FACILITIES MANAGEMENT

OPEN CALL FOR BIDS

FOR

OS-506-23: Ocean Science Centre, AHU-02 Replacement

Request for Open Call Number: **TFM-027-26**

Issued: April 6, 2026

Submission Deadline: **Thursday, April 30, 2026 @ 3:00PM NDT**

REQUEST FOR OPEN CALL FOR BIDS INFORMATION SHEET

Request for Open Call			
Title:	**OS-506-23: Ocean Science Centre AHU-02 Replacement**		
Open Call #:	**TFM-027-26**	Issue Date:	**April 6, 2026**
Non-Mandatory Site Visit:	**Location: Ocean Science Centre, Main Building, Main Entrance (by touch tank) @ 11:00AM**		**April 20, 2026**
Questions Deadline:	**Eight (8) days prior to closing time, at 3:00pm (NST).**	Closing Date & Time: Bid Submission Format: Opening Date, Time & Location:	**Thursday April 30, 2026 @ 3:00 pm NDT** **opencalls@mun.ca** **Thursday, April 30, 2026 @ 3:30 pm NDT** **Via Conference line: 1-416-915-6530 (toll free) Access Code: 2773 547 8263 Attendee ID: Please press Pound(#)**
Bids Irrevocable Period after Submission Deadline:			**45 days (See section 1.6)**

Bid Submission: Responses to this solicitation must be submitted by email to opencalls@mun.ca Email subject line must read: BID SUBMISSION: TFM-027-26 Ocean Science Centre AHU-02 Replacement

PLEASE NOTE
1. Addition of Section 1.11 in Part 1.
2.The Stipulated Price Contract has been updated as of January 2026.
Vendors are encouraged to take note of these updates.

Inquiries and Communication

Inquiries and communication: Strategic Procurement Office, Memorial University of Newfoundland, opencalls@mun.ca. Inquiries accepted only via email. No phone calls will be accepted. **Please reference open call Title and Open Call # from above, ie: TFM-027-26 Ocean Science Centre AHU-02 Replacement in subject line. Emails not containing this requirement information in the subject line will NOT receive a response.**

Bids submitted by fax, mail, courier, drop off or by any other means of delivery

other than by email stated above shall not be accepted.

ABOUT MEMORIAL UNIVERSITY

As Newfoundland and Labrador's only university, Memorial has a special obligation to the people of this province. Established as a memorial to the Newfoundlanders who lost their lives on active service during the First and Second World Wars, Memorial University draws inspiration from these shattering sacrifices of the past as we help to build a better future for our province, our country and our world.

We are a multi-campus, multi-disciplinary, public university committed to excellence in teaching and learning, research and scholarship, and to public engagement and service. We strive to have national and global impact, while fulfilling our social mandate to provide access to university education for the people of the province and to contribute to the social, cultural, scientific and economic development of Newfoundland and Labrador and beyond.

The Memorial experience goes beyond academics; it invites a discovery of self, community and place. At Memorial, we celebrate our unique identity through the stories of our people – the work of scholars and educators, the ingenuity of students, the achievements of alumni – and the impact we collectively make in the province, the country and the world. Memorial is the natural place where people and ideas become.

Memorial University has more than 18,500 students and 3,600 faculty and staff spread across four campuses and nearly 100,000 alumni active throughout the world. From local endeavors to research projects of national importance, Memorial's impact is felt far and wide.

Mission, Vision and Values

Vision

Memorial University will be one of the most distinguished public universities in Canada and beyond, and will fulfill its special obligation to the people of Newfoundland and Labrador.

Mission

Memorial University is an inclusive community dedicated to innovation and excellence in teaching and learning, research, scholarship, creative activity, service and public engagement.
Memorial welcomes and supports students and scholars from all over the world and contributes knowledge and expertise locally, nationally and internationally.

Values

Excellence: Encouraging and promoting excellence through innovation and creativity, rigor and pragmatism.

Integrity: Being honest and ethical in all interactions, maintaining the highest ethical standards in teaching, research, public engagement and service.

Collegiality: Engaging others with respect, openness and trust in pursuit of a common purpose, having regard for individuals, ideals and the institution as a whole.

Inclusiveness and diversity: Embracing and acting on responsibility to guarantee diversity and equity.

Responsiveness: Being receptive to individuals and communities.

Accountability: Accepting responsibility for achievement of common goals and objectives.

Freedom and Discovery: Supporting the freedom to pursue knowledge that is based on individual and collective intelligence, curiosity, ingenuity and creativity.

Recognition: Acknowledging, tangibly, all aspects of university enterprise including teaching and learning, research, scholarship, creative activity and public engagement.

Responsibility to place: Valuing and fulfilling the special obligation to the people of Newfoundland and Labrador by supporting and building capacity for excellence that:

- addresses needs and opportunities for Newfoundland and Labrador;
- engages the university community on matters of national and international significance;
- produces and delivers academic programs of national and international calibre; and,
- Recognizes the dynamic opportunities presented by a multi-campus institution.

Responsibility to learners: Recognizing students as a first priority and providing the environment and support to ensure their academic and personal success.

Interdisciplinary collaboration: Supporting overarching themes in all pursuits that cut across academic units and address significant opportunities and challenges for which Memorial is particularly well positioned to build nationally and internationally recognized capacity.

Sustainability: Acting in a manner that is environmentally, economically and socially sustainable in administration, academic and research programs.

Memorial's exceptional staff and students contribute to the vitality and positive

environment of the university through active community engagement. Memorial University has always been a publicly engaged institution. Since the founding of the University in 1949, the work of many of Memorial's students, faculty and staff has emphasized the importance of strong, sustained partnerships with members of the public of Newfoundland and Labrador and beyond.

Faculty and Staff

Memorial is one of the largest employers in the province, with approximately 3,600 faculty and staff. Memorial has been recognized as an Employer of Distinction by the Newfoundland and Labrador Employers' Council, which is reflective of its investment in comprehensive benefits, services such as childcare and recreation facilities, emphasis on work-life balance, and its vibrant work environment.

Governance and Administration

The management, administration and control of the property, revenue, business and affairs of the University are vested in a Board of Regents. The Board is appointed under the *Memorial University Act* and is responsible for the management, administration, and control of the property, revenue, business and affairs of the university. Matters of an academic character are in general charge of the Senate of the University.

For more information on Memorial University of Newfoundland, please visit:
Memorial's home page: http://www.mun.ca/

Territory Acknowledgements at Memorial:

We acknowledge that the lands on which Memorial University's Campus are situated are in the traditional territories of diverse Indigenous groups and we acknowledge with respect the diverse histories and cultures of the Beothuk, *Mi'kmaq, Innu, and Inuit of this province*

DIVISION 28 - ELECTRONIC SAFETY AND SECURITY

END OF SECTION

PART 1 – SUBMISSION INSTRUCTIONS

1.1 Bids to be Submitted on Time

Bids must be submitted as set out above on or before the Submission Deadline. Bids submitted after the Submission Deadline will be rejected. Onus and responsibility rest solely with the bidder to submit its bid to the email indicated in the Open Call for Bids on or before the Submission Deadline. The Owner does not accept any responsibility for any bids submitted by means other than the email listed above. Bidders making submissions near the deadline do so at their own risk due server availability. The time for the closing will be determined according to the inbox, time stamp on opencalls@mun.ca.

Bids received after the closing time based on this time stamp, will NOT be considered.

1.2 Bids to be Submitted in Prescribed Format

- Bidders should submit **one (1)** email submission in PDF format.
- Please note: File size cannot exceed 15 MB. Otherwise server may reject bid submission due to size.
- **Bids submitted by fax, mail, courier, drop off or by any other means of delivery other than by email stated above shall not be accepted.**

1.3 Amendment/Revision of Bids

Bidders shall amend their bids after they have been submitted if, and only if, the amendment is emailed prior to the Submission Deadline marked **BID SUBMISSION AMENDMENT** followed by open call number and name. Previous submissions shall be cancelled and the bid submission with the most recent date and time shall be considered the final bid.

Bidders shall revise **APPENDIX C- Pricing form *only*** by submitting an updated **Pricing Form** prior to submission deadline. The revised **Pricing Form** shall replace the **Pricing Form** received with the original bid submission.

PLEASE NOTE: **APPENDIX C – Pricing Form** is the only section of the bid that can be revised independently. All other amendments/revisions shall require completing a new bid submission.

Bidders may revise their bid by email: opencalls@mun.ca

The Owner does not accept any responsibility for amendments submitted by means other than the email listed above. Bidders making submission near the deadline do so at their own rick due to service availability. The time for the closing will be determined according to the inbox, time stamp on opencalls@mun.ca. Amendments to bids received after the closing time base on this times stamp, will NOT be considered.

