIONS

15.1 Add new GC 2.5 EMERGENCY SITUATIONS as follows:

".1 The *Consultant* or the *Owner* has the right to determine the existence of an emergency situation and, when such an emergency situation is deemed to exist, the *Consultant* may instruct the *Contractor* to take action to remedy the situation. If the *Contractor* does not take timely action or, if the *Contractor* is not available, the *Consultant* may direct others to remedy the situation. Any such action or direction taken by the *Owner* shall not relieve the *Contractor* of its responsibilities as the "constructor" pursuant to the Occupational Health and Safety Act (Ontario).

.2 If the emergency situation was the fault of the *Contractor*, the remedial work shall be completed at the cost of the *Contractor* and with no additional cost to the *Owner* and the *Owner* shall be entitled to seek reimbursements for all costs associated with the remedial work including the cost of work done by third parties.

.3 If the emergency situation was not the fault of the *Contractor*, the *Owner* shall pay for the remedial work."

16. GC 3.1 CONTROL OF THE WORK

16.1 Add new paragraph 3.1.3 as follows:

"Prior to commencing individual procurement, 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 dimensions are not included or exact locations are not apparent, the *Contractor* shall immediately notify the Consultant in writing and obtain written clarification from the Consultant before proceeding with any part of the affected work."

16.2 Add new paragraph 3.1.4 as follows:

"The *Contractor* shall perform the work in a good and workmanlike manner, using new materials, in accordance with all applicable laws and current best practices and standards in the construction industry at the Place of Work. The *Contractor* acknowledges that both time and quality are of the essence and the *Contractor* will perform the Work or cause the Subcontractors and Suppliers to perform the Work in accordance with the Construction Schedule, as amended from time to time, and in an expeditious and professional manner.

17. GC 3.2 CONSTRUCTION BY OWNER OR OTHER CONTRACTORS

17.1 Add new paragraph 3.2.3.5 as follows:

"Subject to GC 9.4 – CONSTRUCTION SAFETY, for the *Owner*'s own forces and for *Other Contractor*s, assume overall responsibility for compliance with all aspects of the applicable health and safety legislation of the Place of the Work, including all of the responsibilities of the "Constructor" under the *Occupational Health and Safety Act* (Ontario)."

18.3 Add new paragraph 3.2.3.6 as follows:

"provide for the co-ordination of the activities and work of *Other Contractors* and *Owner's* own forces with the *Work* of the *Contract.*"

18. GC 3.4 CONSTRUCTION SCHEDULE

18.1 Delete paragraph 3.4.1 in its entirety and replace it with the following:

"3.4.1 The *Contractor* shall:

.1 within 10 *Working Days* from the date of the *Contract* award, prepare for the *Owner's* and *Consultant's* review and *Acceptance*, a construction schedule, including identification of the critical path of the *Work,* the schedule of operations, the proposed methods of construction and sequence of *Work*, and the time the *Contractor* proposes to complete the various items of *Work* within the *Contract Time*. The schedule shall be designed to ensure conformity with the *Contract Time*. The schedule will be in a Gannt chart format in either .pdf or excel format and include:

(a) activity sequences and durations;

(b) process for obtaining any required permits;

(c) work block planning and track protection requested;

(d) special allocation of labour and *Products*;

(e) processing of *Shop Drawings* and samples;

(f) delivery of *Products* involving long lead time procurement;

(g) usage and occupancy requirements of the *Owner* of those portions of the *Work* having usage or occupancy priority;

(h) *Substantial Performance of the Work*, and *Ready-for-Takeover* reflecting that such milestones will be achieved by no later than the dates specified in Article A-1.3; and

(i) any other schedule requirements set out in the *Contract Documents*.

If the construction schedule submitted by the *Contractor* is not *Accepted* by the *Owner* and the *Consultant*, the *Contractor* shall make revisions to the construction schedule until it is *Accepted* by the *Owner* and the *Consultant*. Once *Accepted* by the *Owner* and the Consultant, the schedule submitted by the *Contractor* shall become the "*Construction Schedule*." Notwithstanding any other terms of this *Contact*, the *Contractor* shall not be entitled to receive any payment from the *Owner* until a construction schedule has been submitted by the *Contractor* and *Accepted* by the *Owner* and the *Consultant*. The *Owner* may, at its sole discretion, not issue an order to commence work until the schedule has been received and *Accepted*.

.2 during performance of the Work and in accordance with the controls and reporting requirements in the *Contract Documents*, provide for the *Consultant's* and *Owner's* review and *Acceptance*, progress reports updating the *Construction Schedule*, reporting on the progress achieved, percentage of completion, schedule status and financial status with areas of immediate concern

highlighted. If the schedule is affected by approved *Change Orders*, the *Contractor* shall submit an updated *Construction Schedule*, if requested by the *Consultant*, within 7 *Working Days* of the request. This updated schedule shall show how the *Contractor* proposes to perform the balance of the *Work*, so as to complete the *Work* within the *Contract Time*.

.3 provide progress reports with each application for payment, in the form provided by the *Owner* attached as Schedule C, for review and *Acceptance*, including an update of the *Construction Schedule* referred to in paragraph 3.4.1."

18.2 Add new paragraphs 3.4.2 and 3.4.3 as follows:

"3.4.2 If,

.1 at any time it should reasonably appear to the *Owner* or the *Consultant* that the actual progress of the Work is behind schedule or is likely to become behind schedule, based on critical path methodology, and Notice in Writing of such opinion is given to the *Contractor*; or

.2 the *Contractor* becomes aware of or notices a slippage in the Construction Schedule,

then the *Contractor* shall take appropriate steps to cause the actual progress of the *Work* to conform to the *Construction Schedule* and shall produce and present to the *Owner* and the *Consultant*, for their review and *Acceptance*, within 5 *Working Days* after becoming aware of the schedule slippage, a recovery plan demonstrating how the *Contractor* will achieve the recovery of the *Construction Schedule*.

3.4.3 The *Contractor* is responsible for performing the *Work* within the *Contract Time*. Any schedule submissions revised from the *Accepted* baseline *Construction Schedule* or *Accepted* revised Construction Schedule pursuant to GC 3.4 CONSTRUCTION SCHEDULE, during construction are deemed NOT to be approved extensions to the *Contract Time.* Revisions to the *Construction Schedule* shall not be made without the prior written *Acceptance* of the *Owner*. All requests by the *Contractor* for a revision to the *Construction Schedule* that includes an extension to the *Contract Time* or adjustment to the date(s) for *Substantial Performance of the Work* or *Ready-for-Takeover* must be approved by the *Owner* through an executed *Change Order.*"

19. GC 3.5 SUPERVISION

19.1 Amend paragraph 3.5.1 by adding at the end of that paragraph:

"…, and upon the *Contractor* obtaining the *Owner*'s written consent, which consent will not be unreasonably withheld."

19.2 Add new paragraph 3.5.3 as follows:

"Notwithstanding paragraph 3.5.2, the representative of the *Contractor* attending a meeting with one or more of the *Owner*, the *Owner*'s representative and the *Consultant* shall be deemed to have authority to act on behalf of the *Contractor* and bind the *Contractor* in matters related to this *Contract*."

19.3 Add new paragraph 3.5.4 as follows:

"The *Owner* may, at any time during the course of the *Work*, request the replacement of the appointed *Contractor*'s representative(s), where the grounds for the request involve conduct on the part of the *Contractor*'s representative(s) which jeopardizes the safety of the *Owner*'s operations or the Work or the proper progress of the Work. Immediately upon receipt of the request, the *Contractor* shall make arrangements to appoint an Acceptable replacement. The *Contractor* shall indemnify and hold the *Owner* harmless from and against any damages, costs, expenses, claims, injuries and other liabilities suffered by the *Owner* arising from the conduct of the representative that is being replaced."

20. GC 3.6 SUBCONTRACTORS AND SUPPLIERS

20.1 Add new paragraph 3.6.1.4:

"ensure the *Subcontractors* and *Suppliers*, while working on the *Owner*'s property, are aware of and comply with the *Owner*'s policies, including its Fit for Duty Policy, and with the Ontario Northland Operating Manual, including the Current Summary Bulletin, the current Ontario Northland Time Table, C.R.O.R. 2022, Infrastructure Special Instructions, Dangerous Goods and Ontario Northland General Operating Instructions, as applicable."

20.2 Delete paragraph 3.6.2 in its entirety and replace it with new paragraph 3.6.2

"The *Contractor* shall not change Subcontractors or Suppliers identified in the *Contract Documents* without the prior written approval of the *Owner* which approval will not be unreasonably withheld."

20.3 Delete paragraphs 3.6.3 and 3.6.4 in their entirety and replace them with "Intentionally Left Blank".

20.4 Add new paragraph 3.6.7 as follows:

"The responsibility as to which *Supplier* and/or *Subcontractor* provides the specific labour, *Products* and services for each item of work rests solely with the *Contractor*, within and in accordance with the requirements and limitations listed in the *Contract Documents* with respect to approval of Suppliers and/or Subcontractors permitted to perform work on the Project."

21. GC 3.7 LABOUR AND PRODUCTS

21.1 Amend paragraph 3.7.1 by adding the words, "..., agents, *Subcontractors* and *Suppliers* …" after the word "employees".

21.2 Amend paragraph 3.7.2 by adding the following words at the beginning of the paragraph: "Except as otherwise provided in the technical *Specifications*" and adding the following sentence at the end of that paragraph:

"The *Contractor* represents and warrants that the *Products* supplied by the *Contractor* in accordance with the *Contract* are not subject to any conditional sales contract and are not subject to any security rights obtained by any third party which may subject any of the *Products* to seizure and/or removal from the Place of the Work."

21.3 Add new paragraph 3.7.4 as follows:

"Upon receipt of a Notice in Writing from the *Consultant*, the *Contractor* shall take action to rectify any situation involving its employee, agent, *Subcontractor* or *Supplier* whose work is unsatisfactory to the Consultant or the *Owner* or who are considered by the *Consultant* or the *Owner* to be unskilled or otherwise objectionable. If after giving sufficient warning the *Contractor* is not able to reasonably rectify such situation, then such employee, agent, *Subcontractor* or *Supplier* shall be dismissed from the Place of the Work and the *Contractor* shall indemnify and hold the *Owner* and the *Consultant* harmless from and against any damages, costs, expenses, claims, injuries and other liabilities suffered by the *Owner* or the *Consultant* arising from the dismissal of such employee, agent, *Subcontractor* or *Supplier*."

21.4 Add new paragraph 3.7.5 as follows:

"The *Contractor* is responsible for the safe on-site storage of *Products* and their protection (including *Products* supplied by the *Owner* and *Other Contractor*s to be installed under the *Contract*) in such ways as to avoid dangerous conditions or contamination to the *Products* or other persons or property and in locations at the *Place of the Work* identified by the *Contractor* and *Accepted* by the *Owner* and the *Consultant*. The *Owner* shall provide all relevant information on the *Products* to be supplied by the *Owner* or *Other Contractors*."

21.5 Add new paragraph 3.7.6 as follows:

"The *Contractor* shall not employ any persons to perform Work whose labour affiliation, or lack thereof, is incompatible with other labour employed in connection with the Work. Any costs arising from labour disputes, as a result of the employ of any such person by the *Contractor*, its Subcontractors or Suppliers shall be at the sole expense of the *Contractor*."

21.6 Add new paragraph 3.7.7 as follows:

"The *Contractor* and the *Owner* and its representatives shall cooperate and shall take all reasonable and necessary actions to maintain stable and harmonious labour relations with respect to the Work at the Place of the

Work, including cooperation to attempt to avoid work stoppages, trade union jurisdictional disputes and other labour disputes."

22. GC 3.8 SHOP DRAWINGS

22.1 Delete paragraph 3.8.7 and replace it with the following:

"3.8.7 The *Consultant* will review and return *Shop Drawings* in accordance with the schedule agreed upon as described in paragraph 3.8.2, or, in the absence of such schedule, with reasonable promptness. If, for any reason, the *Consultant* cannot process them within the agreed-upon schedule or with reasonable promptness, the *Consultant* shall notify the *Contractor* and they shall meet to review and develop a revised schedule for processing such *Shop Drawings* that is *Acceptable* to the *Owner*. The *Contractor* shall update the *Shop Drawings* schedule to correspond to changes in the *Construction Schedule*. Changes in the *Contract Price* or *Contract Time* may be made only in accordance with GC 6.1, GC 6.2 or GC 6.3"

22.2 Add new paragraphs 3.8.8, 3.8.9, 3.8.10 and 3.8.11 as follows:

3.8.8 The *Contractor* shall provide *Shop Drawings* and *Submittals* in the form specified, or if not specified, as directed by the *Consultant*. *Shop Drawings* provided by the *Contractor* to the *Consultant* shall indicate by stamp, date and signature of the person responsible for the review that the *Contractor* has reviewed each one of them. Certain *Specifications* sections require the *Shop Drawings* to bear the seal and signature of a professional engineer. Such professional engineer must be registered in the jurisdiction of the Place of the Work and shall have expertise in the area of practice reflected in the *Shop Drawings*.

3.8.9 *Shop Drawings* which require approval of any *Authority Having Jurisdiction* shall be provided to such authority by the *Contractor* for the authority's approval.

3.8.10 The *Contractor* shall provide revised *Shop Drawings* to correct those which the *Consultant* rejects as inconsistent with the *Contract Documents*, unless otherwise directed by the *Consultant*. The *Contractor* shall notify the *Consultant* in writing of any revisions to the *Shop Drawings* other than those requested by the *Consultant*.

3.8.11 Reviewed *Shop Drawings* shall not authorize a change in the *Contract Price* and/or the *Contract Time*."

23. GC 3.9 USE OF THE WORK

23.1 Add new GC 3.9 – USE OF THE WORK as follows:

"**GC 3.9 USE OF THE WORK**

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

3.9.2 The *Contractor* shall not load or permit to be loaded any part of the *Work* with a weight or force that will endanger the safety of the Work.

3.9.3 The *Owner* shall have the right to enter or occupy the *Place of the Work* in whole or in part for the purpose of placing fittings and equipment, or for other use before *Ready-for-Takeover*, if, in the opinion of the *Consultant*, such entry and occupation does not prevent or substantially interfere with the *Contractor* in the performance of the *Contract* within the *Contract Time*. Such entry or occupation shall neither be considered as acceptance of the Work or in any way relieves the *Contractor* from its responsibility to complete the *Contract*."

24. GC 3.10 CUTTING AND REMEDIAL WORK

24.1 Add new GC 3.10 – CUTTING AND REMEDIAL WORK as follows:

"**GC 3.10 CUTTING AND REMEDIAL WORK**

3.10.1 The *Contractor* shall perform the cutting and remedial work required to make the affected parts of the Work come together properly. Such 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.

3.10.2 The *Contractor* shall coordinate the Work to ensure all cutting and remedial work required is kept to a minimum."

25. GC 3.11 CLEANUP

25.1 Add new GC 3.11 – CLEANUP as follows:

"**GC 3.11 CLEANUP**

3.11.1 The *Contractor* shall comply with all requirements for cleanup at the *Place of the Work* as specified in the *Contract Documents*. The *Contractor* shall provide to the *Owner* for *Acceptance* a *Waste Management Plan*, and a waste reduction plan if required by *Environmental Laws*, for the waste products, debris and any *Excess Soils* generated by the *Work,* which plan shall comply with all *Environmental Laws* and the *Specifications*. The costs of disposing of all waste products and debris, including products and debris containing *Environmental Contaminants*, and *Excess Soil* resulting from the *Work* is included in the *Contract Price*.

3.11.2 Before applying for *Substantial Performance of the Work*, the *Contractor* shall remove waste products and debris and shall leave the *Place of the Work* clean and suitable for use or occupancy by the *Owner*. All products, tools, *Construction Equipment* and *Temporary Work* not required for the performance of any remaining *Work* shall be removed by the *Contractor*.

3.11.3 As a condition precedent to final payment, the *Contractor* shall remove any remaining products, tools, *Construction Equipment*, *Temporary Work*, waste products and debris from the *Place of the Work* to the satisfaction of the *Owner*.

3.11.4 In performing work to correct deficiencies or work under warranty following *Ready-for-Takeover* of the *Work*, the *Contractor* shall maintain the *Place of the Work* in a tidy condition and shall immediately remove waste products and debris.

3.11.5 The *Contractor* shall comply with all *Environmental Laws* in disposing of the waste products, debris and *Excess Soil* resulting from the *Work*. The *Contractor* shall assume all liability and responsibility for any waste products, debris and *Excess Soil*, including any such materials containing *Environmental Contaminants*, which are removed from the *Place of the Work* by the *Contractor* and during the transportation of the waste products, debris and *Excess Soils* to the appropriate waste disposal site. The *Contractor* shall submit landfill weigh bills from a waste disposal site as proof that all waste has been disposed of at a certified waste disposal site. The *Contractor* shall submit a *Waste Management Report* as part of the *Close-Out Documentation* described in paragraph 5.5.1.2 to be submitted with the application for verification of *Ready-for-Takeover*.

3.11.6 In the event that the *Contractor* fails to remove waste and debris as provided in this GC 3.11, then the *Owner* or the *Consultant* may give the *Contractor* twenty-four (24) hours' *Notice in Writing* to meet its obligations respecting clean up. Should the *Contractor* fail to meet its obligations pursuant to this GC 3.11 within the twenty-four (24) hour period next following delivery of the notice, the *Owner* may remove such waste and debris and deduct from payments otherwise due to the *Contractor*, the *Owner*'s costs for such clean up, including a reasonable mark-up for *Administration Costs*."

26. GC 3.12 PERFORMANCE BY CONTRACTOR

26.1 Add new GC 3.12 – PERFORMANCE BY CONTRACTOR as follows:

"**GC 3.12 PERFORMANCE BY CONTRACTOR**

3.12.1 In performing its obligations, duties and responsibilities under this *Contract*, the *Contractor* shall exercise the degree of care, skill and diligence that would normally be exercised by an experienced, skilled and prudent contractor supplying similar services for similar projects. The *Contractor* acknowledges and agrees that, throughout this *Contract*, the *Contractor*'s obligations, duties and responsibilities shall be judged, evaluated and

interpreted in accordance with this standard. The *Contractor* shall exercise the same standard of care in respect of any *Products*, *Subcontractors*, *Suppliers*, personnel or procedures which it may recommend to the *Owner* or employ on the *Project*.

3.12.2 The *Contractor* further represents, covenants and warrants to the *Owner* that:

.1 The personnel and *Subcontractors* it assigns to the *Project* are appropriately experienced;

.2 It has a sufficient staff of qualified and competent personnel to replace its designated supervisor and project manager, subject to the *Owner*'s approval, in the event of death, incapacity, removal or resignation; and

.3 there are no pending, threatened or anticipated claims that would have a material effect on the financial ability of the *Contractor* to perform its work under the *Contract*."

3.12.3 The *Owner* has a Vendor Performance Policy which requires the *Owner* to complete an evaluation of the *Contractor*'s performance of its obligations under this *Contract*. The performance evaluation of the *Contractor* for the supply of the *Work* will be used in the assessment of the *Contractor*'s proposals in response to future procurements. The performance evaluation may also result in the *Contractor* being disqualified from submitting proposals in response to future procurements in accordance with the terms of the policy. The policy can be found at http://ontarionorthland.ca/en/requests-tenders."

27. 3.13 EXCESS SOIL MANAGEMENT

27.1 Add new GC 3.13 – EXCESS SOIL MANAGEMENT as follows:

"**GC 3.13 EXCESS SOIL MANAGEMENT**

3.13.1 The *Contractor* shall be solely responsible for the proper management of all *Excess Soil* at the *Place of the Work* and for performance of the *Work* in compliance with the rules, regulations and practices required by the *Excess Soil Regulation* until such time as *Ready-for-Takeover* is achieved. Without restricting the generality of the previous sentence, the *Contractor's* responsibility under this GC 3.13 includes the testing, designation, transportation, tracking, temporary and/or final placement, record keeping, and reporting of all *Excess Soil* in connection with the *Work* all in compliance with the *Excess Soil Regulation.*

3.13.2 The *Contractor* shall indemnify and save harmless the *Owner*, their agents, officers, directors, administrators, governors, employees, consultants, successors and assigns from and against the consequences of any and all infractions committed by the *Contractor,* or those for whom it is responsible at law, under the *Excess Soil Regulation*, or any environmental protection legislation, including the payment of legal fees and disbursements on a substantial indemnity basis."

27A GC 4.1 CASH ALLOWANCES

27A.1 Add the following at the end of paragraph 4.1.2:

"The maximum markup for the *Contractor*'s overhead and profit on a cash allowance shall be five percent (5%)."

27A.2 Delete the last sentence in paragraph 4.1.4.

27A.3 Delete paragraph 4.1.5 in its entirety and replace it with the following:

"The *Contract Price* shall be adjusted by *Change Order* to provide for any difference in the total value of all cash allowances and the actual cost of the *Work* performed under all cash allowances."

27A.4 Add new paragraph 4.1.8:

"4.1.8 The *Owner* may require the *Contractor* to obtain competitive bids, at no additional cost to the *Owner*, for portions of the *Work* to be paid from cash allowances."

28. GC 5.1 FINANCING INFORMATION REQUIRED OF THE OWNER

28.1 Delete GC 5.1 – FINANCING INFORMATION REQUIRED OF THE *OWNER* in its entirety including all paragraphs thereunder and replace it with "Intentionally left blank."

28.2 **GC 5.2 APPLICATIONS FOR PAYMENT**

28.3 Delete paragraph 5.2.1 in its entirety and replace it with new paragraph 5.2.1:

"5.2.1 On a *Working Day* that is not more than 10 calendar days after the end of each *Payment Period*, a representative of the *Contractor*, *Owner*, and the *Consultant* shall attend a meeting to discuss and review the *Work* completed during the *Payment Period*, including quantities, if applicable (the "**Pre-Invoice Submission Meeting**"). The *Contractor* shall bring with it to the *Pre-Invoice Submission Meeting* the following:

.1 a draft of its anticipated application for payment for the applicable *Payment Period*;

.2 the schedule of values submitted in accordance with GC 5.2.4, and *Accepted* by the *Consultant* in accordance with GC 5.2.5;

.3 *Subcontractor* and *Supplier* invoices and supporting materials;

.4 receipts for reimbursable expenses (where expressly permitted by the *Contract*, if at all);

.5 accounts and records documenting the cost of performing the *Work* attributable to any *Change Order* or *Change Directive*;

.6 any visual documentation (photos, videos, diagrams) evidencing the progress of the *Work*; and

.7 any other documents reasonably required by the *Contract Documents*, the *Owner* or *Consultant*."

28.4 Delete paragraph 5.2.2 in its entirety and replace it with new paragraph 5.2.2:

"5.2.2 Within 5 calendar days following the *Pre-Invoice Submission Meeting*, the *Contractor* shall deliver to the *Owner*, with a copy to the *Consultant*, its application for payment that complies with the requirements of GC 5.2.6 for *Work* performed during a *Payment Period* (the "**Proper Invoice Submission Date**"), provided that if the fifth (5th) calendar day following the *Pre-Invoice Submission Meeting* falls on a calendar day that is not *Working Day*, the *Proper Invoice Submission Date* shall be deemed to fall on the next *Working Day*. However, the following shall apply to the delivery of all *Contractor* applications for payment:

.1 If the *Contractor* fails to deliver its application for payment, at the interval prescribed in GC 5.2.2, subject to written approval by the *Owner*, the *Contractor* shall not be entitled to submit its application for payment until the next prescribed interval. Should the *Owner* decide to accept an application for payment submitted after the applicable *Proper Invoice Submission Date* (which the *Owner* is under no obligation to do), such acceptance shall not be construed as a waiver of any of the *Owner*'s rights, or as a waiver or release of the *Contractor*'s obligations to strictly comply with the requirements prescribed in this GC 5.2 – APPLICATIONS FOR PAYMENT;

.2 If an application for payment is delivered by the *Contractor* to the *Owner* on a day that is prior to an eligible *Proper Invoice Submission Date*, the application for payment will not be considered or reviewed by the *Owner* or the *Consultant* until the earliest eligible *Proper Invoice Submission Date* as identified in GC 5.2.2, at which point the application for payment will be deemed to have been received by the *Owner* and the *Consultant* for the purpose of review and evaluation;

.3 Notwithstanding any other provision of this *Contract*, the *Contractor* shall not deliver an application for payment for consideration as a *Proper Invoice* by the *Owner*, during the *Restricted Period (Proper Invoice)*;

.4 The *Owner* and the *Contractor* hereby consent to the giving and receiving of *Proper Invoices* electronically and in accordance with the requirements of this GC 5.2 – APPLICATIONS FOR PAYMENTS."

28.5 Amend paragraph 5.2.3 by adding the following to the end of that paragraph:

"but no amount claimed shall include Products delivered to the Place of the Work unless the Products are free and clear of all security interests, liens, and other claims of third parties, subject to claims for lien pursuant to the *Construction Act*."

28.6 Amend paragraph 5.2.4 by deleting the words "the *Consultant*, at least 15 calendar days" and replacing them with "the *Owner* and the Consultant, at least 30 calendar days"

- and -

add the words "in a form acceptable to the *Owner*," after the words "*Contract Price*".

28.7 Amend paragraph 5.2.5 by adding the words "or the *Owner*" after the words "as the Consultant".

28.8 Delete paragraph 5.2.6 in its entirety and replace it with new paragraph 5.2.6:

"5.2.6 Each application for payment submitted pursuant to GC 5.2.2 shall:

.1 be in a form prescribed, or otherwise approved in writing, by the *Owner*;

.2 include all the requirements for a *Proper Invoice* prescribed by the *Construction Act* and the *Contract Documents*;

.3 be delivered to the *Owner* and to the *Consultant* in the same manner as a *Notice in Writing*; and

.4 unless otherwise directed in writing by the *Owner*, by email to pay.inv@ontarionorthland.ca and to the *Owner*'s representative listed in Article A-6."

28.9 Amend paragraph 5.2.8 by adding the following new sentence at the end of that paragraph:

"Any *Products* delivered to the *Place of the Work* but not yet incorporated into the Work shall remain at the risk of the *Contractor* notwithstanding the title has passed to the *Owner* pursuant to GC 13.1 – *OWNER*SHIP OF MATERIALS."

28.10 Add new paragraph 5.2.9 as follows:

"5.2.9 The *Contractor* shall prepare and maintain current *As-Built Drawings* which shall consist of the *Drawings* and *Specifications* revised by the *Contractor* during the *Work*, showing changes to the *Drawings* and *Specifications*, which current *As-Built Drawings* shall be maintained by the *Contractor* and made available to the *Consultant* for review with each application for progress payment. The *Owner* reserves the right to retain a reasonable amount for the value of the *As-Built Drawings* not presented for review."

28.11 Add new paragraph 5.2.10 as follows:

"5.2.10 Upon receipt of an application for payment submitted for payment by the *Contractor* in accordance with GC 5.2 - APPLICATIONS FOR PAYMENT, the *Owner* and the *Consultant* will assess whether all of the requirements for a *Proper Invoice* are satisfied and, if the application for payment does not meet the requirements, the *Owner* or the *Consultant*, as applicable, will return the application for payment to the *Contractor* with reasons setting out why the application for payment does not meet the requirements for a *Proper Invoice* and the *Contractor* may resubmit the application for payment with all required information within 3 *Working Days* of the *Contractor's* receipt of the *Owner's* or *Consultant's* reasons. For clarity,

.1 if an application for payment does not include all of the requirements for a *Proper Invoice* required by GC 5.2.6.2, it shall not be considered a "Proper Invoice" for the purposes of the *Construction Act* and the *Owner* shall have no obligation to make a payment and the time periods set out in GC 5.3 -

PAYMENTS and in Section 6.4 of the *Construction Act* shall not apply until the *Contractor* has submitted an application for payment that includes all information required by GC 5.2.6.2;

.2 if the *Contractor* fails, refuses, or neglects to resubmits its application for payment within 3 *Working Days* after it is returned in accordance with this GC 5.2.10, the *Contractor* shall be deemed to have failed to deliver its application for payment and GC 5.2.2.1 shall apply;

.3 where the *Contractor* disagrees with the *Owner's* or the *Consultant's* assessment that some of the of the requirements for a *Proper Invoice* required by GC 5.2.6.2 are missing from its application for payment, nothing in this GC 5.2.10 shall prevent the *Contractor* from resubmitting the same application for payment without any additional or new information; and

.4 the *Owner* reserves the right, in its sole, absolute and unfettered discretion, to waive an error or minor irregularity in any application for payment delivered by the *Contractor* for the purposes of deeming an application for payment a "Proper Invoice" within the meaning of the *Construction Act*, but the *Owner* shall be under no obligation to exercise this right."

29. GC 5.3 PAYMENT

29.1 Delete paragraph 5.3.1 in its entirety and replace it with a new paragraph 5.3.1:

"5.3.1 After receipt by the *Owner* and the *Consultant* of an application for payment submitted by the *Contractor* in accordance with GC 5.2 – APPLICATIONS FOR PAYMENT:

.1 the *Consultant* will either:

(a) issue to the *Owner,* with a copy to the *Contractor*, a certificate for payment in the amount applied for in the *Proper Invoice*, or

(b) issue to the *Owner,* with a copy to the *Contractor,* a certificate for payment for an amount determined by the *Consultant* to be properly due to the *Contractor* after applying any credits, withheld amounts, or other set-offs which the *Consultant* has determined that the *Owner* is entitled to notwithstanding any notice of dispute or disagreement that the *Contractor* may have served, along with the *Consultant's* reasons why an amount other than what is claimed in the *Proper Invoice* is properly due to the *Contractor*, which finding the *Owner* may accept or amend prior to the *Owner* issuing a *Notice of Non-Payment*, if any, in accordance with GC 5.3.2;

.2 the *Owner* shall make payment to the *Contractor*, on account as provided in Article A-5,

(a) in the amount stated in the certificate for payment, or

(b) in the amount stated in the certificate for payment less such amount stated in the *Owner*'s *Notice of Non-Payment* issued pursuant to GC 5.3.2,

on the 28th calendar day after receipt of a *Proper Invoice*, unless such 28th calendar day lands on a day that is other than a *Working Day*, in which case payment shall be made on the next *Working Day* after such 28th day."