Email inquiries and requests for clarification shall be accepted up to eight (**8) days (3:00pm NST)** prior to the closing time. Inquiries and requests for clarification received after this date shall not be addressed. The Strategic Procurement Office will be the only official source of

information regarding this Open Call for Bids and information from any other source shall be considered unofficial and may not be correct.

1.4 Amendment of Open Call for Bid Documents

To ensure consistency and quality in the information provided to bidders the Owner shall provide, by way of amendment to this Open Call for Bids, in the form of an addendum, any relevant information with respect to the Open Call inquiries received in writing without revealing the source of those inquiries. Bidders are cautioned that it is their responsibility to ensure that they receive all information relevant to this Open Call. The Owner shall not be responsible for bidders who fail to inform themselves regarding the scope and nature of the work. The Owner shall publish all amendments on Memorial University's current service providers: MERX: www.merx.com, BIDS: www.bids.ca and PODS: www.pods.net. In addition, all amendments will be published on https://www.mun.ca/finance/strategic_procurement/. Bidders should check on a regular basis for Open Call updates. Bidders are solely responsible for ensuring they are aware of and have complied with all amendments by tender closing time. In the event there is a discrepancy between MERX, BIDS, and PODS and the official website https://www.mun.ca/finance/strategic_procurement/ website, the https://www.mun.ca/finance/strategic_procurement/ is the official website. Bidders are welcome to register their email address through opencalls@mun.ca to receive addendum notifications from Open Calls as a matter of courtesy. This does not relieve any Bidder of their responsibility to ensure all addenda has been received.

1.5 Withdrawal of Bids

Bidders may withdraw their bids prior to the Submission Deadline. To withdraw a bid, a notice of withdrawal must be sent to the opencalls@mun.ca email address prior to the Submission Deadline. The Owner is under no obligation to return withdrawn bids.

1.6 Bids Irrevocable after Submission Deadline

Bids shall be irrevocable for a period of **45** days running from the moment that the Submission Deadline passes.

1.7 Delivery

Time is of the essence and delivery schedule(s) are legally binding. Memorial University reserves the right to assess penalties or cancel awards to Bidders who fail to meet the stated delivery or completion dates. Delivery of all materials and services must be DAP (delivered at place) or DDP (delivered duty paid (all locations) and local environs.

1.8 Signature

Memorial University, in consideration of section 11 of the Electronic Commerce Act, confirms its acceptance of electronic signatures, or other acceptable form of electronic consent, in satisfaction of the signature requirement for bid submissions. The electronic form of signature or consent must be directly related to the relevant bid submission at issue and must be reliable, in a manner as determined by Memorial University, for the purpose of identifying the person submitting the bid response. By submitting a bid under this process, the bidder confirms that the signatory has the appropriate and proper authority to bind the bidder to its submission, a confirmation upon which Memorial University relies in the

processing of the bid submission.

Bidders must complete Appendix B –Submission Form. Any bids received without Appendix B completed will be deemed non-complaint.

1.9 Closure

In the event that the University is closed earlier than normally expected prior to a scheduled open calls closing for that day, or for the full day, the closing date for those open calls will be extended to the next business day for the University at the same time as listed originally.

1.10 Corporations Act

The Corporations Act of Newfoundland and Labrador requires that an extra-provincial company be registered before it begins or carries on business in the Province. If your company is not registered, please apply for the appropriate forms and procedures to:

Commercial Registrations Division
Dept of Government Services, PO Box 8700 St John's, NL Canada A1B 4J6
Phone: 709-729-3317, Fax: 709-729-0232
Website: http://www.gs.gov.nl.ca/registries/companies/corp_art_inc.html

1.11 Stipulated Price Contract

The successful bidder will be required to sign the *Department of Facilities Management General Conditions and Agreement Between Owner and Contractor for the Stipulated Price Contract* upon receipt of the pre-award letter.

[End of Part 1]

PART 2 – EVALUATION AND AWARD

2.0 Stages of Evaluation

The Owner will conduct the evaluation of bids in the following stages:

2.1.0 Stage I – Mandatory Submission Requirements

Stage I will consist of a review to determine which bids comply with all of the mandatory submission requirements. Bids that do not comply with all of the mandatory submission requirements as of the Submission Deadline will, subject to the express and implied rights of the Owner, be disqualified and not evaluated further.

2.1.1 Stage II – Mandatory Technical Requirements

Stage II will consist of a review to determine which bids comply with all of the mandatory technical requirements. Bids that do not comply with all of the mandatory technical requirements as of the Submission Deadline will, subject to the express and implied rights of the Owner, be disqualified and not evaluated further. The mandatory technical requirements are listed in Appendix A - Specifications.

2.1.2 Stage III – Pricing

Stage III will consist of a scoring of the submitted pricing of each compliant bid in accordance with the evaluation method set out in the Pricing Form (Appendix C). The evaluation of price will be undertaken after the evaluation of mandatory requirements has been completed.

2.2 No Amendment to Forms

Other than inserting the information requested on the mandatory submission forms set out in the Open Call, a bidder may not make any changes to any of the forms. Any bid containing any such changes, whether on the face of the form or elsewhere in the bid, shall be disqualified.

2.3 Selection of Lowest Compliant Bidder as Preferred Supplier

Subject to the Owner's reserved rights, the compliant bidder with the lowest pricing will be the preferred supplier, and will be selected to enter into the Agreement in accordance with the following section. In the event of a tie, the preferred supplier will be determined by way of a coin toss, in accordance with the Public Procurement Policy. Provincial suppliers, suppliers with a place of business in Newfoundland and Labrador, will be given provincial supplier preference provision. This mandates an allowance of ten percent for provincial suppliers for all procurement below trade agreement thresholds.

Please note, the supplier preference does not apply when the estimated value of the commodity is above the trade agreement threshold shown in the following table.

Public Body	Thresholds			
	Goods	Services	Public Works	Lease of Space
Memorial University	$133,800	$133,800	$334,400	$100,000

2.4 Notice to Bidder and Execution of Agreement

Notice of selection by the Owner to the preferred supplier shall be in writing. The preferred supplier shall execute the Agreement, the form and content of which will be mutually agreed upon between the parties and satisfy any other applicable conditions of this open call within fifteen (15) days of notice of selection. This provision is solely for the benefit of the Owner and may be waived by the Owner.

2.5 Failure to Enter into Agreement

If a selected bidder fails to execute the Agreement or satisfy the pre-conditions of award listed in the Open Call Particulars within fifteen (15) days of notice of selection the Owner may, without incurring any liability, proceed with the selection of another bidder and pursue all remedies available to the Owner.

2.6 Payment Terms

The University's standard payment terms are net 30 days after delivery of goods, or net 15 days after successful completion of installation as applicable. In the case of services, payment terms are also net 30 days after successful completion of the service. These terms shall also apply in the case of sub-contracted items. Prepayments will not be considered unless the supplier provides an irrevocable standby letter of credit, or the supplier provides a credit reference from its banker (in conjunction with a 50% materials and labour bond and a 50% performance bond) satisfactory to the Director of Financial and Administrative Services.

[End of Part 2]

PART 3 – TERMS AND CONDITIONS OF THE OCB PROCESS

3.1 Open Call Incorporated into Bid

All of the provisions of this Open call are deemed to be accepted by each bidder and incorporated into each bidder's bid. A bidder who submits conditions, options, variations or contingent statements to the terms as set out in this Open call, either as part of its bid or after receiving notice of selection, unless otherwise indicated, shall be disqualified.

3.2 Bidders to Follow Instructions

Bidders should structure their bids in accordance with the instructions in this Open call. Where information is requested in this Open Call, any response made in a bid should reference the applicable section numbers of this Open Call.

3.3 Bids in English

All bids are to be in English only.

3.4 No Incorporation by Reference

The entire content of the bidder's bid should be submitted in a fixed form, and links to the content of websites or other external documents referred to in the bidder's bid but not attached will not be considered to form part of its bid.

3.5 References and Past Performance

In the evaluation process, the Owner may consider information provided by the bidder's references and may also consider the bidder's past performance or conduct on previous contracts with the Owner or other institutions.

3.6 Information in Open Call Only an Estimate

The Owner and its advisors make no representation, warranty or guarantee as to the accuracy of the information contained in this Open Call or issued by way of addenda. Any quantities shown or data contained in this Open Call or provided by way of addenda are estimates only, and are for the sole purpose of indicating to bidders the general scale and scope of the Deliverables. It is the bidder's responsibility to obtain all the information necessary to prepare a bid in response to this Open Call.