29.2 Add new paragraph 5.3.2 as follows:

"5.3.2 In the event that the application for payment delivered by the *Contractor* pursuant to GC 5.2 – APPLICATIONS FOR PAYMENT does not include the requirements for a Proper Invoice or if the *Owner* disputes the amount claimed as payable in the *Proper Invoice*, then the *Owner* shall within 14 calendar days of receipt of the application for payment, issue a *Notice of Non-Payment* (Form 1.1)."

29.3 Add new paragraph 5.3.3 as follows:

"5.3.3 Where the *Owner* has delivered a *Notice of Non-Payment*, as specified under GC 5.3.2, the *Owner* and the *Contractor* shall first engage in good faith negotiations to resolve the dispute. If within 10 calendar days following the issuance of a *Notice of Non-Payment*, the *Owner* and the *Contractor* cannot resolve the dispute, either party may issue a notice of adjudication in a form prescribed under the *Construction*

Act, in which case the *Owner* and the *Contractor* will agree to submit the dispute to *Adjudication* as set out under PART 8 – DISPUTE RESOLUTION. The amounts disputed and described under the *Notice of Non-Payment* shall be held by the *Owner* until all disputed amounts of the relevant *Proper Invoice* have been resolved pursuant to PART 8 – DISPUTE RESOLUTION. Any portion of the *Proper Invoice* which is not the subject of the *Notice of Non-Payment* shall be payable within the time period set out in paragraph 5.3.1.2."

29.4 Add new paragraph 5.3.4 as follows:

"5.3.4 Without limitation, the *Owner* shall be entitled to deduct from or, set off against, any payment of the *Contract Price* and any other amounts payable by the *Owner* to the *Contractor* under the *Contract*:

.1 any amount expended by the *Owner* in exercising the *Owner*'s rights under this *Contract* to perform any of the *Contractor*'s obligations that the *Contractor* has failed to perform;

.2 any damages, costs or expenses (including, without limitation, reasonable legal fees and expenses) incurred by the *Owner* as a result of the failure of the *Contractor* to perform any of its obligations under the *Contract*; or

.3 any other amount owing from the *Contractor* to the *Owner* under this *Contract*."

29.5 Add new paragraph 5.3.5 as follows:

"5.3.5 The *Contractor* represents, warrants, and covenants to the *Owner* that it is familiar with its prompt payment and trust obligations under the *Construction Act* and will take all required steps and measures to ensure that it complies with the applicable prompt payment and trust provisions under the *Construction Act* including, without limitation, section 8.1 of the *Construction Act*. Evidence of the *Contractor*'s compliance under this paragraph 5.3.5 will be made available to the *Owner* within 5 *Working Days* following receipt by the *Contractor* of a *Notice in Writing* making such request."

30. C 5.4 SUBSTANTIAL PERFORMANCE OF THE WORK AND PAYMENT OF HOLDBACK

30.1 Delete paragraph 5.4.2 in its entirety and replace it with the following:

"5.4.2 After the date of *Substantial Performance of the Work* is established, the *Contractor* and all *Subcontractors* who have completed their subcontracts shall complete on a commercially reasonable efforts basis within 30 days all deficient work including providing the required *Close-Out Documentation*, unless the reasons for any delay is *Acceptable* to the *Owner*. All deficient work not completed within the above time may be completed by the *Owner* and the cost of this work may at the option of the *Owner* be deducted from the *Contractor*'s next application for payment, or otherwise recoverable upon written demand by the *Owner* to the *Contractor*."

30.2 Delete paragraph 5.4.3 and replace it with the following:

"5.4.3 Immediately following the issuance of a certificate of Substantial Performance of the Work, the *Contractor* shall publish the certificate referred to in paragraph 5.4.1.2 in the manner provided in the *Construction Act*. Failing valid publication by the *Contractor* within 3 Working Days following the issuance of the certificate, the *Owner* shall be at liberty to publish the certificate and back-charge the *Contractor* for its reasonable costs for doing so."

30.3 Delete paragraph 5.4.4 and replace it with the following:

"5.4.4 After publication of the certificate of the *Substantial Performance of the Work*, the *Contractor* shall submit an application for payment of the outstanding *Construction Act* holdback amount, which application for payment shall:

.1 include all of the requirements listed in Schedule A to these Supplementary Conditions, as applicable to the application for payment of the holdback amount; and

.2 include a statement that the *Contractor* has not received any written notices of lien or any claims for liens from any *Subcontractor* or *Supplier*.

After the receipt of a complete application for payment of the holdback amount from the *Contractor*, the *Consultant* will issue a certificate for payment of the holdback amount, provided that such amount is subject to and will only become due and payable in accordance with GC 5.4.5 and the *Construction Act*."

30.4 Delete paragraph 5.4.5 and replace it with the following:

"5.4.5 The *Construction Act* holdback amount shall become due and payable the day immediately following the expiration of the holdback period prescribed by the *Construction Act*, subject to the occurrence of any of the following:

.1 the preservation of a lien in respect of the *Project* that has not been satisfied, discharged or otherwise provided for in accordance with the *Construction Act*;

.2 receipt by the *Owner* of a written notice of lien that has not been satisfied, discharged or otherwise provided for in accordance with the *Construction Act*; or

.3 prior to the expiry of 40 calendar days following the publication of the certificate of *Substantial Performance of the Work,* the *Owner* publishes a *Notice of Non-Payment* of holdback in accordance with the *Construction Act,* setting out the amount of holdback that will not be paid, which may include non-payment to secure the correction of deficiencies and/or the completion of the *Work*."

30.5 Add new paragraph 5.4.7 as follows:

"5.4.7 Where *the Construction Act* allows for release of *Construction Act* holdback on subcontract work which is 100% complete prior to the release of holdback contemplated under GC 5.4.5, the Contractor may make application to the *Owner* and the *Consultant* by written request for a review by the *Consultant* to determine the date of completion of the subcontract and shall submit such supporting material as the *Consultant* may in its discretion require, including:

.1 Description of the scope of *Work* included in the subcontract.

.2 Declaration of Last Supply by the *Subcontractor* as prescribed in subsection 31(5) of the Construction Act (Form 7).

.3 Certificate of Completion of Subcontract as prescribed in subsection 33(1) of the *Construction Act* (Form 10).

.4 Workplace Safety & Insurance Board clearance certificate for the *Contractor*, the *Subcontractor* concerned, and any other *Subcontractors* and *Suppliers* who have provided any services to the *Subcontractor*.

.5 Statutory declaration by an officer of the *Subcontractor* in the form CCDC Document 9B - 2018.

.6 *Contractor*'s written acknowledgement to the *Owner* that the requirements of the *Contract Documents* will not be altered by early release of the *Construction Act* holdback of the completed subcontracts.

.7 Confirmation by the bonding company that it has been notified of the intent to claim early release of holdback and does not object.

.8 Sufficient evidence to the *Owner*'s reasonable satisfaction that, as of the date of the *Contractor*'s application, no claims for lien have been preserved against the *Place of the Work* that have not been vacated by the posting of security, discharged, or otherwise addressed in accordance with GC 5.8 – CONSTRUCTION LIENS."

31. GC 5.5 FINAL PAYMENT

31.1 Delete GC 5.5 – FINAL PAYMENT in its entirety and replace it with the following:

"5.5.1 When *Ready-for-Takeover* has been achieved in accordance with GC 12.1 – READY-FOR-TAKEOVER and the *Contractor* considers the Work is complete, and after the *Contractor*, the *Owner*, and the *Consultant* have attended a *Pre-Invoice Submission Meeting* analogous to the requirement in GC 5.2.1, the *Contractor* may submit an application for final payment to the *Owner* and the *Consultant* and the *Contractor* shall:

.1 include all of the requirements set out in GC 5.2.1, including without limitation those requirements listed in Schedule A to these Supplementary Conditions that are specific to an application for final payment;

.2 ensure that all warranties, *Extended Warranties*, records, operation and maintenance manuals, data books, literature maintenance sheets, list of outstanding work and deficiency list, *Waste Management Report*, keys, Certificate of Clearance from WSIB, proof of publication of the certificate of *Substantial Performance of the Work* and the *As-Built Record Drawings* are submitted to the *Consultant (*collectively, the "**Close-Out Documentation**"). Such submissions shall constituent requirements for the *Proper Invoice* for final payment; and

.3 if applicable, (a) a certificate from the *Consultant* or written confirmation from the *Owner* that the deficiencies or incomplete *Work* waived by the *Owner* pursuant to GC 12.1.2 have been fully rectified as of the date of the *Contractor's* application for final payment, and/or (b) written confirmation, signed by the *Owner* and the *Contractor,* that the *Contract Price* has been reduced by a specified amount in exchange for the *Owner* releasing the *Contractor* of its obligation to rectify the certain outstanding deficiencies and/or incomplete *Work* waived by the *Owner* pursuant to GC 12.1.2, as detailed in such written confirmation."

5.5.2 After receipt by the *Owner* of an application for final payment submitted by the *Contractor* in accordance with paragraph 5.5.1:

.1 the *Consultant* will either:

(a) issue to the *Owner* with a copy to the *Contractor*, a certificate for payment in the amount applied for in the *Proper Invoice*, or

(b) issue to the *Owner,* with a copy to the *Contractor,* a certificate for payment for an amount determined by the *Consultant* to be properly due to the *Contractor* after applying any credits, withheld amounts*,* or other set-offs which the *Consultant* has determined that the *Owner* is entitled to notwithstanding any notice of dispute or disagreement that the *Contractor* may have served, along with the *Consultant's* reasons why an amount other than what is claimed in the *Proper Invoice* is properly due to the *Contractor*, which finding the *Owner* may accept or amend prior to the *Owner* issuing a *Notice of Non-Payment*, if any, in accordance with GC 5.3.2;

.2 the *Owner* shall make payment to the *Contractor*, on account as provided in Article A-5,

(a) in the amount stated in the certificate for payment, or

(b) in the amount stated in the certificate for payment less such amount stated in the *Owner*'s *Notice of Non-Payment* issued pursuant to GC 5.3.2,

on the 28th calendar day after receipt of a *Proper Invoice*, unless such 28th calendar day lands on a day that is other than a *Working Day*, in which case payment shall be made on the next *Working Day* after such 28th day."

5.5.3 In the event that the application for final payment delivered by the *Contractor* does not include the requirements of GC 5.5.1 (including the requirements for a *Proper Invoice*) or where the *Owner* disputes the amount claimed as payable in the *Proper Invoice*, then the *Owner* shall within 14 calendar days of receipt of the application for payment, issue a *Notice of Non-Payment*. Where the *Owner* has delivered a Notice of Non-Payment, as specified under this GC 5.5.3, the *Owner* and the *Contractor* shall first engage in good faith negotiations to resolve the dispute. If within 10 calendar days following the issuance of a Notice of Non-Payment, the *Owner* and *Contractor* cannot resolve the dispute, either party may issue a notice of Adjudication in a form prescribed under the *Construction Act*. The *Owner* and *Contractor* will then submit the dispute to Adjudication as set out under PART 8 – DISPUTE RESOLUTION.

5.5.4 The amounts disputed and described under the Notice of Non-Payment shall be held by the *Owner* until all disputed portions of the Proper Invoice for final payment have been resolved in accordance with PART 8 – DISPUTE RESOLUTION. Any portion of the Proper Invoice which is not the subject of a Notice of Non-Payment shall be payable within the time period set out in paragraph 5.5.2.2.

5.5.5 Subject to the provision of paragraph 10.4.1 of GC 10.4 – WORKERS' COMPENSATION, and any lien legislation applicable to the Place of the Work, the *Owner* shall make payment, to the *Contractor* in accordance with paragraph 5.5.2.2.

5.5.6 Notwithstanding anything else in this GC 5.5 – FINAL PAYMENT the *Owner* shall retain a finishing holdback as provided for in the *Construction Act*, which shall be released to the *Contractor* upon expiry of the lien period provided for under the *Construction Act*, provided no construction liens have been registered.

5.5.7 As additional requirements for release of finishing construction lien holdback, the *Contractor* shall submit the following documentation:

.1 a written declaration that no claims for lien or written notices of lien have been received by it;

.2 a *Statutory Declaration* in the form set out in Schedule B that all accounts for labour, subcontracts, Products, construction machinery and equipment, and other indebtedness which may have been incurred by the *Contractor* and for which the *Owner* might in any way be held responsible have been paid in full up to the previous progress payment, except for amounts properly retained as a holdback or as an identified amount in dispute; and

.3 a Workplace Safety & Insurance Board Clearance Certificate."

32. GC 5.8 WITHHOLDING OF PAYMENT

32.1 Add new paragraph GC 5.8 WITHHOLDING OF PAYMENT as follows:

"GC 5.8 WITHOLDING OF PAYMENT

5.8.1 Upon notice to the *Contractor*, the *Owner* may, subject to the *Owner*'s requirement to issue a Notice of Non-Payment under the *Construction Act,* withhold or retain all or any portion of any payment due to the *Contractor* under this *Contract* to ensure the performance of the *Work* or to protect the *Owner*'s rights in respect of the events set out in this paragraph 5.8.1, but only such portion of any payment as is reasonably necessary for such purpose. The *Owner* may make such withholding or retention upon the occurrence and continuance of any of the following events:

.1 the *Contractor* is in default of any of its material obligations under this *Contract*;

.2 all or any part of such payment is attributable to Work which is defective or not performed in accordance with the *Contract Documents*;

.3 the *Contractor* has improperly failed to make prompt payments to its Subcontractors and Suppliers respecting Work for which the *Owner* has made payment to the *Contractor*; or

.4 the amounts described in section 17(3) of the *Construction Act*."

5.8.2 In the event of deficiencies or delays in the Work that the *Contractor* fails or refuses to address upon receiving notice of same in accordance with the requirements of the *Contract*, the *Owner* may, without limiting the remedies available to it under this *Contract* and subject to the *Owner*'s requirement to issue a *Notice of Non-Payment* under the *Construction Act*, retain and set off as against any payments that would otherwise be owing to the *Contractor*, the reasonable costs of rectifying such deficiencies or delays as determined by the *Owner*."

5.8.3 In addition to any rights the *Owner* has pursuant to the *Construction Act* and subject to the *Owner*'s requirement to issue a *Notice of Non-Payment* under the *Construction Act*, if a lien is registered against the *Place of the Work* or served upon the *Owner*, or an action commenced against the *Owner*, by any *Subcontractor*, the *Owner* having made all payments currently due in accordance with the payment terms of the *Contract Documents*, the *Owner* shall have the right to withhold from any money otherwise due to the *Contractor*, the full amount claimed in the lien action plus an additional amount sufficient to satisfy all of the *Owner* expenses relating to such lien action, including legal and consulting costs. These funds, less expenses incurred, shall be released to the *Contractor* upon the full discharge of all liens and dismissal of all actions against the *Owner*."

33. GC 5.9 CONSTRUCTION LIENS

33.1 Add new GC 5.9 – CONSTRUCTION LIENS as follows:

"**GC 5.9 – CONSTRUCTION LIENS**

5.9.1 Notwithstanding anything else in this PART 5 – PAYMENT, in the event a claim for lien is registered against title to the *Place of the Work* by the *Contractor*, a *Subcontractor* or a *Supplier*, or served on the *Owner* with regard to the Project by a *Subcontractor* or a *Supplier*, or the *Owner* receives a written notice of or claim for lien from a *Subcontractor* or a *Supplier*, the *Owner* shall be entitled to withhold any payment otherwise due to the *Contractor* until such time as such claims have been dealt with as provided below.