3.7 Bidders to Bear Their Own Costs

The bidder will bear all costs associated with or incurred in the preparation and presentation of its bid, including, if applicable, costs incurred for interviews or demonstrations.

3.8 Bid to be Retained by the Owner

The Owner will not return the bid or any accompanying documentation or samples submitted by a bidder.

3.9 Trade Agreements

Bidders should note that procurements falling within the scope of the Canadian Free Trade Agreement, and/or the Canada-European Union Comprehensive Economic Trade Agreement are subject to those trade agreements but that the rights and obligations of the parties will be governed by the specific terms of this Open Call.

3.10 No Guarantee of Volume of Work or Exclusivity of Contract

The Owner makes no guarantee of the value or volume of work to be assigned to the preferred supplier. The Agreement will not be an exclusive contract for the provision of the described Deliverables. The Owner may contract with others for goods and services the same as or similar to the Deliverables or may obtain such goods and services internally.

3.11 Communication After Issuance of Open Call

Bidders shall promptly examine all of the documents comprising this Open Call, and

(a) shall report any errors, omissions or ambiguities; and
(b) may direct questions or seek additional information in writing by email to opencalls@mun.ca on or before the Deadline for Questions. All questions or comments submitted by bidders by email to the Open Call Contact shall be deemed to be received once the email has entered into the Open Call Contact's email inbox. No such communications are to be directed to anyone other than the Open Call Contact, and the Owner shall not be responsible for any information provided by or obtained from any source other than the Strategic Procurement Office. The Owner is under no obligation to provide additional information. It is the responsibility of the bidder to seek clarification from the Open Call Contact on any matter it considers to be unclear. The Owner shall not be responsible for any misunderstanding on the part of the bidder concerning this Open Call or its process.

3.12 All New Information to Bidders by Way of Addenda

This Open Call may be amended only by addendum in accordance with this section. If the Owner, for any reason, determines that it is necessary to provide additional information relating to this Open Call, such information will be communicated to all bidders by addenda. Each addendum forms an integral part of this Open Call and may contain important information, including significant changes to this Open Call. Bidders are responsible for obtaining all addenda issued by the Owner. In the Submission Form (Appendix B), bidders MUST confirm their receipt of all addenda by setting out the number of each addendum in the space provided.

3.13 Addenda and Extension of Submission Deadline

Any addendum issued within four (4) calendar days of the Open Call for Bids closing (Including on closing day) will extend closing by a reasonable period to be determined by Memorial University.

When evaluating bids, the Owner may request further information from the bidder or third parties in order to verify, clarify or supplement the information provided in the bidder's bid. The response received by the Owner shall, if accepted by the Owner, form an integral part of the bidder's bid.

3.14 Notification to Other Bidders

In accordance with section 30 of the *Public Procurement Regulations*, once the Agreement is awarded by the Owner, the outcome of the Open Call will be publicly posted at https://www.mun.ca/finance/strategic_procurement/. There will be no issuing of regret letters.

3.15 Debriefing

In accordance with the Public Procurement Act and Regulations, unsuccessful bidders may request a debriefing within ten (10) business days after the award has been posted. The request must be sent in writing to the Open call contact. The intent of the debriefing information session is to provide the bidder an overview of their bid and why it was unsuccessful and to help the bidder in presenting a better bid in subsequent procurement opportunities. The debriefing process is not for the purpose of providing an opportunity to challenge the procurement process or its outcome. A debriefing shall not disclose information regarding another bidder's bid.

3.16 Supplier Complaint Process

If a bidder wishes to register a complaint with respect to the Open Call process, the complaint should be provided in writing and within the parameters established by section 25 of the Public Procurement Regulations, as amended. The notice must provide a detailed explanation of the bidder's concerns with the procurement process or its outcome, in addition to such other information as may be required by the *Regulations*. Bidders should note that these complaint procedures are separate and distinct from any dispute resolution processes that may be provided for under applicable trade agreements. If a bidder wishes to dispute a matter under an applicable trade agreement, the bidder must follow the process set out in the trade agreement.

3.17 Conflict of Interest and Prohibited Conduct

The Owner may disqualify a bidder for any conduct, situation or circumstances, determined by the Owner, in its sole and absolute discretion, that constitutes a conflict of interest.

The Owner reserves the right to disqualify any bidder that in the Owner's sole opinion has an actual or potential conflict of interest or an unfair advantage.

For the purposes of this Open Call, the term "Conflict of Interest" includes, but is not limited to, any situation or circumstance where in relation to the Open Call process, the bidder has an unfair advantage or engages in conduct, directly or indirectly, that may give it an unfair advantage, including but not limited to: (i) having, or having access to, confidential information of the Owner in the preparation of its bid that is not available to other bidders, (ii) communicating with any person with a view to influencing preferred treatment in the Open Call process (including but not limited to the lobbying of decision makers involved in the Open Call process), or (iii) engaging in conduct that compromises, or could be seen to compromise, the integrity of the open and competitive Open Call process or render that process non-competitive or unfair.

Bidders are required to disclose, to the Open Call Contact, any potential or perceived conflict of interest issues prior to Open Call closing date and time.

3.18 Disqualification for Prohibited Conduct

The Owner may disqualify a bidder, rescind a notification of selection or terminate a contract subsequently entered into if the Owner determines that the bidder has engaged in any conduct prohibited by this Open Call.

3.19 Bidder Not to Communicate with Media

Bidders must not at any time directly or indirectly communicate with the media in relation to this Open Call or any agreement entered into pursuant to this Open Call without first obtaining the written permission of the Open Call Contact.

3.20 No Lobbying

Bidders must not, in relation to this Open Call or the evaluation and selection process, engage directly or indirectly in any form of political or other lobbying whatsoever to influence the selection of the successful bidder(s).

3.21 Illegal or Unethical Conduct

Bidders must not engage in any illegal business practices, including activities such as bid-rigging, price-fixing, bribery, fraud, coercion or collusion. Bidders must not engage in any unethical conduct, including lobbying, as described above, or other inappropriate communications; offering gifts to any employees, officers, agents, elected or appointed officials or other representatives of the Owner; deceitfulness; submitting bids containing misrepresentations or other misleading or inaccurate information; or any other conduct that compromises or may be seen to compromise the competitive process provided for in this Open Call.

3.22 Past Performance or Past Conduct

The Owner may prohibit a supplier from participating in a procurement process based on past performance or based on inappropriate conduct in a prior procurement process, including but not limited to the following:

(a) illegal or unethical conduct as described above;

(b) the refusal of the supplier to honor submitted pricing or other commitments; or

(c) any conduct, situation or circumstance determined by the Owner, in its sole and absolute discretion, to have constituted a Conflict of Interest.

(d) performance on other contracts, including the efficiency and workmanship as well as the extent to which the Bidders performed the Work in accordance with the contractual clauses and conditions, is sufficiently poor to jeopardize the successful completion of the project being bid on, by way of previous contractor performance evaluations.

In addition, the Owner may suspend the bidding privileges of a supplier with regard to non-compliant or substandard performance in accordance with section 26 of the *Public Procurement Regulations*.

3.23 Confidential Information of the Owner

All information provided by or obtained from the Owner in any form in connection with this Open Call either before or after the issuance of this Open Call:

(a) is the sole property of the Owner and must be treated as confidential;

(b) is not to be used for any purpose other than replying to this Open Call and the performance of the Agreement;

(c) must not be disclosed without prior written authorization from the Owner; and

(d) must be returned by the bidder to the Owner immediately upon the request of the Owner.

3.24 Confidential Information of Proponent

This procurement process is subject to the *Access to Information and Protection of Privacy Act, 2015* (*ATIPPA, 2015*). A Proponent must identify any information in its Proposal or any accompanying documentation supplied in confidence for which confidentiality is requested to be maintained by the Owner. The confidentiality of such information will be maintained by the Owner, except as otherwise required by law or by order of a court or tribunal. Proponents are advised that their Proposal will, as necessary, be disclosed, on a confidential basis, to advisers retained by the Owner to advise or assist with the Request for Proposal process, including the evaluation of Proposals.

The Proponent agrees that any specific information in its submission that may qualify for an exemption from disclosure under subsection 39(1) of the *ATIPPA, 2015* has been identified in its submission. If no specific information has been identified it is assumed that, in the opinion of the Proponent, there is no specific information that qualifies for an exemption under the subsection 39(1) of the *ATIPPA, 2015*.

Contracting with the Owner is a public process. Information provided through this process will be disclosed when requested under the *ATIPPA, 2015*, except where disclosure of that information is harmful to the business' interests, as set out in the three-part test in the *ATIPPA, 2015*.

Information, including the financial value of a contract resulting from this procurement process, will be publicly released as part of the award notification process, in accordance with section 30 of the *Public Procurement Regulations*.

If a Proponent has any questions about the collection and use of personal information pursuant to this Request for Proposal, questions are to be submitted to the Request for Proposal Contact. Further information relating to subsection 39(1) of the ATIPPA, 2015 is provided in guidance documents available through the Office of the Information and Privacy Commissioner at https://oipc.nl.ca/guidance/documents.

3.25 Reserved Rights of the Owner

The Owner reserves the right to:

(a) make public the names of any or all bidders as well as bid price and value of contract;

(b) make changes, including substantial changes, to this Open Call provided that those changes are issued by way of addendum in the manner set out in this Open Call; request written clarification or the submission of supplementary written information in relation to the clarification request from any bidder and incorporate a bidder's response to that request for clarification into the bidder's bid. This shall not be an opportunity for bid repair;

(c) assess a bidder's bid on the basis of: (i) a financial analysis determining the actual cost of the bid when considering factors including quality, service, price and transition costs arising from the replacement of existing goods, services, practices, methodologies and infrastructure (howsoever originally established); and (ii) in addition to any other evaluation criteria or considerations set out in this Open Call consider any other relevant information that arises during this Open call process; and (iii) Unbalanced bids, as determined by the Owner, will be rejected (i.e. prices must fairly represent proper compensation for various items of work to be done).

(d) waive minor irregularities and formalities and accept bids that substantially comply with the requirements of this Open Call ;

(e) verify with any bidder or with a third party any information set out in a bid;

(f) check references other than those provided by any bidder;

(g) disqualify a bidder, rescind a notice of selection or terminate a contract subsequently entered into if the bidder has engaged in any conduct that breaches the process rules or otherwise compromises or may be seen to compromise the competitive process;

(h) cancel this Open Call process at any stage;

(i) cancel this Open Call process at any stage and issue a new Open Call for the same or similar deliverables;

(j) accept any bid in whole or in part; or

(k) reject any or all bids;

(l) not necessarily select the lowest or any bidder;

And these reserved rights are in addition to any other express rights or any other rights that may be implied in the circumstances.

3.26 Limitation of Liability

By submitting a bid, each bidder agrees that:

(a) neither the Owner nor any of it employees, officers, agents, elected or appointed officials,

advisors or representatives will be liable, under any circumstances, for any claim arising out of this Open Call process including but not limited to costs of preparation of the bid, loss of profits, loss of opportunity or for any other claim; and

(b) the bidder waives any right to or claim for any compensation of any kind whatsoever, including claims for costs of preparation of the bid, loss of profit or loss of opportunity by reason of the Owner's decision not to accept the bid submitted by the bidder for any reason, the Owner's decision to enter into an agreement with any other bidder or to cancel this bidding process, and the bidder shall be deemed to have agreed to waive such right or claim.

3.31 Governing Law and Interpretation

These Terms and Conditions of the Open Call Process:

(a) are intended to be interpreted broadly and independently (with no particular provision intended to limit the scope of any other provision);

(b) are non-exhaustive and shall not be construed as intending to limit the pre-existing rights of the Owner; and

(c) are to be governed by and construed in accordance with the laws of the Province of Newfoundland & Labrador and the federal laws of Canada applicable therein.

3.32 Facility Compliance Requirement

(a) Equipment, power tools, instruments and appliances intended for use within Memorial University's facilities must comply with all regulatory requirements related to use and/or installation in University facilities. This includes but is not limited to certification/listing by recognized agencies, Pressure Vessel Act of Newfoundland and Labrador and similar.

(b) Items provided related to this open call that receive power from the University's electrical system must be certified or listed for use within Canada by a recognized agency such as Canadian Standards Association (CSA) or Underwriter Laboratories Canada (ULC). A full list of agencies recognized by Memorial University is available upon request.

(c) Equipment, tools, instruments and appliances that generate pressure may require registration as a pressure system with the Province of Newfoundland and Labrador. Compliance with the Boiler, Pressure Vessel and Compressed Gas Regulations under the Public Safety Act of Newfoundland and Labrador and the Boiler, Pressure Vessel, and Pressure Piping Code CSA B51:19 shall be demonstrated.

(d) The vendor is responsible for all costs associated with ensuring the system is compliant with legislative requirements and for the application and registration processes. Field certifications may be considered but all costs and efforts for such scenarios are the responsibility of the vendor.

[End of Part 3]

PART 4 – ENVIRONMENTAL HEALTH AND SAFETY REQUIREMENTS

4.1 Maintaining a healthy and safe environment for all members of the campus community, as well as visitors, is a priority with the University. This involves a commitment from all sectors of the campus community and extends to outside agencies having occasion to come on campus to conduct business.

The following requirements will apply to all work undertaken by contractors and service personnel on any University property or for any work undertaken on behalf of the Owner.

4.1.0 Regulations, Codes and Standards

Contractors shall be familiar with and abide by provisions of various safety codes and standards applicable to the work performed and should refer to:

The Contractor shall be completely responsible for the safety of the Work as it applies to protection of the public and property and construction of the Work.

The codes that must be followed and enforced for safety are:

(a) The National Building Code, Part 8, Safety Measures at Construction and Demolition Sites (Latest Edition);

(b) Canadian Code for Construction Safety (Latest Edition) as issued by the Associate Committee of the National Building Code;

(c) The Occupational Health and Safety Act of Newfoundland and Labrador (most current version) and Regulations.

In particular, strict adherence to the Provincial Occupational Health and Safety Act and Regulations and with the National Building Code of Canada, Part 8 is required.

4.2.0 General Health and Safety Regulations

(a) Contractors/service agencies shall ensure that members of the campus community are not endangered by any work or process in which they may be engaged. Work areas shall be adequately barricaded, and if dust or fumes are generated, suitable enclosures shall be installed to contain such emissions.

(b) No material shall be stored in such a way as to obstruct walkways or represent a danger to pedestrian or vehicular traffic.

(c) Adequate protection shall be provided to prevent the possibility of goods falling from scaffolding or elevated areas. Areas where goods are being loaded or off loaded shall be barricaded or otherwise protected to prevent unauthorized entry. Appropriate warning signs must be posted.

(d) The work areas must be kept reasonably clean and free from debris which could constitute a fire hazard. Care must be taken to ensure that the work process does not activate fire

alarm detection devices. (Generation of dust and fumes can activate smoke detectors causing a false alarm).

(e) Due consideration shall be given to fire safety in buildings. Flammable goods must be kept away from sources of ignition. No work involving the use of open flame devices must be undertaken around flammable solvents of gases.

(f) Some University buildings contain asbestos and other hazardous materials. Do not alter or disturb any goods believed to contain asbestos goods (unless this is a duly authorized part of the project). Consult with University officials before proceeding with any work.

(g) Safety Data Sheets shall be procured for any hazardous product used on campus. Such sheets shall be made readily available for consultation as required under the Workplace Hazardous Materials Information System (WHMIS).

(h) Contractors are required to complete the online training module for Memorials Zero Energy Isolation Program (ZEIP) before mobilizing on site. Training can be accessed via the link: https://ooc.citl.mun.ca/enrol/index.php?id=21 .

- First time users must create an account. Click **'Create new account'**. Enter required information and click **'Create my new account'**.
- A confirmation email will be sent to the email you entered when creating your account. Open that email and click the link it contains.
- Click **'Zero energy isolation Program for Contractors'**.
- To enroll in the training, enter the enrollment key: 7653. Click **'Enroll me'**.
- Complete the training according to the instructions provided in the course.
- Successful completion certificates shall be available during auditing by Environmental Health & Safety.

NOTE: The above requirements are not to be considered all-inclusive and are considered to be complementary to the safety requirements outlined in the agreement between the University and Supplier. Certain conditions and circumstances may require adherence to additional safety requirements.

As a general requirement, contract/service personnel are expected to conduct all work on campus in a professional and safe manner and to give priority to the safety and welfare of members of the campus community.

4.3.0 Contractor Safety Management

4.3.1 All Contractors and Subcontractors to be used by the Contractor in the execution of the Contract shall be required to submit confirmation of a current third party occupational health and safety program certification (Letter of Assurance). These may include, but not be limited to, Certificate of Recognition (COR), OHSAS 18001, and CSA Z.1000.

4.3.2 All Contractors and Subcontractors shall be required to review and follow all requirements of sections 4.4.5.2. below.