5.9.2 In the event that a claim for lien or a written notice of a lien is received by the *Owner* in relation to the *Project*, the *Contractor* shall, within 10 calendar days, at its sole expense, arrange for the vacating or the discharge of the claim for lien and/or the withdrawal of the written notice of lien or have the lien vacated pursuant to the *Construction Act*. If the *Contractor* commences an application to the Court to have the lien vacated, the *Contractor* shall provide the *Owner* with copies of all court documents submitted by the *Contractor* and the Order issued by the Court. If the lien is only vacated, the *Contractor* shall, if requested, undertake the *Owner*'s defence of any subsequent action commenced in the respect of the lien at the *Contractor*'s expense.

5.9.3 If the *Contractor* fails or refuses to take such steps as required under paragraph 5.9.2, the *Owner* shall, at its option, be entitled to take all steps necessary to vacate and/or discharge the claim for lien or the withdrawal of the written notice of lien, and all costs incurred by the *Owner* in doing so (including, without limitation, legal fees on a full indemnity basis and any payment which may ultimately be made out of or pursuant to security posted to vacate the lien) shall be the responsibility of the *Contractor*, and the *Owner* may deduct such amounts from the amounts otherwise due or owing to the *Contractor*.

5.9.4 Without limiting any of the foregoing, the *Contractor* shall satisfy all judgments and pay all costs resulting from any liens or any actions brought by a *Subcontractor* or *Supplier* in connection with any liens, or in connection with any other claim or lawsuit brought against the *Owner* by any person that provided services or materials to the Project which constituted part of the Work, and the *Contractor* shall indemnify the *Owner* for any and all costs (including, without limitation, legal fees on a solicitor and client basis) the *Owner* may incur in connection with such claims or actions.

5.9.5 Section 20(1) of the *Construction Act* does not apply to this *Contract* and no general lien arises under or in respect of the *Work*, such that all liens shall arise and expire on a lot-by-lot basis."

34. GC 6.1 OWNER'S RIGHT TO MAKE CHANGES

34.1 Amend paragraph 6.1.2 by adding the following to the end of that paragraph:

"This requirement is of the essence and it is the express intention of the parties that any claims by the *Contractor* for a change in the *Contract Price* and/or *Contract* Time shall not be approved unless there has been compliance with PART 6 – CHANGES IN THE WORK. No course of conduct or dealing between the parties, no express or implied acceptance of alterations or additions to the Work and no claims that the *Owner* has been unjustly enriched by an alteration or addition to the Work, whether in fact there is any such unjust enrichment or not, should be the basis for a claim for additional payment under this *Contract* or a claim for any extension of the *Contract* Time."

34.2 Add new paragraph 6.1.3 as follows:

"The *Contractor* agrees that changes resulting from construction coordination, including but not limited to site surface conditions, site coordination, and *Subcontractor* and *Supplier* coordination, are included in the *Contract Price* and shall not entitle the *Contractor* to claim an addition to the *Contract Price* in relation to coordination."

35. GC 6.2 CHANGE ORDER

35.1 Add new paragraph 6.2.3 as follows:

"The *Contractor* shall not be entitled to any additional compensation arising out of changes to the *Work* aside from the amounts determined and agreed to under this GC 6.2, or as provided in GC 6.3 – CHANGE DIRECTIVE. The *Contractor*'s fee for overhead and profit related to a *Change Order* or *Change Directive* shall be as set out in the *Contract Documents*."

35.2 Add new paragraph 6.2.4 as follows:

"*Change Orders* are not valid and binding upon the *Owner* unless approved and executed in accordance with the *Owner*'s internal approval processes."

36. GC 6.3 CHANGE DIRECTIVE

36.1 Delete paragraph 6.3.6.3 in its entirety and replace it with the following:

".3 The *Contractor*'s fee shall be as specified in paragraphs 6.2.3 and the *Contractor*'s fee for overhead and profit shall be as set out in the *Contract Documents*."

36.2 Amend GC 6.3.7.10 by adding the following to the end of the paragraph:

", provided that such amounts are not caused by negligent acts, omissions, or default of the *Contractor* or *Subcontractor*;"

36.3 Delete GC 6.3.7.17 in its entirety including all subparagraphs.

37. GC 6.4 CONCEALED OR UNKNOWN CONDITIONS

37.1 Amend paragraph 6.4.4 by deleting the words "and GC 9.5 – MOULD" and substituting the words "GC 9.5 – MOULD and GC 9.6 – IMPACT ASSESSMENT."

37.2 Add new paragraph 6.4.5 as follows:

"The *Contractor* acknowledges that it has received the *Impact Assessment Reports* for the *Project* that are described in the RFP documents and that it has considered the mitigation measures described in the *Impact Assessment Reports* in the *Contract Price*. If the *Impact Assessment Reports* are not completed prior to the closing of the RFP submission deadline, any adjustments required to the *Contract Price* shall be determined in accordance with GC 9.6.2.3. The *Impact Assessment Reports* are provided for information only and the *Owner* shall not be liable for any errors or omissions in the reports."

37.3 Add new paragraph 6.4.6 as follows:

"The *Contractor* confirms that, prior to submitting its response to the RFP for the Project, it had the opportunity to carefully investigate the *Place of the Work* and applied to that investigation the degree of care and skill described in paragraph 3.12.1, given the amount of time provided between the issue of the RFP documents and the actual submission deadline for the RFP, the degree of access provided to the *Contractor* prior to submission of the response, and the sufficiency and completeness of the information provided by the *Owner*. The *Contractor* is not entitled to compensation or to an extension of the *Contract* Time for conditions which could reasonably have been ascertained by the *Contractor* by such careful investigation undertaken prior to the submission of its response."

38. GC 6.5 DELAYS

38.1 Delete paragraph 6.5.1 in its entirety and replace it with the following:

"If the *Contractor* is delayed in the performance of the *Work* by an act or omission of the *Owner* or the *Consultant* or anyone employed or engaged by the *Owner* or *Consultant* directly, contrary to the provisions of the *Contract Documents*, then the *Contract* Time shall be extended for such reasonable time as the *Consultant* recommends and the *Owner* approves. The *Contractor* shall be reimbursed by the *Owner* for its reasonable direct costs directly flowing from the delay but excluding any indirect, consequential, or special damages."

38.2 Delete paragraph 6.5.2 in its entirety and replace it with the following:

"If the *Contractor* is delayed in the performance of the *Work* by a stop work order issued by a court or other *Authority Having Jurisdiction* on account of a breach, violation, contravention, or a failure to abide by any laws, ordinances, rules, regulations, or codes or the advice, recommendations and instructions of public health officials directly by the *Owner*, the *Owner*'s *Other Contractor*(s) or the *Consultant* and relating to the *Work* or the *Place of the Work* 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, then the *Contract Time* shall be extended for such reasonable time as the *Consultan*t may recommend in consultation with the *Contractor* and the *Owner* approves. The *Contractor* shall be reimbursed by the *Owner* for the reasonable direct costs directly flowing from the delay but excluding any indirect, consequential, or special damages."

38.3 Delete paragraph 6.5.3 in its entirety and replace it with the following:

"6.5.3.1 If the performance of the *Work* or the performance of any other obligation(s) of party to this *Contract* is delayed by *Force Majeure*, then the *Contract* Time shall be extended for such reasonable time as the *Owner* and the *Contractor* shall agree. The extension of time shall not be less than the time lost as a result of the event causing the delay, unless the *Contractor* and the *Owner* agree to a shorter extension. Neither party shall be entitled to payment for its costs incurred by such delays. Upon reaching agreement on the extension of the *Contract* Time attributable to the *Force Majeure* event, the *Owner* and the *Contractor* shall execute a *Change Order* indicating the length of the extension to the *Contr*act Time and confirming that there are no costs payable by either party to the other for the extension of *Contract Time*.

6.5.3.2 Notwithstanding the foregoing, the *Owner* may issue a *Change Directive* requiring the *Contractor* to undertake those specific actions identified in the *Change Directive* as the *Contractor* can reasonably and safely initiate to remove or relieve either the *Force Majeure* or its direct or indirect effects on the *Project*, in which case the *Contract Price* will be adjusted in accordance with paragraph 6.3.7. If the *Contractor* fails within the time period specified in the *Change Directive* to take such action, then the *Owner* may, at its sole and absolute discretion and after it has given Notice in Writing to the *Contractor*, take some or all of such actions to partially or wholly remove or relieve such *Force Majeure* or its direct or indirect effects, and thereafter require the *Contractor* to resume the performance of the *Work*."

38.4 Delete paragraph 6.5.4 in its entirety and replace it with the following:

"No extension of the *Contract Time* will be approved unless the *Contractor* provides *Notice in Writing* to the *Owner* within 3 *Working Days* of the date upon which the *Contractor* ought reasonably to have been aware of the delay contemplated in paragraphs 6.5.1, 6.5.2 or 6.5.3. For the *Notice in Writing* to be valid under this paragraph 6.5.4 it must include specific details about:

.1 the cause of the delay;

.2 the likely impact the delay will have on the *Contract Time* and details of the extension of time being requested; and

.3 mitigation efforts, if any, undertaken by the *Contractor* or, where no mitigation efforts have been undertaken by the *Contractor*, the reasons why mitigation is either not possible or has not been undertaken by the *Contractor*."

38.5 Add new paragraph 6.5.6 as follows:

"If the *Contractor* delays the performance of the *Work* and such delay is for a cause within the *Contractor*'s control, the *Contractor* shall pay to the *Owner* the per diem rate for liquidated damages specified in Article 10 of the *Contract* for each day of delay if *Ready-for-Takeover* is not achieved in accordance with the time specified in Article A-1.3. If the per diem rate for liquidated damages is not specified in the *Contract Documents*, the *Contractor* shall pay to the *Owner* the *Administration Costs* incurred by the *Owner* as a result of the delay."

38.6 Add new paragraph 6.5.7 as follows:

"If the *Contractor* is delayed in the performance of the *Work* due to the replacement of a representative, worker, *Subcontractor* or *Supplier* pursuant to GC 3.5.4, 3.6.2 or 3.7.4, the *Contractor* shall pay to the *Owner* the per diem rate for liquidated damages specified in Article 10 of the *Contract* for each day of delay if *Ready-for-Takeover* is not achieved in accordance with the time specified in Article A-1.3. If the per diem rate for liquidated damages is not specified in the *Contract Documents*, the *Contractor* shall pay to the *Owner* the

Administration Costs incurred by the *Owner* as a result of the delay.

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

39.1 Amend paragraph 7.1.2 by adding the words "including failing or neglecting to comply with the requirements in GC 3.4 – CONSTRUCTION SCHEDULE..." immediately following the word "properly" in line one.

39.2 Amend paragraph 7.1.3.1 as follows:

Insert after the word "commences" the words "and is diligently proceeding with".

39.3 Revise paragraph 7.1.3.2 by substituting the words "an acceptable schedule" with "a schedule *Acceptable* to the *Owner*".

39.4 Amend paragraph 7.1.4.2 by adding to the end of the paragraph the words "and within 5 Working Days publish a notice of termination (form 8) in accordance with the *Construction Act*."

39.5 Amend paragraph 7.1.5.3 by substituting the words "the difference" at the end of paragraph 7.1.5.3 with the words "on the expiry of the warranty period specified in paragraph 12.3.1 for that portion of the *Work* performed by the *Contractor*, provided that such payment shall be made only in accordance with the requirements set out in GC 5.5 – FINAL PAYMENT and GC 5.8 – WITHHOLDING FROM PAYMENT".

39.6 Amend paragraph 7.1.5.4 by substituting the words "the difference" at the end of paragraph 7.1.5.4 with the words "for that portion of the Work performed by the *Contractor*, provided that such payment shall be made only in accordance with the requirements set out in GC 5.5 – FINAL PAYMENT and GC 5.8 – WITHHOLDING FROM PAYMENT".

39.7 Add new paragraph 7.1.7 as follows:

"The *Owner* may, if conditions arise which make it necessary for reasons other than as provided in paragraphs 7.1.1 and 7.1.4, suspend performance of the Work or terminate the *Contract* by giving *Notice in Writing* to that effect to the *Contractor* identifying the reason for the suspension and the expected length of the suspension. Such suspension or termination shall be effective in the manner specified in said notice and shall be without prejudice to any claims which either party may have against the other."

39.8 Add new paragraph 7.1.8 as follows:

"The *Contractor* upon receiving notice of suspension or termination from the *Owner* shall suspend all operations as soon as reasonably possible except work which, in the *Contractor*'s opinion is necessary for the safety of personnel and for the care and preservation of the *Work*, the materials and plant. In the event of such suspension, the *Contractor* shall be reimbursed by the *Owner* for the reasonable costs incurred by the *Contractor* for such protection. Subject to any directions in the notice of suspension or termination, the *Contractor* shall discontinue ordering materials, facilities and supplies and make every reasonable effort to delay delivery of existing orders and, in the event of termination, to cancel existing orders on the best terms available."

39.9 Add new paragraph 7.1.9 as follows:

"During the period of suspension, the *Contractor* shall not remove from the *Place of the Work* any part of the *Work*, or any *Product* or materials without the consent of the *Owner*."

39.10 Add new paragraph 7.1.10 as follows:

"If the Work should be suspended for a period of 30 days or less, the *Contractor*, upon the expiration of the period of suspension, shall resume the performance of the *Work* in accordance with the *Contract Documents*. If the suspension was not due to an act or an omission of the *Contractor*, there shall be an equitable adjustment to the *Contract* Time and the *Contract Price* as agreed upon by the *Owner* and the *Contractor*."

39.11 Add new paragraph 7.1.11 as follows:

"If, after 30 days from the date of notice of suspension of the *Work* the *Owner* and the *Contractor* agree to continue with and complete the Work, the *Contractor* shall resume operations and complete the *Work* in accordance with the terms and conditions agreed upon by the *Owner* and the *Contractor*."

39.12 Add new paragraph 7.1.12 as follows:

"The *Owner* may terminate this *Contract* at any time for any or no reason. Such termination shall be effective upon the date specified in the *Owner*'s *Notice in Writing* advising of the termination of the *Contract* pursuant to this paragraph 7.1.12. In such event, the *Owner* shall pay for the actual and verifiable *Work* performed up to the effective date of termination, including demobilization costs, and for such additional costs, if any, directly flowing from and which are a reasonable consequence of the termination, but excluding any consequential, indirect or special damages, termination fees, penalties or levies, and any claims for loss of profit, lost deposits, or lost opportunity. The *Owner* shall not be liable to the *Contractor* for any other claims, costs or damages whatsoever arising from such termination of the *Contract*. Within 3 Working Days of termination by the *Owner*, the *Contractor* shall deliver a *Notice in Writing* to each of its *Subcontractors* and *Suppliers* confirming the effective date of the termination."

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

40.1 Amend paragraph 7.2.1 by adding to the end of the paragraph the words "and within 5 *Working Days* publish a notice of termination (form 8) in accordance with the *Construction Act*."