4.3.3 Prior to Contract award, the Contractor will be required to provide the Information requested in 4.4.5.2. below.

4.3.4 The University reserves the right to stop any work or portion of work where no documentation can be produced on site which identifies the hazards presented by a piece of work, safe work procedures for work or certification of employees performing work. The Contractor is liable for any costs incurred by affected parties associated with such a stoppage.

4.4.0 Contractor Safety Management Element

4.4.1 Purpose

This element establishes the requirements for the administration and monitoring of contractor health and safety programs and activities at Memorial University. These measures shall ensure that contractors understand their collective responsibility with respect to the Occupational Health & Safety Act and Regulations, Memorial University policy and this element.

4.4.2 Scope

This procedure shall apply to all work done for Memorial University of Newfoundland with respect to the provision of services as outlined below. Memorial University reserves the right to exempt a Contractor from this element, in whole or in part, based upon an evaluation of the risk of the work being conducted. This evaluation must comply with the hazard identification and risk management element.

4.4.3 Definitions

Act: Newfoundland & Labrador Occupational Health & Safety Act, latest edition.
Contract: A documented agreement between Memorial University and a contractor.
Contractor: The principal contractor, person, partnership, or corporation bound to execute the work under the contract and defined as such in the agreement is responsible for the supervision of the work so as to ensure the work is carried out in accordance with the contract.
Project Management Team: The group assigned by the University to act on behalf of the owner with respect to the execution of Contractor work.
Principal Contractor: The person primarily responsible for the carrying out of a contract.
Regulations: Newfoundland & Labrador Occupational Health & Safety Regulations, latest edition.
Subcontractor: A person, firm or corporation having a direct contract with the Contractor or subcontractor(s) to perform a part or parts of the work included in the contract, or to supply products worked to a special design according to the contract documents, but does not include one who merely supplies products not so worked.

Owner: The Owner, Engineer/Architect are the persons, firms or corporation identified as such in the Contract. The term Owner, Engineer/Architect means, respectively, each of the Owner, Engineer/Architect and their authorized representatives as designated by each such party in writing.
Work: The services and job procedure completion that is described in the contract.

4.4.4 Roles and Responsibilities

4.4.4.1 Project Management Team, including Environmental Health & Safety

Will monitor the Contractor's performance for health and safety compliance. Monitoring activities may include but are not limited to:

- planned and unplanned workplace inspections;
- attendance of meetings;
- communications of safety related issues and topics, as deemed necessary;
- review of contractor records, inspections, work practices and documentation; and
- complete audits to verify that contractors and subcontractors are meeting their legislative, procedural and contractual responsibilities.

4.4.4.2 Contractors

Will comply with applicable Federal and Provincial legislation and applicable MUN safety procedures. Contractor responsibilities include but not limited to:

- report all incidents immediately to the required University project team followed by a written incident report within 24 hours;
- be responsible for the safety of subcontractors including those not under their employ;
- stop work if the conditions are such that work cannot be performed safely;
- perform evaluation, monitoring of the workplace to identify potential hazards and associated risks and ensure corrective actions are implemented;
- ensure daily task specific hazard assessments are completed; and
- maintain the accountability of persons responsible for the reporting and correction of hazards.

4.4.5 Procedure

4.4.5.1 Considerations prior to signing of contract

Prior to signing of contract, the preferred General Contractor shall provide proof of compliance with 4.4.4.2. within seven (7) calendar days. After a pre-signing start up meeting, the General Contractor shall provide proof of compliance of themselves and their subcontractors with 4.4.4.2. as well as the information requested in Section 4.4.4.2.(a)(b).

4.4.5.2 Requirements

All Contractors, and their Subcontractors, shall be required to submit confirmation of a current third party occupational health and safety program certification (Letter of Assurance). These may include, but not be limited to, Certificate of Recognition (COR), OHSAS 18001, and CSA Z.1000.

Contractors shall also provide the following:

(a) health and safety policy statement;

(b) safety program table of contents; and

(c) site hazard assessment;

The hazard assessment shall be updated by the General Contractor and re-submitted whenever the conditions, work practices or work forces change to the extent that new hazards can be identified.

In lieu of a Subcontractors 3rd party program, Contractors shall be required to integrate the Subcontractor(s) into the Contractors program and provide proof of same.

Memorial reserves the right to request and audit the full safety program of Contractors and Subcontractors and their associated documentation. This documentation may include, but not be limited to the following:

(a) safety program and/or manual

(b) applicable documented safe work practices;

(c) inspection reports and schedules;

(d) required employee safety training certifications and qualifications; and

(e) updated list of OHS Committee and/or a worker health and safety representative, or workplace health and safety designate.

Request for submission shall be complied with within 7 calendar days of a written request from Memorial’s Environmental Health and Safety unit.

Memorial reserves the right to:

(a) Reject any Contractor that fails to meet the requirements or schedules outlined herein;

(b) The University reserves the right to stop any work or portion of work where the risk presents an immediate danger.

4.4.5.3 Schedule of Submissions

General Contractors and their sub-contractors who have complied with 5.1.1 will be permitted to commence physical work on the site however no work shall be performed by the General Contractor, their sub-contractors until such a time as they comply with 5.1.1.

4.4.6 Post-Contract Evaluation

Environmental Health & Safety will determine the extent of the evaluation of the Contractor's safety performance at the completion of the contract. This evaluation will be conducted by way of a standard contractor safety evaluation form and will be supported by objective evidence documented during the term of the Contract. The records of the evaluation must be retained with the project owner.

4.5 Access To Site

4.5.1 All Contractors and Subcontractors to be used in the execution of the Contract shall give advance notification of when they will be on site. Any work to be performed outside of Regular Time must have advance approval of the Owner.

Any discontinuation of the Work which causes a Contractor or their Subcontractors to suspend operations onsite will require the following:

- Contractor/Subcontractors shall notify the Owner of the stop work date.
- Contractor/Subcontractors shall ensure the site is left in a safe and secure condition.
- Contractor/Subcontractors shall ensure that locks and tags on mechanical and/or electrical systems are removed and, where necessary, replaced by the University.
- Contractor/Subcontractors shall not return to site without expressed prior permission from the Owner.

[End of Part 4]

PART 5– GENERAL CONDITIONS

5.1 I/We hereby authorize the Owner to release names of Subcontractors, Suppliers and Manufacturers used in my/our Bid including those as listed in Appendix "D", where such information is requested from the Owner.

5.2 I/We understand that Bids that do not list major Subcontractors and Suppliers and Manufacturers where required in Appendix “D” may be rejected.

5.3 I/We reserve the right to substitute other Subcontractors and/or Suppliers and/or Manufacturers for any Subcontractor or Suppliers or Manufacturer withdrawing their Bid or becoming bankrupt after the date hereof. Any such substitutes shall be subject to the approval of the Owner and contingent upon evidence of withdrawal or bankruptcy satisfactory to the Owner.

5.4 I/We agree that upon approval by the Engineer/Architect, the Owner shall have the right to take possession of any part of the work upon its completion, except for minor deficiency items, and that such possession shall not necessarily constitute acceptance of that part of the work.

5.5 I/We understand and agree that the Owner may order changes to the work in the form of additions or deletions in accordance with the General Conditions, Supplementary General Conditions and the intent of the Contract Documents.

5.6 I/We understand and agree that the Unit Price Table in Appendix "C2" must be completed where indicated and the total amount included in my/our stipulated price for the total performance of the work under Part 4 of the Bid and Acceptance form. I/We understand that the Unit Prices include all costs and charges of every kind, including overhead and profit, to perform the items of work listed in Appendix "A". I/We also understand that these same Unit Prices will be used for additions or deletions to the actual measured quantities.

5.7 When Appendix “E” is included in the Open Call, I/we understand that bids which do not list project references, where required in Appendix “E”, will be rejected.

5.8 Corporations Act

The Corporations Act of Newfoundland and Labrador requires that an extra-provincial company be registered before it begins or carries on business in the Province. If your company is not registered, please apply for the appropriate forms and procedures to:

Commercial Registrations Division
Dept. of Government Services, PO Box 8700
St John’s, NL Canada A1B 4J6
Phone: 709-729-3317, Fax: 709-729-0232
Website: http://www.gs.gov.nl.ca/registries/companies/corp_art_inc.html

[End of Part 5]

Part 6 – Supplementary Terms and Conditions

6.1 The open call document consist of the Open Call and Acceptance Form, General Conditions of Contract, Supplementary General Conditions of Contract, Special Conditions, Campus Safety and Health Regulations, Contractors Performance Evaluation, Drawings, Specifications and any Addenda to the Contract Documents issued before the open call closing period.

6.2 Surety

6.2.1 Bid Surety

Bids shall be accompanied by a copy of a bid security by way of a Bid Bond from a surety company acceptable to the Owner and which is licensed to do business in the Province of Newfoundland and Labrador or a copy of a cheque in the amount of 10 percent of the bid price. Originals to be delivered to Memorial University post tender closing. Bid security will not be required for a total contract value of $100,000 or less (HST Excluded), unless specifically called for in the contract documents. The bid security will be returned to the bidder upon receipt of the required Performance Bond and Labour and Materials Payment Bond as per 6.2.2 below.

The terms of the bid security will be invoked and the amount retained by the Owner if: the Tenderer fails to enter into a formal agreement, where one is specified, when notified of the award of the Contract within the tender validity period; or fails to provide the required Performance Bond and Labour and Materials Payment Bond within the time specified

6.2.2 Public Work's Surety

Within seven (7) days of the issuance of the letter of acceptance, the preferred Bidder shall obtain and deliver to the Owner a Performance Bond in the amount of 50 percent of the bid price (HST Excluded) which guarantees the successful and complete performance of the Work. The Performance Bond is required as a condition of bid award. In lieu of a Performance Bond an approved certified cheque in the amount of 10 percent of the bid price may, at their option, be accepted for retention by the Owner until the successful completion of the Contract. The certified cheque will be retained until satisfactory completion of the Work including the warranty period after which it will be returned to the Contractor. Performance Bond or other such security will not be required for a contract value of $100,000 or less. No Work is to be undertaken while the above performance security remains outstanding.

Within seven (7) days of issuance of the letter of acceptance, the preferred Bidder shall obtain and deliver to the Owner a Labour and Materials Payment Bond in the amount of 50 percent of the bid price (HST Excluded). The Labour and Materials Payment Bond is required as a condition of the bid award. In lieu of a Labour and Materials Payment Bond, an approved certified cheque in the amount 10 percent of the bid price may, at their option, be accepted for retention by the Owner until successful completion of the Contract. The certified cheque will be retained until substantial completion of the Work as defined by the Mechanics Lien Act and upon receipt of an acceptable statutory declaration form stating that all labour and material obligations due and payable under the Work have been discharged, after which it will then be returned to the Contractor. Labour and Materials

Payment Bond or other such security will not be required for a contract value of $100,000 or less. No Work is to be undertaken while the above labour and materials security remains outstanding.

No interest will be paid to the preferred Bidder for any certified cheques on deposit during the period of retention.

The cost of all bid, performance and labour and materials security shall be included in the bid price

6.3 Site Visit

A site visit may occur at the time and location identified on the Request for Open Calls for Bids Information Sheet.

Questions will not be answered at the site visit.

Before submitting a bid, Bidders may carefully examine the site of the Proposed Work and fully inform themselves of the existing condition and limitations. It is the responsibility of the Bidder to report any unsatisfactory conditions in writing which may adversely affect the proper completion of the work, to opencalls@mun.ca, at least **eight (8)** days before the open call closing date. Submission of a bid shall imply acceptance of previously completed Work and the conditions of the site, and the Contractor shall, therefore, be fully responsible for executing the Work in accordance with the Contract Documents.

6.4 Substitution of Materials

6.4.1 The open call shall be based upon using the materials or products as specified without substitution, unless there is an "or approved alternate" clause. Where two or more brand names are specified, the choice shall be left to the bidder. Where only one brand name is stated, there shall be no substitution.

6.4.2 Where the Specifications include the "or approved alternate" clause, substitutions may be proposed provided that the request for a substitution is received in writing at least eight (8) days (3:00pm NST) prior to the open call closing date and shall clearly define and describe the product for which the substitution is requested. Submissions shall compare in tabular form, to the characteristics and performance criteria of the specified material.

6.4.3 It is the Bidder's responsibility to ensure that the substituted article is equivalent to the specified article with regard to design, function, appearance, durability, operation and quality.

6.4.4 Request for substitutions made after the award of the contract will be subject to the requirements of Clause 2.37.0 MATERIALS AND SUBSTITUTIONS in the General Conditions of the Contract and will only be considered under special circumstances or where it is clear, at the Engineer's/Architect's discretion, that proposed substitution will provide a substantial benefit to the Owner.

6.4.5 Approval of the substitution shall be in the form of an addendum to the Specifications.

The decision on substitutions will be final.

6.5 Completion date

6.5.1 Bidders shall state the time required to complete the Contract from time of open call award. The bidder shall, within seven (7) days after the Contract is award submit a preliminary construction schedule indicating as closely as possible the starting and completion date for the major sections of the Work.

[End of Part 6]

APPENDIX A – SPECIFICATIONS AND DRAWINGS

SPECIFICATIONS AND DRAWINGS
LOCATED AT THE END OF THIS DOCUMENT

APPENDIX B – SUBMISSION FORM

1. Bidder Information

Please fill out the following form, naming one person to be the bidder's contact for the Open Call process and for any clarifications or communication that might be necessary.	
Full Legal Name of Bidder:	
Any Other Relevant Name under which Bidder Carries on Business:	
Street Address:	
City, Province/State:	
Postal Code:	
Phone Number:	
Fax Number:	
Company Website (if any):	
Bidder Contact Name and Title:	
Bidder Contact Phone:	
Bidder Contact Fax:	
Bidder Contact Email:	

2. Offer

The bidder has carefully examined the Open Call documents and has a clear and comprehensive knowledge of the Deliverables required under the Open Call. By submitting a bid, the bidder agrees and consents to the terms, conditions and provisions of the Open Call, including the Form of Agreement, and offers to provide the Deliverables in accordance therewith at the rates set out in the completed Pricing Form (Appendix C1 and/or C2 and/or C3).

3. Rates

The bidder has submitted its rates in accordance with the instructions in the Open Call and in the Pricing Form (Appendix C1 and/or C2 and/or C3). The bidder confirms that it has factored all of the provisions of Appendix A, including insurance and indemnity requirements, into its pricing assumptions and calculations.

4. Addenda

4.1 The bidder is deemed to have read and accepted all addenda issued by the Owner. The onus is on bidders to make any necessary amendments to their bids based on the addenda. The bidder is required to confirm that it has received all addenda by listing the addenda numbers in table below:(**Listing of individually the numbers of each Addendum received in the blank space)**

NOTE: FAILURE TO COMPLETE "TABLE: ADDENDA RECEIVED" LOCATED BELOW SHALL RESULT IN BID DISQUALIFICATION:

TABLE 1.10: ADDENDA RECEIVED

Bidders who fail to complete the above table will be deemed to have not received all posted addenda and shall be deemed **non- compliant.**

5. No Prohibited Conduct

The bidder declares that it has not engaged in any conduct prohibited by this Open Call.

6. Disclosure of Information

The bidder hereby agrees that any information provided in this bid, even if it is identified as being supplied in confidence, may be disclosed where required by law or by order of a court or tribunal. The bidder hereby consents to the disclosure, on a confidential basis, of this bid by the Owner to the advisers retained by the Owner to advise or assist with the Open Call process, including with respect to the evaluation of this bid.

7. Bid Irrevocable

The bidder agrees that its tender shall be irrevocable for a period of **45** days running from the moment that the Submission Deadline passes.

8. Execution of Agreement

The bidder agrees that in the event its bid is selected by the Owner, in whole or in part, it will finalize and execute the Agreement in the form set out in Appendix A (or in a form mutually acceptable to the parties) to this Open Call in accordance with the terms of this Open Call . Failure to submit this signature section will render the proposal NON-COMPLIANT and the proposal will be disqualified.

BIDDER SIGNATURE FORM:

BIDDERS MUST COMPLETE THE BIDDER SIGNATURE FORM. ANY BIDS RECEIVED WITHOUT THE BIDDER CONTACT FORM COMPLETED WILL BE DEEMED NON- COMPLIANT

(See Part 1 section 1.8 for Electronic Signature acceptance)

Signature of Witness	Signature of Bidder Representative
Name of Witness	Name of Bidder Representative
	Title of Bidder Representative
	Date

I have the authority to bind the bidder.