40.2 Amend paragraph 7.2.2, by:

(i) adding the following after the words "public authority" in the second line:

"on account of a breach, violation, contravention, or a failure to abide by any laws, ordinances, rules, regulations, or codes of *Authorities Having Jurisdiction*, directly by the *Owner*, the *Owner's Other Contractor*(s) or the *Consultant* and relating to the *Work* or the *Place of the Work*,"; and,

(ii) adding the following to the end of the paragraph:

"unless an acceptable arrangement for an extension of the *Contract* Time is agreed to by the *Contractor* and the *Owner*."

40.3 Delete paragraph 7.2.3.1 in its entirety and replace it with "Intentionally left blank".

40.4 Delete paragraph 7.2.3.3 in its entirety and replace it with a new paragraph 7.2.3.3:

".3 the *Owner* fails to pay the *Contractor* when due the amount certified by the Consultant or awarded by arbitration or a Court, except where the *Owner* has a bona fide claim for set off or otherwise under GC 5.8 – WITHHOLDING FROM PAYMENT; or"

40.5 Amend paragraph 7.2.3.4 by deleting all the words after "degree" and replacing them with "and the *Contractor* confirms by a detailed Notice in Writing to the *Owner* that sufficient cause exists. Such detailed written statement must contain particulars, including references to the *Contract Documents*, and supporting documentation demonstrating the alleged default by the *Owner*."

40.6 Amend paragraph 7.2.4 by adding to the end of the paragraph the words "and within 5 Working Days publish a notice of termination (form 8) in accordance with the *Construction Act*."

40.7 Delete 7.2.5 in its entirety and replace it with the following:

"If the *Contractor* terminates the *Contract* under the conditions described in this GC 7.2, the *Contractor* shall be entitled to be paid for all Work performed to the date of termination. The *Contractor* shall also be entitled to recover the costs associated with termination, including the costs of demobilization, losses sustained on Products and construction machinery and equipment. The *Contractor* shall not be entitled to any recovery for any indirect, special or consequential losses."

41. GC 8.2 ADJUDICATION

41.1 Delete GC 8.2 – ADJUDICATION in its entirety, including all subparagraphs thereunder.

42. GC 8.3 NEGOTIATION, MEDIATION, ARBITRATION AND ADJUDICATION

42.1 Delete GC 8.3 – NEGOTIATION, MEDIATION, AND ARBITRATION, including all paragraphs thereunder and replace it with the following:

"**GC 8.3 – NEGOTIATION, MEDIATION, ARBITRATION AND ADJUDICATION**

"8.3.1 Save and except where the *Contractor* has given an undertaking, in accordance with the *Construction Act*, to refer a dispute to Adjudication, prior to delivering a notice of *Adjudication* in a form prescribed by the *Construction Act*, the parties agree to first address all *Disputes* in a tiered approach as follows:

.1 A *Dispute* shall be referred to the *Owner*'s project manager for the *Project* and a representative of the *Contractor* of the equivalent seniority or position for resolution within a period not to exceed 30 days.

.2 If unresolved, after following the process described in paragraph 8.3.1.1, the *Dispute* shall be referred to the *Owner*'s Director or Vice President who is responsible for the Project and an employee of the *Contractor* of the equivalent seniority or position for resolution within a period not to exceed 30 days.

.3 If unresolved after following the process described in paragraph 8.3.1.2, and only at the election of the *Owner*, the Dispute shall be referred to the CEO of the *Owner* and the most senior executive employee of the *Contractor* for resolution within a period not to exceed 30 days. If the *Owner* does not elect, at its sole option, to proceed under this paragraph 8.3.1.3, the *Dispute* may proceed to under either step as described in paragraphs 8.3.2 or 8.3.3.

8.3.2 If the *Dispute* remains unresolved despite the Parties' attempting to resolve it following the process in paragraph 8.3.1, a party may elect to proceed with the *Dispute* by way of an *Adjudication*. If a party elects to proceed by way of an *Adjudication*, the other party shall not be bound to proceed by way of an Adjudication, save and except where the parties are obliged under the *Construction Act*. The following procedures shall apply to any *Adjudications* the parties engage in under the *Construction Act*:

.1 any hearings shall be held in the offices of the *Owner*, or, if such offices are unavailable, another venue as the parties may agree and which is acceptable to the adjudicator;

.2 the *Adjudication* shall be conducted in English;

.3 each party may be represented by counsel throughout an *Adjudication*;

.4 there shall not be any oral communications with respect to issues in dispute that are the subject of an *Adjudication* between a party and the adjudicator unless it is made in the presence of both parties or their legal representatives; and

.5 a copy of all written communications between the adjudicator and a party shall be given to the other party at the same time.

8.3.3 Any documents or information disclosed by the parties during an *Adjudication* are confidential and the parties shall not use such documents or information for any purpose other than the *Adjudication* in which they are disclosed and shall not disclose such documents and information to any third party, unless otherwise required by law, save and except the adjudicator.

8.3.4 In respect of any claim or dispute, if the *Contractor* fails to comply with any of the notice requirements set out in the *Contract Documents* then the *Contractor* shall be barred from advancing such claim(s) or dispute(s) and shall have no entitlement whatsoever in respect of such claim(s) or dispute(s) (including to an increase in payment under the *Contract*, or an extension of *Contract Time*) and by failing to comply with the notice requirements waives the right to make any such claim(s) or dispute(s) in an *Adjudication* or in any other form of dispute resolution available under this *Contract* or at law. This GC 8.3.4 shall

operate conclusively as an estoppel and bar in the event such claims or disputes are brought in an *Adjudication* or other form of dispute resolution and the *Owner* may rely on this GC 8.3.4 as a complete defence to any such claims or disputes.

8.3.5 The parties hereby acknowledge and agree:

.1 that counterclaims, claims of set-off or the exercise or use of other contractual rights that permit the *Owner* to withhold, deduct or retain from monies otherwise owed to the *Contractor* under the *Contract* may be referred to, and included as part of, *Adjudications* under the *Construction Act*;

.2 that disputes related to the termination or abandonment of the *Contract*, as well as any disputes that arise or are advanced following the termination or abandonment of the *Contract*, shall not be referred to *Adjudication* under the *Construction Act*;

.3 that notice(s) of *Adjudication*, with respect to any dispute or claim relating to the *Project*, shall not be given, and no *Adjudication* shall be commenced following *Ready-for-Takeover*, abandonment, or termination of the *Contract*;

.4 that any *Adjudication* between the *Contractor* and a *Subcontractor* or a *Supplier* that relates to an *Adjudication* between the *Owner* and the *Contractor* shall be joined together to be adjudicated by a single adjudicator, provided that the adjudicator agrees to do so, and the *Contractor* shall include a provision in each of its subcontracts that contain an equivalent obligation to this GC 8.3.5.4; and

.5 that, other than where the *Contractor* is obliged to commence an *Adjudication* pursuant to an undertaking under the *Construction Act*, neither the *Owner* nor the *Contractor* shall commence an *Adjudication* during the *Restricted Period (Adjudication).*

8.3.6 If the *Dispute* remains unresolved despite the parties attempting to resolve it following the process in paragraph 8.3.1 or, following a determination of the *Dispute* pursuant to an *Adjudication* under paragraph 8.3.2, a party may elect to proceed with the *Dispute* under a mediation model to be agreed upon by the parties. A party shall elect to proceed to mediation no later than: (i) 10 days following the expiry of the timeline set out in paragraphs 8.3.1.2 or 8.3.1.3, whichever is the later, or (ii) 10 days following the rendering of the adjudicator's determination following an *Adjudication*. Where a party elects to proceed with mediation within the timelines prescribed in this paragraph 8.3.6, the other party shall be bound to proceed to mediation. No later than 10 days after a party makes an election to proceed to mediation, or such longer period as may be mutually agreed between the parties, the parties shall enter into a mediation agreement which shall set out the mediation process and designate the mediator.

8.3.7 If neither party elects to proceed to mediation within the timelines outlined in paragraph 8.3.5 or 8.3.6, or the parties are unable to enter into a mediation agreement within the time limits, the matter shall proceed and be finally resolved by binding arbitration by a single arbitrator in accordance with the *Arbitration Act* by an arbitration agreement to be executed by the parties and the arbitrator. The parties shall mutually agree on the selection of the arbitrator, failing which the arbitrator shall be appointed in accordance with the *Arbitration Act*. The arbitration proceedings shall take place in Toronto, Ontario, Canada. The language of the arbitration shall be English. The Parties agree that any arbitration award, including with respect to costs, shall be binding on the Parties, may be enforced in any court of competent jurisdiction and shall be final and no appeals or judicial reviews shall be permitted as of right or by application to any court of competent jurisdiction, except on errors of law. The parties shall each bear their own costs and their proportionate share of any joint costs of arbitration, subject to any award of an arbitrator.

8.3.8 The timelines in GC 8.3 may be amended by mutual agreement of the parties."

43. GC 8.4 RETENTION OF RIGHTS

43.1 Amend paragraph 8.4.2 by replacing "paragraph 8.3.6" with "paragraph 8.3.7".

43.2 Add new paragraph 8.4.3 as follows:

"8.4.3 If the *Owner* gives the notice in writing described in paragraph 8.3.7 to have a dispute resolved by arbitration, the *Contractor* agrees that this paragraph 8.4.3 shall be construed as a formal consent to the stay of any lien proceedings until an award is rendered in the arbitration or such dispute as otherwise resolved between the parties. In no event shall the *Contractor* be deprived of its right to enforce its lien

against the *Project* should the *Owner* fail to satisfy any arbitral award against it in full on the dispute in respect of which the lien proceedings were commenced. Provided nothing in this paragraph 8.4.3 shall prevent the *Contractor* from taking the steps required by the *Construction Act* to preserve and/or perfect a lien to which it may be entitled."

44. GC 9.1 PROTECTION OF WORK AND PROPERTY

Amend paragraph 9.1.1.1 by adding the following words at the end of that paragraph:

"...which the *Contractor* could not reasonably have discovered applying the degree of care and skill described in paragraph 3.4.1 to its review of the *Contract Documents*."

44.1 Delete paragraph 9.1.2 in its entirety and replace it with the following new paragraph 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 discoverable by applying to an inspection of the Place of *Work* the degree of care and skill described in paragraph 3.12.1."

44.2 Add new paragraph 9.1.5 as follows:

"The *Contractor* shall neither undertake to repair and/or replace any damage whatsoever to the work of *Other Contractor*s, or to adjoining property, nor acknowledge the same was caused or occasioned by the *Contractor*, without first consulting the *Owner* and receiving written instructions as to the course of action to be followed from either the *Owner* or the *Consultant*. However, where there is danger to life or public safety, the *Contractor* shall take such emergency action as it deems necessary to remove the danger."

45. GC 9.2 TOXIC AND HAZARDOUS SUBSTANCES

45.1 Add new paragraph 9.2.10 as follows:

"The *Contractor* shall indemnify and hold harmless the *Owner*, the *Consultant*, their agents and employees from and against claims, demands, losses, costs, damages, actions, suits or proceedings arising out of or resulting from exposure to, or the presence of, toxic or hazardous substances or materials which were either brought on to the *Place of the Work* by the *Contractor*, or anyone for whom the *Contractor* is in law responsible, and mishandled or handled negligently or improperly or which are otherwise mishandled or handled negligently or improperly by the *Contractor*, or anyone for whom the *Contractor* is in law responsible, thereby creating exposure to toxic or hazardous substances or materials. This obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity set out in GC 13.1 – INDEMNIFICATION or elsewhere in the *Contract* or which otherwise exist respecting a person or party described in this paragraph."

46. GC 9.4 CONSTRUCTION SAFETY

46.1 Delete paragraph 9.4.1 in its entirety and replace it with the following:

"9.4.1 The *Contractor* shall be solely responsible for construction safety at the *Place of the Work* and for compliance with the rules, regulations and practices required by the applicable construction health and safety legislation and shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of the *Work*. Without limiting the generality of the foregoing, the *Contractor* shall comply with the occupational health and safety laws and regulations and any orders, recommendations and restrictions made by the federal, provincial or municipal governments and the advice, recommendations and instructions of public health officials, as they apply to the *Place of the Work*. If the *Place of the Work* is located on the *Owner*'s premises, the *Contractor* shall comply with all the *Owner*'s policies and directions to ensure the health and safety of the *Owner*'s employees and *Other Contractor*s as well as the *Contractor*'s employees, *Subcontractors* and *Suppliers*. The *Contractor* shall submit its Health and Safety Plan to the *Owner* and the *Consultant* for *Acceptance* prior to commencing the *Work*, which Plan shall include all the elements required by the *Specifications* for a Health and Safety Plan. The *Contractor* shall indemnify and hold harmless the *Owner* for any fines, penalties or other costs imposed or assessed on or incurred by the *Owner* arising from the *Contractor*'s failure to comply with the applicable health and safety laws, any orders, recommendations and restrictions of the federal, provincial or municipal governments or the advice, recommendations and instructions of public health officials. "

46.2 Amend GC 9.4.2 by adding the following words after "and the *Contractor*":

", *Subcontractors* and *Suppliers*".

46.3 Amend GC 9.4.3 by adding the following words after "and the *Contractor*":

", *Subcontractors* and *Suppliers*".

46.4 Delete paragraph 9.4.4 in its entirety and replace it with the following:

"9.4.4 Prior to the commencement of the *Work*, the *Contractor* shall submit to the *Owner*:

.1 a current WSIB clearance certificate;

.2 copies of the *Contractor*'s insurance policies having application to the Project or certificates of insurance, at the option of the *Owner*;

.3 documentation of the *Contractor*'s in-house safety-related programs; and

.4 a copy of the Notice of Project filed with the Ministry of Labour naming itself as "Constructor" under the *Occupational Health and Safety Act*."

46.5 Delete paragraph 9.4.5 in its entirety and replace it with the following:

"The *Contractor* shall indemnify and save harmless the *Owner*, its agents, officers, directors, employees, consultants, successors and assigns from and against the consequences of any and all safety infractions committed by the *Contractor* under the *Occupational Health and Safety Act* and any breaches of the *Emergency Management and Civil Protection Act* and related orders, recommendations or regulations, including the payment of legal fees and disbursements on a full indemnity basis."

46.6 Add new paragraph 9.4.6 as follows:

"9.4.6 The *Contractor* shall ensure that it and its employees, *Subcontractors* and *Suppliers* are aware of and, while being on the *Owner*'s property, comply with the *Owner*'s policies, including its Fit for Duty Policy, and with the Ontario Northland Operating Manual, including the Current Summary Bulletin, current Ontario Northland Time Table, C.R.O.R. 2022, Infrastructure Special Instructions, Dangerous Goods and Ontario Northland General Operating Instructions, as applicable."

46.7 Add new paragraph 9.4.7 as follows:

"9.4.7 In the event of an emergency threatening health, life or property, the *Contractor* shall take such action as may be necessary to save lives and protect persons from injury and to protect and preserve the property. The *Contractor* shall notify the *Owner* of such emergency as promptly as is practical under the circumstances."

47. GC 9.6 IMPACT ASSESSMENT

47.1 Add new GC 9.6 – IMPACT ASSESSMENT as follows:

"**GC 9.6 IMPACT ASSESSMENT**

9.6.1 The *Contractor* shall be responsible for:

.1 ensuring that any potential impacts and areas of concern identified in the *Contract Documents* or *Impact Assessment Reports*, if provided, are mitigated during the *Work*; and,

.2 identifying any previously unknown impacts relating to fish, navigable waters, species at risk, vegetation, wildlife, socio-economic and heritage that arise prior to commencing the *Work* and during the *Work*.