IN SIGNING THIS PAGE AND SUBMITTING YOUR PROPOSAL, THE PROPONENT ACKNOWLEDGES HAVING READ, UNDERSTOOD AND AGREED TO THE TERMS AND CONDITIONS OF THIS DOCUMENT

APPENDIX C1 – PRICING FORM

1. INSTRUCTIONS ON HOW TO COMPLETE THE PRICING FORM

- Rates must be provided in Canadian Dollars
- Rates quoted by the bidder must be all-inclusive and must include all labor and material costs, all travel and carriage costs, all insurance costs, all costs of delivery to the Owner, all costs of installation and set-up, including any pre-delivery inspection charges, and all other overhead, including any fees or other charges required by law
- Owner: Having carefully examined the site and all conditions affecting the proposed work as well as the Bid Documents including the Drawings and Specifications, all Addenda and the Instructions to bidders, I/We, the undersigned, hereby offer to furnish all necessary labour, materials, superintendence, plant, tools, equipment, etc., required to complete all work requisite and necessary for the proper execution of this Contract, expeditiously and in the satisfactory manner and accept in full payment therefore a stipulated sum of:

The scope of work for Price A, Price B and Price C is outlined in the contract documents - see specification section 01 11 00 Summary of Works. The Owner reserves the right to delete any or all parts of this tender and award individual and/or combined parts.		
	Contract Bid (HST Excluded)	
Price A: Subtotal		HST EXCLUDED
Price B: Sum of Allowances (Section 01 21 00)	$35,000.00	HST EXCLUDED
Price C: Total: [$(A+B)]		HST EXCLUDED

I/We agree to commence work within two (2) weeks after the acceptance of my/our Bid and complete the work in _____weeks from the acceptance of the Bid and to coordinate the scheduling of our work with that of all Subcontractors working on the Project. The time of completion indicated herein is required and will be a significant factor in assessing bids.

2. THE DELIVERABLES:

TFM-027-26 Ocean Science Centre AHU-02 Replacement
as per specifications listed in Appendix A

3. MANDATORY SUBMISSION REQUIREMENTS

(a) Submission Form (Appendix B)
Each bid must include a Submission Form (Appendix B) completed and signed by an authorized representative of the bidder.

(b) Each bid must include Pricing Form (Appendix C1) as per instructions on form.

(c) Where Appendix C2 and C3 are required, they must be included in bid submission.

APPENDIX D - LIST OF SUBCONTRACTORS

Herewith is the list of Subcontractors, Suppliers and/or Manufacturers referred to in Section no. **5.1 of Part 5 of the Open Call and Acceptance Form**. The Subcontractors and Suppliers whose bids have been used in the preparation of this Bid must be listed in full including work to be done by own forces (B.O.F.). By Own Forces will be considered valid and satisfactory only if, prior to award, the supplier provides three (3) current (< 3 years) references of satisfactory completion of trade work of similar ***scale, scope and complexity*** as that described within the Bid documents. Trade certifications may be requested in addition to the references above. The determination of suitability is entirely at the discretion of the owner and shall be based on submitted documentation. The owner may use their knowledge and understanding of experience and performance of the Contractor on past work in lieu of this submission. The list will be subject to the approval of the Owner.

NOTE: FAILURE TO COMPLETE THIS PORTION OF THE BID SUBMISSION SHALL RESULT IN DISQUALIFICATION.

The trades below, if listed, have been identified by the owner, however it is the Bidder's responsibility to identify all applicable subtrades.

TRADE/DIVISION	SUBCONTRACTOR - SUPPLIER - MANUFACTURER
Hazardous Materials Abatement	
Demolition	
Concrete	
Metal Fabrications	
Plumbing	
HVAC	
Controls	
Electrical	
Add trades as needed	

APPENDIX E – PROJECT REFERENCE (ROOFING PROJECTS ONLY)

Hereunder is a list of project references, as required in the specifications. The list will be subject to the approval of the Owner.

NOTE: FAILURE TO COMPLETE THIS PORTION OF THE BID SUBMISSION SHALL RESULT IN BID DISQUALIFICATION.

Project Reference #1	
Project Name:	
Building Location:	
Owner & Contact Information:	
Roof Area (Sq Ft):	
Construction Cost:	
Date of Completion:	
Was work completed as Prime or Sub-Contractor?	
Existing Deck Construction:	
Roof System Construction: **<u>Example Only:</u>** **Metal Deck** **Densdeck Deck Cover** **Sopravap'r** **Sopra-iso (2 layers)** **Sopraboard** **Base Sheet Membrane** **Cap Sheet Membrane**	
Mechanically Fastened or Fully Adhered System?	

DEPARTMENT OF FACILITIES MANAGEMENT

GENERAL CONDITIONS
AND
AGREEMENT BETWEEN OWNER AND CONTRACTOR
FOR
THE STIPULATED PRICE CONTRACT

JANUARY 2026

DEPARTMENT OF FACILITIES MANAGEMENT

GENERAL CONDITIONS AND AGREEMENT
BETWEEN OWNER AND CONTRACTOR FOR THE STIPULATED PRICE CONTRACT

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1.0 DEFINITIONS

1.1.1 Contract Documents

The Contract Documents consist of the Instructions to bidders, Executed Agreement between the Owner and the Contractor, General Conditions of Contract, Supplementary General Conditions of Contract, Special Conditions, Campus Safety and Health Regulation, , Specifications, Drawings and such other documents forming part of the open call, including all amendments thereto incorporated before their execution and subsequent amendments thereto made pursuant to the provisions of the Contract or agreed upon between the parties. The successful bid and any Addenda to the Specifications issued during the bidding period shall also form part of the Contract Documents.

1.1.2 Owner, Engineer/Architect, Contractor

The Owner, Engineer/Architect and Contractor are the persons, firms or corporation identified as such in the Agreement. The term Owner, Engineer/Architect and Contractor means the Owner, Engineer/Architect and Contractor or their authorized representatives as designated by each party in writing.

1.1.3 Subcontractors

A Subcontractor is a person, firm or corporation having a direct contract with the Contractor to perform a part or parts of the Work included in the Contract, or to supply products worked to a special design according to the Contract Documents but does not include one who merely supplies products not so worked.

1.1.4 The Project

The Project is the total construction contemplated of which the Work performed under the Contract Documents may be the whole or a part.

1.1.5 The Work

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

1.1.6 Place of Work

The Place of Work is the designated site or location of the project of which the Work may be the whole or a part.

1.1.7 Products/Materials/Equipment

The term Products/Materials/Equipment means all materials, machinery, equipment and fixtures forming the Work as required by the Contract Documents but does not include machinery and equipment used for preparation, fabrication, conveying and erection of the Work and normally referred to as construction machinery and equipment.

1.1.8 Other Contractor

The term Other Contractor means any persons, firm or corporation employed by or having a separate contract directly or indirectly with the Owner for Work other than that required by the Contract Documents.

1.1.9 Time

a) The Contract Time is the time stated in the Open Call for Bid and Acceptance Form for substantial performance of the Work.

b) The date of substantial performance of the Work is the date certified by the Engineer/Architect.

c) The term day, as used in the Contract Documents, shall mean the calendar day.

d) The term working day means any day observed by the construction industry in the area of the place of the Work.

1.1.10 Substantial Performance of the Work

A Contract shall be deemed to be substantially performed:

a) When the Work or a substantial part thereof is ready for use or is being used for the purpose intended; and

b) When the Work to be done under the Contract is capable of completion or correction at a cost of not more than:

(i) 3% (Three per centum) of the first two hundred and fifty thousand dollars ($250,000) of the Contract Price;

(ii) 2% (Two per centum) of the next two hundred and fifty thousand dollars ($250,000) of the Contract Price; and

(iii) 1% (One per centum) of the balance of the Contract Price.

c) When the Work or a substantial part thereof is ready for use or is being used for the purpose intended and where the Work cannot be completed expeditiously for reasons beyond the control of the Contractor, the value of the remaining Work to be completed shall be deducted from the Contract Price in determining substantial performance. As per Section 4.19.0, Substantial Performance will not be issued until the final commissioning of the Work has been successfully completed.

d) In all cases, time is of the essence regarding substantial performance.

1.1.11 Total Performance of the Work

Total Performance of the Work shall mean when the entire Work except those items arising from the provision **2.26.0 WARRANTY** has been performed to the requirements of the Contract Documents and is so certified by the Engineer/Architect.

1.1.12 Changes in the Work

Changes in the Work means additions, deletions or other revisions to the Work within the general scope of Work as contemplated by the Contract Documents.

1.1.13 Extra Work

Extra Work means any additional work or service, the performance of which is beyond the scope of Work as contemplated by the Contract Documents.

2.0 GENERAL CONDITIONS

2.1.0 INTENTIONALLY LEFT BLANK

2.2.0 DOCUMENTS

2.2.1 The Contract Documents shall be signed by the Owner and by the Contractor, in accordance with Part 1 – Submission Instructions, Open Call for Bids. A digital copy of the executed Stipulated Price Contract will be provided to the Contractor.

2.2.2 Words and abbreviations which have well-known technical or trade meanings are used in the Contract Documents in accordance with such recognized meanings.