9.6.2 If the *Contractor* or *Owner* observes or reasonably suspects the presence of any impacts described in paragraph 9.6.1.2 that are not mentioned or accounted for in the *Contract Documents* or *Impact Assessment Reports*, if any, and related mitigation plans,

.1 the observing party shall immediately report the circumstances to the other party;

.2 the *Contractor* shall immediately take reasonable steps, including stopping the *Work* if necessary, to ensure that any potential impacts are mitigated; and,

.3 if the *Owner* and *Contractor* do not agree on the existence, significance or mitigation measures for the impact, the *Owner* shall retain and pay for an independent qualified expert to investigate and determine the issue and the parties will enter into a *Change Order* if the mitigation measures will cause an increase or decrease in the *Contractor*'s cost or time to perform the *Work*.

9.6.3 If the *Contractor* fails to comply with the requirements in paragraph 9.6.2, the *Contractor* shall:

.1 be responsible for all costs incurred by the *Owner* or the *Contractor* to mitigate the damage caused due to the failure;

.2 not be entitled to request a *Change Order* relating to the failure to comply; and

.3 indemnify the *Owner* and hold it harmless from any claims, damages, costs, fines or other expenses, including reasonable legal fees and expenses, relating to or arising from the *Contractor*'s failure to comply with paragraph 9.6.2."

48. GC 9.7 ENVIRONMENTAL PROTECTION FOR CONSTRUCTION IN AND AROUND WATERBODIES

48.1 Add new GC 9.7 – ENVIRONMENTAL PROTECTION FOR CONSTRUCTION IN AND AROUND WATERBODIES as follows:

"**GC 9.7 ENVIRONMENTAL PROTECTION FOR CONSTRUCTION IN AND AROUND WATERBODIES**

9.7.1 The *Contractor* shall comply with the environmental protection requirements and mitigation measures that apply to construction involving work in and around waterbodies and on waterbody banks as set out in OPSS.PROV 182.

9.7.2 Pursuant to section 38(4) of the *Fisheries Act,* the *Contractor* has an obligation to notify the Department of Fisheries & Oceans ("DFO") when the *Work* results in the unauthorized death of fish or a harmful alteration, disruption or destruction ("HADD") of fish habitat or where there is imminent danger that the death of fish or HADD of fish habitat could occur. The notification shall be done using the form attached as Schedule D. The *Contractor* shall also notify the Consultant and the *Owner* of any such incidents. Failure to notify DFO of such incidents is a federal offence.

9.7.3 In accordance with the *Fisheries Act*, notification must be made without delay to DFO after the *Contractor* ensures the immediate health and safety risks are managed at the *Place of the Work*. Updates to DFO may be provided at a later time, if required.

9.7.4 All spills and sediment releases into a waterbody during the *Work* must be immediately reported by the *Contractor* to the *Consultant* and the *Owner* who must report the release to the Spills Action Centre ("SAC") operated by the Ministry of Environment, Conservation and Parks ("MECP") at 800-288-6060. If the *Consultant* or the *Owner* is not available, the *Contractor* shall report the incident to SAC. The *Contractor* shall take all reasonable measures to mitigate or remedy any adverse effects that result from the occurrence or might reasonably be expected to result from it."

49. GC 9.8 ENVIRONMENTAL SPILLS AND RELEASES

49.1 Add new GC 9.8 – ENVIRONMENTAL SPILLS AND RELEASES as follows:

"**GC 9.8 ENVIRONMENTAL SPILLS AND RELEASES**

9.8.1 All spills and releases of hazardous substances in the course of the *Work* must be immediately reported by the *Contractor* to the *Consultant* and the *Owner* who will report the spill or release to the MOECP SAC. If the *Consultant* or the *Owner* is not available, the *Contractor* shall report the incident to the MOECP SAC and the ONTC RTC at 800-558-4129 or Ext. 141.

9.8.2 The *Contractor* shall take immediate steps to mitigate the damage to the environment and contain the spill or release. If the *Contractor* does not take timely action or, if the *Contractor* is not available, the *Consultant* or the *Owner* may direct others to remedy the situation.

9.8.3 If the spill or release was the fault of the *Contractor*, the remedial work shall be completed at the cost of the *Contractor* and with no additional cost to the *Owner* and the *Owner* shall be entitled to seek reimbursements for all costs associated with the remedial work including the cost of work done by third parties.

9.8.4 If the spill or release was not the fault of the *Contractor*, the *Owner* shall pay for the remedial work.

50. GC 10.1 TAXES AND DUTIES

50.1 Amend paragraph 10.1.2 by adding the following sentence at the end of that paragraph:

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

50.2 Add new paragraph 10.1.3 as follows:

"Where an exemption or a recovery of sales taxes, customs duties, excise taxes or Value Added Taxes, rebates, or monies from incentive programs is applicable to the *Contract*, the *Contractor* shall, at the request of the *Owner*, assist, join in, or make application for any exemption, recovery or refund of all such taxes, duties, rebates and incentives and all amounts recovered or exemptions obtained shall be for the sole benefit of the *Owner*. The *Contractor* agrees to endorse over the *Owner* any cheques received from the federal or provincial governments, or any other *Authority Having Jurisdiction*, as may be required to give effect to this paragraph 10.1.3."

50.3 Add new paragraph 10.1.4 as follows:

"The *Contractor* shall maintain accurate records tabulating equipment, material and component costs reflecting the taxes, customs duties, excise taxes and *Value Added Taxes* paid."

50.4 Add new paragraph 10.1.5 as follows:

"Any refund of taxes, including without limitation, any government sales tax, customs duty, excise tax or *Value Added Taxes*, whether or not paid, which is found to be inapplicable or for which exemption may be obtained, is the sole and exclusive property of the *Owner*."

50.5 Add new paragraph 10.1.6 as follows:

"The *Contractor* agrees to cooperate with the *Owner* and to obtain from all *Subcontractors* and *Suppliers* cooperation with the *Owner* in the application for any rebates, incentives or refund or exemption of any taxes, which cooperation shall include, but not be limited to, making or concurring in the making of an application for any such rebates, incentives, refund or exemption and providing to the *Owner* copies, or where required, originals of records, invoices, purchase orders and other documentation necessary to support such applications. All such rebates, incentives or refunds shall either be paid to the *Owner*, or shall be a credit to the *Owner* against the *Contract Price*, in the *Owner*'s discretion."

50.6 Add new paragraph 10.1.7 as follows:

"Customs duties penalties, or any other penalty, fine or assessment levied against the *Contractor* shall not be treated as a tax or customs duty for purposes of this GC 10.1."

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

51.1 Delete paragraph 10.2.2 in its entirety and substitute the following:

"The *Owner* has Crown immunity from the *Building Code Act* and the *Planning Act* and will not be obtaining building permits or development approvals. The *Owner* shall obtain and pay for any permanent easements over *Third Party Property* required for the completion of the Work. The *Contractor* shall be responsible for all other permissions for access to *Third Party Property*."

51.2 Add to the end of paragraph 10.2.4. the following:

"Whenever standards of law, ordinances, rules, regulations, codes and orders relating to the *Work* differ, the most stringent standards shall govern."

51.3 Amend paragraph 10.2.5 by adding the words, "Subject to paragraph 3.4.1" to the beginning of the paragraph

- and

add the following to the end of the second sentence:

"...and no further *Work* on the affected components of the *Contract* shall proceed until these changes to the *Contract Documents* have been obtained by the *Contractor* from the *Consultant*."

51.4 Amend paragraph 10.2.6 by adding the following sentence at the end of that paragraph:

"In the event the *Owner* suffers loss or damage as a result of the *Contractor*'s failure to comply with paragraph 10.2.5, and notwithstanding any limitations described in paragraph 13.1.1, the *Contractor* agrees to indemnify and to hold harmless the *Owner* and the *Consultant* from and against any claims, demands, losses, costs, damages, actions, suits or proceedings resulting from such failure by the *Contractor*."

51.5 Amend paragraph 10.2.7 by adding the words "which changes were not or could not have reasonably been known to the *Owner* or the *Contractor*, as applicable, at the time of deadline for submission of responses to the RFP and which changes did not arise as a result of a public emergency or other *Force Majeure* event" to the second line, after the words "authorities having jurisdiction".

51.6 Add new paragraph 10.2.8 as follows:

"The *Contractor* shall furnish necessary certificates as evidence that the *Work* installed conforms with laws and regulations of authorities having jurisdiction, including certificates of compliance for *Owner*'s occupancy or partial occupancy. These certificates are to be final certificates giving complete clearance of the *Work*."

52. GC 10.3 PATENT FEES

52.1 Delete paragraph 10.3.2 in its entirety.

53. GC 10.4 WORKERS' COMPENSATION

53.1 Add new paragraph 10.4.2 as follows:

"10.4.2 The *Contractor* shall be solely responsible for its employees and officers and for its *Subcontractors* and their officers and employees, including ensuring that all required employer filings, contributions, deductions, and payments are made or remitted, as the case may be, with respect to applicable employer health taxes and under the *Employment Insurance Act*, the Canada Pension Plan, the Ontario *Workplace Safety and Insurance Act, 1997*, and all equivalent legislation in any other applicable jurisdiction. Without limiting the generality of the foregoing, the *Contractor* shall indemnify, defend and hold harmless the *Owner*, its directors, officers, and employees from all claims, demands, actions, suits or proceedings arising from any health, medical, disability or similar claims which *Contractor*'s employees or officers or any of its *Subcontractors* or their officers or employees may make against the *Owner*, its directors, officers, or employees during or after the *Contract Time*, whether or not such claims are attributable to the *Contractor*'s or *Subcontractor*'s performance of the *Work* or related to the *Contractor*'s obligations under this *Contract*."

54. GC 11.1 INSURANCE

54.1 Amend the title of GC 11 to add the words “CONTRACT SECURITY” at end of title.

54.2 Delete items .1 to .8 in paragraph 11.1.1 and in CCDC 41 and replace with the following:

“1. 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 $50,000. 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. 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 including but not limited to:

.1 Bodily injury, death, and property damage including loss of use thereof.

.2 Premises and operations liability.

.3 Products and completed operations liability.

.4 Blanket contractual liability.

.5 Cross liability and severability of interest clauses.

.6 Contingent employer’s liability.

.7 Personal injury liability.

.8 *Owner*’s and *Contractor*’s protective coverage.

.9 Broad form property damage.

.10 Elevator and hoist liability.

.11 Liability for attached machinery, including loading and unloading.

.12 Extension of coverage shoring; blasting; excavation; underpinning; demolition; on work; below ground surface work, including tunneling and grading, if applicable to the Project.

The General Liability Insurance shall not include any exclusion relating to working in the vicinity of railway operations.

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*.

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. 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.

6. Professional Liability Insurance (if applicable). This policy shall cover risks of errors, omissions or negligent acts in the performance of professional services for the *Project*. The Named Insureds are to be approved and accepted for coverage by the Insurer. This policy shall provide for a limit of liability of not less than $1,000,000 per claim and $2,000,000 in the aggregate (inclusive of defence costs and expenses).

7. Technology Liability Insurance (if applicable) for financial loss arising out of an error, omission, or negligent act in the rendering of services in an amount not less than **$5,000,000** per claim and **$5,000,000** aggregate. Such policy shall be on a claims made basis and shall provide coverage for damages and defense costs. The Technology Professional Liability policy will also include an insuring agreement for cyber or network security and privacy liability insurance, covering financial loss arising out of actual or potential unauthorized access, unauthorized use, and a failure to protect confidential information which results in loss or misappropriation of such information in both electronic and non-electronic format. Such insurance will have a limit of an amount not less than $5,000,000 per claim and $5,000,000 aggregate. The *Contractor* shall maintain said liability coverage in place for a three-year period after termination of the *Contract* by way of annual policy renewal, or purchase of extended reporting period.

8. "All Risks" Builders Risk and Boiler & Machinery Insurance (if applicable) shall have limits of not less than the sum of 1.1 times *Contract Price,* plus any property, including design services, the *Owner* provides for incorporation into the *Work*. This policy shall cover all risks of direct physical loss or damage to the *Project*, including but not limited to the perils of earthquake and flood, subject to policy sub limits, warranties and exclusions and shall not be less than the insurance provided by IBC Forms 4042 and 4047 or their equivalent replacement. This insurance shall cover all property forming part of the *Project*, and goods and materials to be incorporated in the *Project* while at the *Place of the Work*, in transit, or while in off-site storage. It shall not provide coverage for the *Contractor's* or *Subcontractors'* equipment other than scaffolding, formwork, fences, shoring, hoarding, falsework, tarpaulins and temporary buildings in connection with the *Work*. The insurance shall not have a deductible greater than $50,000.

9. Pollution Liability Insurance for an amount not less than $5,000,000 per occurrence and in the aggregate and a deductible of not more than $50,000. This policy shall be written on either an Occurrence or Claims Made Form and will provide coverage on a sudden and accidental, and gradual pollution events basis for on-site cleanup and remediation as well as on-site and off-site third party claims for bodily injury and property damage, cleanup and remediation."

55. GC 11.2 CONTRACT SECURITY

55.1 Add new GC 11.2 – CONTRACT SECURITY as follows:

"**GC 11.2 CONTRACT SECURITY**

11.2.1 If required by the RFP, the *Contractor* shall provide a performance bond and a labour and materials payment bond, each issued by a bonding company acceptable to *Owner* and licensed to issue such instruments in the *Place of the Work*, in the amounts and forms as follows:

.1 Amount of performance bond shall be equal to not less than 50% of the *Contract Price* in the form prescribed by the *Construction Act.*

.2 Amount of labour and material payment bond shall be equal to not less than 50% of the *Contract Price* in the form prescribed by the *Construction Act*.

11.2.2 The bonds provided in accordance with paragraph 11.2.1 shall guarantee the faithful performance of the *Contract* in accordance with the *Contract Documents*, including the requirements for warranties provided for the GC 12.3 – WARRANTY, and the payment of all obligations incurred in the event of the *Contractor*'s default, including but not limited to the following:

.1 the payment of legal, accounting, architectural, engineering, and *Consultant*'s expenses incurred by the *Owner* in determining the extent of Work executed and any additional Work required as a result of the interruption of the Work, and its completion; and

.2 the payment of additional expenses to the *Owner* in the form of security guard services, light, heat, power, loss of use of premises, and other related costs, payable over the period between the default of the *Contract* and completion of the *Work*.

11.2.3 Without limiting the foregoing in any way, the bonds shall indemnify and hold harmless the *Owner* for and against costs and expenses (including legal and consultant services and court costs) arising out of or as a consequence of any default of the *Contractor* under this *Contract*.

11.2.4 The *Contractor* shall be responsible for notifying the surety company of any changes made to the *Contract Documents* or the *Contract Price* during the course of the Work.

11.2.5 The premiums for bonds required by the *Contract Documents* shall be included in the *Contract Price*.

11.2.6 Should the *Owner* require additional bonds by the *Contractor* or any of its *Subcontractors*, after the receipt of bids for the *Work*, the *Contract Price* shall be increased by the actual costs attributable to providing such bonds. The *Contractor* shall promptly provide the *Owner*, through the *Consultant*, with any such bonds that may be required."

56. GC 12.1 READY-FOR-TAKEOVER

56.1 Delete GC 12.1.1 in its entirety and replace it with the following:

"12.1.1 *Ready-for-Takeover* shall be achieved when all of the following has occurred, as verified and *Accepted* by the *Owner*:

.1 *Substantial Performance of the Work* has been achieved, as certified by the *Consultant*;

.2 the appropriate permits (if any) for the *Place of the Work* have been obtained from the authorities having jurisdiction;

.3 the *Work* to be performed under the *Contract* has satisfied the requirements for deemed completion in accordance with Section 2(3) of the *Construction Act*,

.4 final cleaning and waste removal, as required by the *Contract Documents*;

.5 the *Contractor* has delivered to the *Consultant* and the *Owner* all inspection certificates from authorities having jurisdiction with respect to any component of the *Work* which has been completed;

.6 subject only to GC 12.1.2, the entire *Work* has been completed to the requirements of the *Contract Documents*, including completion of all items on the punch list prepared at the time of *Substantial Performance of the Work* and the *Work* is being used for its intended purpose, and is so certified by the *Consultant*;

.7 subject only to GC 12.1.2, the *Contractor* has submitted to the *Owner* and the *Consultant* in a collated and organized matter, all *Close-Out Documentation* and any other materials or documentation required by the *Contract Documents*;

.8 subject only to GC 12.1.2, all *Products*, systems and components of the *Project* have been commissioned and certified for operation and accepted by the *Owner* and *Consultant*, and

.9 subject only to GC 12.1.2, the *Contractor* has submitted to the *Owner* and the *Consultant* full and complete *As-built Drawings* and *Specifications* revised by the *Contractor* to reflect the as-built state of the *Work*, clearly showing changes to the *Drawings* and *Specifications* from the original *Contract Documents*, all of which have been *Accepted* by the *Owner* acting reasonably."

56.2 Delete GC 12.1.2 in its entirety and replace it with the following:

"12.1.2 The *Owner* may, in its sole, absolute, and unfettered discretion, waive compliance with a requirement, or a part thereof, for achieving *Ready-for-Takeover* set out in GC 12.1.1.6 to 12.1.1.9 (inclusive). Where the *Owner* exercises the discretion afforded under this GC 12.1.2, the *Contractor* shall be required to comply with GC 5.5.1.3

as part of its application for final payment and the *Owner* and the *Contractor*, in consultation with the *Consultant*, shall establish a reasonable date for completing the *Work*."

56.3 Delete GC 12.1.3 in its entirety and replace it with the following:

"12.1.3When the *Contractor* considers the *Work* has attained *Ready-for-Takeover*, it shall submit a written application to the *Owner* and the *Consultant* for review."

56.4 In GC 12.1.4, delete the words "list and" from the second line.

56.5 Delete GC 12.1.5 in its entirety and replace it with the following:

"12.1.5 Following the confirmation of the date of *Ready-for-Takeover* by the *Consultant* and as confirmed by the *Owner*, the *Contractor* may submit a final application for payment in accordance with GC 5.5 – FINAL PAYMENT."

56.6 Delete GC 12.1.6 in its entirety.

57. GC 12.2 EARLY OCCUPANCY BY THE OWNER

57.1 Delete GC 12.2 – EARLY OCCUPANCY BY THE OWNER in its entirety.

58. GC 12.3 WARRANTY

58.1 Amend paragraph 12.3.2 by adding the words, "Subject to paragraph 1.1.3...." at the beginning of that paragraph.

58.2 Delete paragraphs 12.3.4 and 12.3.5 and replace with the following paragraphs:

"12.3.4 The *Contractor* shall correct, at no additional cost to the *Owner*, defects or deficiencies in the *Work* that appear, prior to and during the *Warranty Period*. Any *Work* repaired or replaced during the *Warranty Period* shall be re-warranted for an additional 12 months from the date of completion of the repair or replacement. Notwithstanding the expiration of the *Warranty Period*, the *Contractor* shall not be relieved of its obligations to correct any defects or deficiencies in the *Work* of which *Notice in Writing* has been given to the *Contractor* prior to the expiration of the *Warranty Period*.

12.3.5 The *Owner* shall provide *Notice in Writing* to the *Contractor* of defects and deficiencies in the *Work* discovered during the *Warranty Period*. The *Contractor* shall submit a remediation plan for the permanent rectification of the defects and deficiencies within 2 *Working Days* after delivery of the *Notice in Writing*, including the schedule for the remediation work to be completed. Upon *Acceptance* by the *Owner* of the remediation plan, the *Contractor* shall remediate the defects and deficiencies in accordance with the schedule set out in the *Accepted* plan. *Acceptance* by the *Owner* of a remediation plan does not prohibit the *Owner* from pursuing other remedies it may have against the *Contractor* arising from the defects and deficiencies in the *Work*.

58.3 Amend paragraph 12.3.6 by adding at the end of the paragraph the following:

"The *Extended Warranty Period* for each *Extended Warranty* described in the *Specifications* shall commence on the expiry of the *Warranty Period* described in paragraph 12.3.1. The *Extended Warranties* shall be submitted to the *Owner* as part of the *Close-Out Documentation*."

58.4 Add the following new paragraphs 12.3.7 to 12.3.12:

"12.3.7 The decision of the *Owner* shall be final as to the existence of such defects and deficiencies in the *Work*, the necessity of remedying same, and the remedial measures required.

12.3.8 If the *Contractor* fails to do the work to correct the defects or deficiencies, the *Owner* shall be entitled to carry out such work by its own forces or by *Other Contractor*s. If such work is work which the *Contractor* should have carried out at the *Contractor*'s own expense, the *Owner* shall be entitled to recover from the *Contractor* the cost thereof or may deduct the same from any monies due or that become due to the *Contractor*, including the warranty holdback, if any.

12.3.9 Any insurance, contract security, surety or deposit required by the *Contract Documents* shall remain in full effect at the expense of the *Contractor* during the *Warranty Period*.

12.3.10 The *Contractor* shall be responsible for the costs for inspection and testing for the correction of defects or deficiencies. The *Owner* shall have the right to deduct the cost of the inspection and testing from any monies owed to the *Contractor*.

12.3.11 The *Owner* may hold back, if set out in the *Contract Documents*, on each application for payment, advance payment or progress draw, 2.5% of the total amount payable under each such application for payment, advance payment or progress draw as security for the *Contractor*'s performance of its warranty obligations. In the event the *Contractor* fails to correct a defect or deficiency during the warranty period within the required time and/or fails to pay for the redesign, reconstruction and other costs related to damages arising from a defect or deficiency, the *Owner* shall have the right to use the warranty holdback, or such part of it still being held by the *Owner* to pay for the costs of remedying the defect or deficiency and any redesign, reconstruction or other costs relating to the defect or deficiency. If the costs are greater than the amount of the warranty holdback, the *Contractor* shall pay the additional costs upon receipt of an invoice from the *Owner*. The *Contractor* shall have the right to invoice the *Owner* for the balance of the warranty holdback at the end of the *Warranty Period* or *Extended Warranty Period* as described in paragraph 12.3.4.

12.3.12 The *Contractor* shall assign to the *Owner* all warranties, guarantees or other obligations for *Work*, services or *Products* performed or supplied by any *Subcontractor*, *Supplier* or other person in connection with the *Work* and such assignment shall be with the consent of the assigning party where required by law or by the terms of that party'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*. Until the expiry of the relevant *Warranty Periods* enforceable against the *Contractor*, the *Owner* shall have in its custody all warranties, guarantees and other obligations to third parties respecting the *Work*.

12.3.13 The *Contractor*'s obligations under this GC 12.3 shall continue notwithstanding any withholding of payment made by the *Owner* under GC 5.8 **–** WITHOLDING OF PAYMENT or by performance by the *Owner* directly or through other forces of the *Contractor*'s obligations under this *Contract*, where the *Contractor* is in default in the performance of such obligations."

59. GC 13.1 INDEMNIFICATION

59.1 Delete GC 13.1 – INDEMNIFICATION in its entirety and substitute the following:

"13.1.1 The *Contractor* shall indemnify and hold harmless the *Owner* and its directors, officers, employees, contractors and agents (collectively the "*Owner*'s Indemnitees") from and against all loss, liability, damage, fines, cost, legal cost and disbursement whatsoever arising out of or related to the Work or the *Contract Documents* ("Loss"), by whomever made, sustained, incurred, brought or prosecuted, arising out of, or in connection with, anything done or omitted to be done by the *Contractor* in the course of the performance of the *Contractor*'s obligations under the *Contract Documents* or otherwise in connection with the Work. The *Contractor* shall, at the *Owner*'s election, either assume the defence of every proceeding brought in respect of such Loss, or cooperate with the *Owner* in the defence, including providing *Owner* with prompt Notice of any possible Loss and providing the *Owner* with all information and material relevant to the possible Loss.

13.1.2 GC 13.1 – INDEMNIFICATION shall govern over the provisions of paragraph 1.3.1 of GC 1.3 – RIGHTS AND REMEDIES.

13.1.3 The *Contractor* shall make full and complete compensation for any bodily injury or death to any person and for any damage caused to the *Owner*'s or a third party's physical property by the *Contractor*'s act or omission.

13.1.4 The *Contractor* shall be liable for any claims arising from any personal injuries to or death of any of the *Contractor*'s employees, *Subcontractors* or *Suppliers* or from any loss of or damage to any property belonging to the *Contractor* or its employees, *Subcontractors* or *Suppliers* during the performance of the *Work* unless caused by the negligent act or omission of *Owner*.

13.1.5 Notwithstanding any other provision of the *Contract Documents*:

(a) The *Owner* shall not be responsible for indirect, consequential, special, incidental or contingent damages of any nature whatsoever, including loss or revenue or profit or damages resulting from interruption of service or transmission. This limitation shall apply regardless of the form of action, damage, claim, liability, cost, expense or loss, whether in contract (including fundamental breach), statute, tort (including negligence), or otherwise, and regardless of whether the *Owner* has been advised of the possibility of such damages; and,

(b) Any express or implied reference to the *Owner* providing an indemnity or any other form of indebtedness or contingent liability that would directly or indirectly increase the indebtedness or contingent liabilities of the *Owner* or the Province of Ontario, whether at the time of execution of this Agreement or at any time during the performance of the Work and the Warranty Period, shall be void and of no legal effect in accordance with s.28 of the Financial Administration Act, R.S.O. 1990, c. F.12.

13.1.6 The *Contractor* shall indemnify the *Owner* and the *Owner* Indemnitees and save them harmless from and against all Loss incurred by the *Owner* arising from:

(a) any decision or interpretation by any court or *Authority Having Jurisdiction* that: (i) any of the *Contractor*'s employees are an employee of the *Owner*; or (ii) the *Owner* is liable to pay statutory contributions or deductions in respect of any of the *Contractor*'s employees under any laws, including employment insurance, provincial health insurance, income tax or other employment matters;

(b) any health, medical disability or similar claims which the *Contractor* or *Contractor*'s employees may have during or after the term of this *Contract*;

(c) a claim by any third party against the *Owner* alleging that the *Submittals* and their use by the *Owner*, infringes any *Intellectual Property rights*;

(d) safety infractions committed by the *Contractor* under the Occupational Health and Safety Act or any other laws, guidelines or public health orders regulating health and safety at the *Place of the Work*;

(e) any claims against the *Owner* for the failure of the *Contractor* to protect the confidentiality of *Confidential Information*;

(f) exposure to, or the presence of, toxic or hazardous substances or materials which were either brought on to the *Place of the Work* by the *Contractor* or the *Contractor* mishandled or handled negligently or improperly the substances or materials;

(g) a claim from adjacent landowners or other third parties regarding damage to their property due to the *Work*; and

(h) the release into the environment of materials resulting from the *Work* that contain *Environmental Contaminants* during the transportation of such materials from the *Place of the Work* to the approved waste disposal site.

60. GC 13.2 WAIVER OF CLAIMS

60.1 Delete GC 13.2 – WAIVER OF CLAIMS in its entirety and substitute the following:

"13.2.1 WAIVER OF CLAIMS BY OWNER

As of the date of the final certificate for payment, the *Owner* expressly waives and releases the *Contractor* from all claims against the *Contractor* including without limitation those that might arise from the negligence or breach of contract by the *Contractor* except one or more of the following:

.1 those made in writing prior to the date of the final certificate for payment and still unsettled;

.2 those arising from the provisions of GC 13.1 – INDEMNIFICATION or GC 12.3 – WARRANTY;

.3 those arising from the provisions of paragraph 9.6.1 of GC 9.6 – IMPACT ASSESSMENTS and arising from the *Contractor* failing to comply with the mitigation plans in the *Impact Assessment Reports* or failing to assess impacts and implement mitigation plans for impacts that arise during the *Work*;

.4 those arising from the provisions of paragraph 9.2.5 of GC 9.2 – TOXIC AND HAZARDOUS SUBSTANCES and arising from the *Contractor* bringing or introducing any toxic or hazardous substances and materials to the *Place of the Work* after the *Contractor* commences the *Work*;

.5 those arising from the provisions of paragraph 9.5.1 of GC 9.5 – MOULD and arising from the *Contractor* bringing or introducing mould to the Place of the Work; or

.6 those made in writing within a period of 6 years from the date of *Substantial Performance of the Work*, as set out in the certificate of *Substantial Performance of the Work*, arising from the *Contractor*'s performance of the *Contract* with respect to material defects or deficiencies in the *Work*.

13.2.2 WAIVER OF CLAIMS BY CONTRACTOR

As of the date of the final certificate for payment, the *Contractor* expressly waives and releases the *Owner* from all claims against the *Owner* including without limitation those that might arise from the negligence or breach of contract by the *Owner* except:

.1 those made in writing prior to the *Contractor*'s application for final payment and still unsettled; and

.2 those arising from the provisions of GC 9.2 – TOXIC AND HAZARDOUS SUBSTANCES, GC 9.5 – MOULD, or GC 10.3 – PATENT FEES.

13.2.3 GC 13.2 – WAIVER OF CLAIMS shall govern over the provisions of paragraph 1.3.1 of GC 1.3 – RIGHTS AND REMEDIES."

61. PART 14 OTHER PROVISIONS

61.1 Add new PART 14 as follows:

"**PART 14 OTHER PROVISIONS**

GC 14.1 *OWNER*SHIP OF MATERIALS

14.1.1 Unless otherwise specified, all materials existing at the *Place of the Work* at the time of execution of the *Contract* shall remain the property of the *Owner*. All work and *Products* delivered to the *Place of the Work* by the *Contractor* shall be the property of the *Owner*. The *Contractor* shall remove all surplus or rejected materials as its property when notified in writing to do so by the *Consultant*.

GC 14.2 *CONTRACTOR* DISCHARGE OF LIABILITIES

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

GC 14.3 DAILY REPORTS/DAILY LOGS

14.3.1 The *Contractor* shall cause its supervisor, or such competent person as it may delegate, to prepare a daily log or diary reporting on weather conditions, work force of the *Contractor*, *Subcontractors*, *Suppliers* and any other forces on site and also record the general nature of *Project* activities. Such log or diary shall also include any extraordinary or emergency events which may occur and also the identities of any persons who visit the *Place of the Work* who are not part of the day-to-day work force.

14.3.2 The *Contractor* shall also maintain records, either at its head office or at the *Place of the Work*, recording manpower and material resourcing on the *Project*, including records which document the activities of the *Contractor* in connection with GC 3.4 – CONSTRUCTION SCHEDULE, and comparing that resourcing to the resourcing anticipated when the most recent version of the schedule was prepared pursuant to GC 3.4 – CONSTRUCTION SCHEDULE.

GC 14.4 CONFIDENTIAL INFORMATION

14.4.1 The *Contractor* must not advertise or issue any information, publication, document or article (including photographs or film) for publication or media releases or other publicity relating to the *Work* or the *Owner*'s *Confidential Information* without the prior written approval of the *Owner*.

14.4.2 The *Contractor* must not, and must ensure that the *Contractor*'s personnel do not, without the prior written approval of ONTC:

.1 use *Confidential Information* other than as necessary for the purposes of fulfilling the *Contractor*'s obligations under this *Contract*; or

.2 disclose the Confidential Information, other than to the *Contractor*'s personnel who need the information to enable the *Contractor* to perform its obligations under this *Contract*, to the *Contractor*'s legal advisors, accountants or auditors, or where disclosure is required by law (including disclosure to any stock exchange).

14.4.3 The *Contractor* must, within 10 *Working Days* (or any other period agreed in writing by ONTC) after a direction by the *Owner* to do so, return or destroy all *Confidential Information* in the *Contractor*'s possession, custody or control.

14.4.4 If the *Owner* or the *Contractor* is required by law to disclose *Confidential Information*, it shall promptly notify the other party so that that party may intervene to prevent the disclosure.

14.4.5 The *Contractor* specifically acknowledges that *Owner* is subject to the *Freedom of Information and Protection of Privacy Act*, R.S.O. 1990, c. F. 4, and that the *Owner* may be compelled by law to disclose certain *Confidential Information*.

14.4.6 The rights and obligations under this Part continue after the termination of this *Contract*.

GC 14.5 CORRUPTION, FORCED LABOUR, SANCTIONS

14.5.1 The *Contractor* warrants that:

.1 no bribe, gift or other inducement has been paid, promised or offered to any official or employee of the *Owner*, the Ministry of Transportation, the Government of Ontario or any other government official relating to the *Owner* entering into this *Contract* with the *Contractor*.

.2 it will take reasonable steps to ensure that its officials and employees do not extort, accept or pay bribes or illicit payments, charge or accept fees that are not legally due or are in excess of those legally due, or unreasonably delay or obstruct the granting of permits, licences, or other such approvals in relation to the project. If the *Contractor* becomes aware of an actual or attempted bribe, extortion, delay or obstruction relating to this *Contract,* the *Contractor* shall report the incident to the *Owner* immediately.

.3 it is unaware of any forced labour or child labour being used at any step of the production of goods produced, purchased or distributed by it in Canada or elsewhere or for the production of goods imported by the *Contractor*.

.4 it has undertaken the appropriate due diligence to ensure its business and its supply chains do not use forced labour or child labour, including an assessment of its business and supply chains that may carry a risk of forced labour or child labour being used and the management of the risk. If applicable, the *Contractor* shall comply with the reporting requirements under the *Fighting Against Forced Labour and Child Labour in Supply Chains Act,* S.C. 2023 c.9.

14.5.2 In compliance with its international obligations or with United Nations obligations, Canada imposes restrictions on trade, financial transactions or other dealings with a foreign country or its nationals. These sanctions may be implemented by regulation under such acts as the *United Nations Act*, the *Special Economic Measures Act (SEMA),* or the *Export and Import Permits Act*. The text of any such regulations

is published in the Canada Gazette, Part II. It is the only text which is authoritative. The *Contractor* shall comply with any such regulations that are in force on the effective date of the *Contract* and will require such compliance by its first-tier *Subcontractors*. The *Owner* relies on such undertaking from the *Contractor* to enter into this *Contract*, and any breach of such undertaking shall entitle the *Owner* to terminate this *Contract* for default and to recover damages from the *Contractor,* including excess re-procurement costs.

GC 14.6 COMMUNICATIONS

14.6 The *Owner* or the Government of Ontario will lead and make any announcements relating to this *Contract* and the *Work*. The *Contractor* shall not make any announcement of any kind, including press releases, social media posts, public declarations, or any form of publication or announcement, in relation to this *Contract* or the *Work* unless prior written consent is given by the *Owner*. Should the *Contractor* be contacted by any media outlet or other person or entity wishing to make any form of publication or announcement, or seeking any information, in relation to this *Contract* or the *Work*, the *Contractor* shall provide no comment and shall immediately notify the *Owner*. The *Contractor* shall immediately notify the *Owner* if it becomes aware of any publication or announcement relating to the *Contract* or the *Work.*

GC 14.7 AUDIT

14.7 The *Contractor* shall keep proper and accurate financial accounts and records, including but not limited to its contracts, invoices, statements, receipts, and vouchers in respect of the *Project* for a least six (6) years after the date that *Ready-for-Takeover* of the *Project* was achieved (the "*Audit Period*"). The *Owner* has the right to audit all such financial accounts and records associated with the *Project* and the *Contract Documents*, including *Submittals*, timesheets, reimbursable out of pocket expenses, materials, goods and *Construction Equipment* claimed by the *Contractor*, at all reasonable times during the term of the *Contract* and the *Audit Period* by providing *Notice in Writing* of its intention to conduct the audit. The *Contractor* shall provide full access to the records to the *Owner* for the purpose of the audit.

GC 14.8 GENERAL

14.8.1 Nothing contained in this *Contract* shall be deemed or construed by the parties nor by any third party as creating the relationship of principal and agent, landlord and tenant, or of partnership or of joint venture between the parties.

14.8.2 In addition to those provisions which are expressly stated to survive the termination or expiration of this *Contract*, the provisions of this *Contract* that are by their nature intended to survive termination or expiration of this *Contract* shall continue in full force and effect subsequent to and notwithstanding termination or expiration until or unless they are satisfied.

14.8.3 This *Contract* may be executed with electronic signatures or may be executed and delivered by electronic transmission and the Parties may rely upon all such signatures as though they were original signatures. This *Contract* may be executed in counterpart and all such counterparts shall, for all purposes, constitute one agreement binding on the parties."

Schedule "A" to the Supplementary Conditions

Requirements for a "Proper Invoice"

To satisfy the requirements for a *Proper Invoice*, the *Contractor*'s application for payment must satisfy the following criteria:

.1 is in the form of a written bill, invoice, application for payment, or request for payment;

.2 is in writing;

.3 contains the *Contractor*'s name, telephone number and mailing address and contact information of the *Contractor*'s project manager;

.4 contains the title of the *Project* and the *Owner*'s contract number or purchase order number under which the work was performed and the related request for qualification, tender, or request for proposal number, as applicable;

.5 contains the date the written bill, invoice, application for payment, or request for payment is being issued by the *Contractor*;

.6 identifies the period of time in which the *Work*, labour, services, *Products* and/or materials were supplied to the *Owner*;

.7 reference to the provisions of the *Contract* under which payment is being sought (e.g. progress payment / milestone, holdback, final payment, etc.);

.8 a description, including quantities where appropriate, of the labour, services, *Products*, or materials, or a portion thereof, that were supplied and form the basis of the *Contractor*'s request for payment;

.9 the amount the *Contractor* is requesting to be paid by the *Owner*, set out in a statement, based on the schedule of values Accepted under paragraph 5.2.5, separating out any statutory or other holdbacks, set-offs and HST;

.10 with each application for payment after the first, a written statement that all accounts for labour, services, subcontracts, materials, equipment, Products, and other indebtedness which may have been incurred by the *Contractor* and for which the *Owner* might in any way be held responsible have been paid in full up to the previous application for payment, except for amounts properly retained as a holdback or as an identified amount in dispute;

.11 with the applications for payment of holdback and for final payment, a *Statutory Declaration* in the form provided by the *Owner* attached as Schedule B stating that all accounts for labour, services, subcontracts, materials, equipment, *Products*, and other indebtedness which may have been incurred by the *Contractor* and for which the *Owner* might in any way be held responsible have been paid in full up to the previous application for payment, except for amounts properly retained as a holdback or as an identified amount in dispute;

.12 a current Workplace Safety Insurance Board clearance certificate;

.13 the progress report required under GC 3.4 CONSTRUCTION SCHEDULE, in the form provided by the *Owner* attached as Schedule C;

.14 an updated Construction Schedule in native and .pdf formats;

.15 if requested by the *Owner*, a current and valid certificate(s) of insurance for the insurance required under GC 11.1 – INSURANCE;

.16 the following statement: "Provided this *Proper Invoice* complies with the requirements of the *Contract* and provided no *Notice of Non-Payment* is issued by the *Owner*, payment is due within 28 days from the date this *Proper Invoice* is received by the *Owner*.";

.17 the name, title, telephone number and mailing address of the person at the place of business of the *Contractor* to whom payment is to be directed;

.18 in the case of the *Contractor*'s application for final payment;

(a) sufficient evidence that the *Contractor* has delivered all warranties to the *Owner*;

(b) sufficient evidence that the *Place of the Work* has been left in a clean and tidy condition, including evidence that any remaining materials, tools, equipment, temporary work, and waste products and debris have been removed from the *Place of the Work*;

(c) landfill waybills for the disposal of the waste products, debris and excess soil removed from the *Place of Work* in accordance with the *Waste Management Plan*; and

(d) an executed, original, full and final release of all claims that may arise as a result of the *Work*, which full and final release executed by the *Contractor* shall be in a form approved by the *Owner*;

.19 information identifying the authority, whether in the *Contract Documents* or otherwise, under which the services or materials were supplied;

.20 any other information that is prescribed in Article A-3, if any, or identified by the *Owner* as required;

.21 the amount invoiced to date;

.22 the percentage of the *Contract Price* invoiced; and

.23 the individual value of *Change Orders* approved during the invoice period and the cumulative value of *Change Orders* for the *Project*.

Ontario Northland

Statutory Declaration of Progress Payment Distribution by *Contractor*

To be made by the *Contractor* **prior to payment** as a condition for release of holdback.	The last application for progress payment for which the Declarant has received payment is No. _____ dated _____.

Identification of *Contract* :

Name of *Contract* (Location and description of the Work as it appears in the *Contract Documents*)

Date of *Contract* : Day : _____ Month : _____ Year : _____

Name of *Owner* : Ontario Northland Transportation Commission

Name of *Contractor*:

Name of Declarant : **Position or Title :** (of office held with *Contractor*)

Declaration

I solemnly declare that, as of the date of this declaration, I am an authorized signing officer, partner or sole proprietor of the *Contractor* named in the *Contract* identified above, and as such have the authority to bind the *Contractor*, and have personal knowledge of the fact that all accounts for labour, subcontracts, products, services, and construction machinery and equipment which have been incurred directly by the *Contractor* in the performance of the work as required by the *Contract*, and for which the *Owner* might in any way be held responsible, have been paid in full as required by the *Contract* up to and including the latest progress payment received, as identified above, except for:

Holdback monies properly retained,

Payments deferred by agreement, or

Amounts withheld by reason of legitimate dispute which have been identified to the party or parties, from who payment has been withheld.

I make this solemn declaration conscientiously believing it to be true and knowing that it is of the same force and effect as if made under oath.

Declared before me in _____

City/Town Province

on _____.

Date

_____ _____

Signature of Declarant A Commissioner for Oaths or Notary Public

Schedule "C" to the Supplementary Conditions

Project Status Report	
Project Title:	
Reporting Period:	Date:
Project Details:	
Planned Budget: Indicate the original *Contract* value	Current Approved Budget: Indicate the original *Contract* value plus approved change orders
Planned Completion: Indicate the *Contract* schedule completion date	Current Project Completion: Fill in revised date if schedule extension approved through change order
Planned Project Percent Complete: How far should theyActual have progressed by this date?	Project Percent Complete: What is their actual percent complete?
Executive Summary	
Provide a summary of what happened during the period, any concerns, risks or wins and plans for the upcoming period.	
Work Completed in the Period	
List List List List List	
Work Planned for Next Period	
List List List List	
Issues and Concerns	
Use this area to identify any concerns related to the project.	
Status of Progress	

Include a graph to show progress or eliminate this section.

Schedule "D" to the Supplementary Conditions

DUTY TO NOTIFY/EMERGENCY WORKS NOTIFICATION FORM

ONTC DUTY TO NOTIFY / EMERGENCY WORKS NOTIFICATION FORM	
SUBMISSION REQUIREMENTS Contact DFO By Phone 1-855-852-8320 **AND** submit this form to fisheriesprotection@dfo-mpo.gc.ca Submit this form to the consultant and the ONTC Project Manager: Esmail Zougari, esmail.zougari@ontarionorthland.ca and to ONTC Legal : legal@ontarionorthland.ca MNRF Office: Contact Area MNRF Office	
PART 1: NOTIFICATION DETAILS	
Type of Notification: □ DUTY TO NOTIFY □ EMERGENCY WORK	
Date of Notification:	Time of Notification:
ONTC *Contract* #:	DFO PATH File # (if applicable):
PART 2: REPORTING INFORMATION	
Name of Person Reporting:	Name of Field Contact:
Telephone #:	Telephone #:
Email:	Email:
PART 3: INCIDENT INFORMATION	
Bank failure □ Culvert failure Erosion and Sediment Control Measures Failure □ Beaver dam breach Other (specify): □ Hwy shoulder failure	
Date of Incident:	Time of Incident:
Location of Site:	Geographic Coordinates (Lat/Long):
Nearest Community (city/town):	Name of Waterbody(ies): Type (watercourse, lake/pond, ditch):
Indicate if any of the following impacts have occurred or are about to occur: Fish Kill (if yes, approximately how many):_____ □ Sediment deposition in channel Bank failure □ Obstruction of fish passage through: Modification of flows □ Channel □ Culvert Other (specify):	

Immediate Actions Taken: (Describe the activities/works that are being / have been immediately implemented. e.g. mitigation measures, damming / pumping etc.)
Photos: □ Attached (Where feasible, it is recommended that the photos be submitted with the form or as follow up)
PART 4: EMERGENCY WORKS
Description of Proposed Emergency Works: (Be as specific as possible. Describe what work will be undertaken within the next two weeks. E.g. culvert replacement (include existing and new culvert diameter / length / type), slope restoration (include material / method),:
Mitigation measures: (Describe what measures have been or will be implemented to address the immediate issue. E.g. sediment fence, turbidity curtain, check dam, fish salvage etc.):
Indicate which of the works will be followed (if applicable): Beaver Dam Removal □ Culvert Maintenance Bridge Maintenance □ Like-for-like culvert replacement Ditch maintenance within 30 m of a □ Temporary watercourse crossing waterbody Riparian vegetation maintenance in existing right-of-way
The Emergency Works are (check one): Temporary (additional work will be required) □ Final (no additional work required)

Proposed Start Date: (YYYY/MM/DD)	Proposed End Date: (YYYY/MM/DD)
PART 5: OTHER AGENCIES NOTIFIED	
Other Agency(ies) Notified: Yes □ No □	Agency(ies) Notified:
Date Notified:	Incident Report No. (if issued by notified Authority):

END OF SUPPLEMENTARY CONDITIONS