2.2.3 In the event of conflicts between Contract Documents, the following shall apply:

a) Documents of later date shall govern;

b) Figured dimensions shown on the drawings shall govern even though they may differ from scaled dimensions on the same drawing;

c) Drawings of larger scale shall govern over those of smaller scale of the same date;

d) Specifications shall govern over drawings;

e) Special Conditions shall govern over Specifications;

f) The General Conditions of Contract shall govern over Specifications;

g) Supplementary General Conditions shall govern over the General Conditions of the Contract;

h) The Executed Agreement between the Owner and the Contractor shall govern over all documents.

2.2.4 The Contractor will be provided, without charge, up to three (3) sets of Contract Documents or parts thereof as are reasonably necessary for the performance of the Work. A .pdf version of the contract documents will also be provided, at the Contractor's request.

2.2.5 The Contractor shall keep a copy of all current Contract Documents and shop drawings on the site, in good order and available to the Engineer/Architect and or their representatives.

2.2.6 Drawings, specifications, models and copies thereof furnished to the Contractor are to be used only with respect to the Work. Such documents and models are

not to be otherwise used or revised in any manner without the written authorization of the Owner.

2.2.7 Models furnished by the Contractor at the Owner's request and expense are the property of the Owner.

2.2.8 Models furnished by the Contractor that have not been requested by the Owner are at the expense of the Contractor.

2.3.0 ADDITIONAL INSTRUCTIONS AND SCHEDULE OF WORK

2.3.1 During the progress of the Work, the Engineer/Architect shall furnish to the Contractor such additional instructions as may be necessary to supplement the Contract Documents. All such instructions shall be consistent with the intent of the Contract Documents.

2.3.2 Additional instructions may include minor changes to the Work which affect neither the Contract Price nor the Contract Time.

2.3.3 Additional instructions may be in the form of drawings, samples, models or written instructions.

2.3.4 Additional instructions will be issued by the Engineer/Architect with reasonable promptness and in accordance with any schedule agreed upon for such instructions.

2.3.5 The Contractor shall prepare and update, as required, a construction schedule indicating the timing of major activities of the Work. The schedule shall be designed to conform with the Contract Time. The schedule shall be submitted to the Engineer/Architect within seven (7) days of the date of the Owner's letter of award. The Contractor shall monitor the progress of the Work relative to the schedule and advise the Engineer/Architect of any revisions required as a result of delays, as provided for in 2.5.0 DELAYS, and indicating what action will be taken to complete the Work within the Contract Time.

2.4.0 ENGINEER/ARCHITECT'S DECISIONS

2.4.1 The Engineer/Architect, in the first instance, shall decide on questions arising under the contract Documents and interpret the requirements therein. Such decisions shall be given in writing.

2.4.2 The Contractor shall notify the Engineer/Architect in writing within fourteen (14) days of receipt of a decision of the Engineer/Architect referred to in 2.4.1, if the Contractor believes that a decision by the Engineer/Architect is in error and/or at variance with the Contract Documents. Unless the Contractor fulfils this requirement, subsequent claims by them for extra compensation arising out of the decision will not be accepted.

2.4.3 If the question of error and/or variance is not resolved immediately, and the Engineer/Architect decides that the disputed work shall be carried out, the Contractor shall act according to the Engineer/Architect's written decision and carry out the disputed work.

Any questions of change in Contract Price and/or extension of Contract Time due to such error and/or variance shall be decided as provided in **2.11.0 DISPUTES**.

In the absence of an Engineer/Architect, the Owner's decisions will prevail.

2.5.0 DELAYS

2.5.1 If it can be clearly shown that the Contractor is delayed in the performance of the Work by any act or fault of the Owner, Engineer/Architect, then the Contract Time shall be extended for such reasonable time as the Engineer/Architect may decide in consultation with the Owner and the Contractor. The Contractor shall be entitled to be reimbursed for any costs incurred by them as a result of such a delay occasioned by the act or fault, provided that it can be clearly shown that the Contractor's forces cannot work efficiently elsewhere on the project and that the incurred cost is limited to that which could not reasonably have been avoided.

2.5.2 If the Contractor is delayed in the performance of the Work by a Stop Work Order issued by any court or other public authority and providing that such order was not issued as the result of any act or fault of the Contractor or of anyone employed by them directly or indirectly then the Contract Time shall be extended for such reasonable time as the Engineer/Architect may decide in consultation with the Contractor.

2.5.3 If the Contractor is delayed in the performance of the Work by civil disorders, labour disputes, strikes, lockouts, (including lockouts decreed or recommended for its members by a recognized Contractor's Association, of which the Contractor is a member) fire, unusual delay by common carriers or unavoidable casualties, or without limit to any of the foregoing, by any cause of any kind whatsoever beyond the Contractor's control, then the Contract Time shall be extended for such reasonable time as may be decided by the Engineer/Architect in consultation with the Owner and the Contractor, but in no case shall the extension of time be less than the time lost as the result of the event causing the delay, unless such shorter extension of time be agreed to by the Contractor.

2.5.4 No extension shall be made for delays unless written notice of claims is given to the Engineer/Architect within fourteen (14) days of its commencement, providing that in the case of the continuing cause of delay one notice shall be necessary.

2.5.5 If no schedule is provided under **2.3.0 ADDITIONAL INSTRUCTIONS AND SCHEDULE OF WORK**, no claim for delay will be considered because of failure to furnish instructions until fourteen (14) days after a demand for such instructions had been made and not then unless such claim is reasonable.

No extension shall be made for delays unless written notice of claims is given to the Engineer/Architect within fourteen (14) days of its commencement, providing that in the case of the continuing cause of delay one notice shall be necessary.

If no schedule is provided under **2.3.0 ADDITIONAL INSTRUCTIONS AND SCHEDULE OF WORK**, no claim for delay will be considered because of failure to furnish instructions until fourteen (14) days after a demand for such instructions had been made and not then unless such claim is reasonable.

2.6.0 OWNER'S RIGHT TO PERFORM WORK, STOP WORK AND/OR TERMINATE CONTRACT

2.6.1 If the Contractor should be adjudged bankrupt or makes a general assignment for the benefit of creditors because of their insolvency or if a Receiver is appointed on account of their insolvency, the Owner may, without prejudice to any other right or remedy they may have, by giving the Contractor or Receiver or Trustee in Bankruptcy written notice, terminate the Contract. If a Performance Bond has been provided by the Contractor guaranteeing faithful performance of the Work, the Owner shall give written notice to the Surety invoking the terms of the bond.

2.6.2 The Owner may notify the Contractor in writing that they are in default of their contractual obligations, if the Contractor:

a) Fails to proceed regularly and diligently with the Work; or

b) Without reasonable cause wholly suspends the carrying out of the Work before the completion thereof; or

c) Fails to maintain or manage the construction schedule as required by 2.3.5 above; or

d) Refuses or fails to supply sufficient, properly skilled workers for proper workmanship, products or construction machinery and equipment for the scheduled performance of the Work within five (5) working days of receiving written notice from the Engineer/Architect except in those cases provided in **2.5.0 DELAYS**; or

e) Fails to make payments due to their Subcontractors, their Suppliers for their workers, or fails to comply with the procedures around Progress Payments in accordance with 2.15.8 and 2.15.9; or

f) Persistently disregards laws or ordinances, or the Engineer/Architect's instructions; or

g) Otherwise violates the provisions of their Contract to a substantial degree.

Such written notice by the Owner shall instruct the Contractor to correct the default within five (5) working days from the receipt of the written notice. If a Performance Bond has been provided by the Contractor, a copy of such written notice will be provided to the Surety.

2.6.3 If the correction of the default cannot be completed within the five (5) working days specified, the Contractor shall be considered to be in compliance with the Owner's instruction if they:

a) Commence the correction of the default within the specified time; and

b) Provide the Owner with an acceptable schedule for such correction; and

c) Complete the correction in accordance with such schedule.

2.6.4 If the Contractor fails to correct the default within the time specified or subsequently agreed upon, the Owner may, without prejudice to any other right or remedy they may have:

a) Correct such default and deduct the cost thereof as certified by the Engineer/Architect from any payment due under the Contract; or

b) Terminate the Contract by written notice to the Contractor. If a Performance Bond has been provided by the Contractor, the Owner will provide the Surety with a copy of such notice.

2.6.5 If the Owner terminates the Contract under the conditions set out above, they are entitled to:

a) Take possession of the premises and products and utilize the temporary buildings, plants, tools, construction machinery and equipment, goods and materials, intended for, delivered to and placed on or adjacent to the Work and may complete the Work by whatever method they may deem expedient but without undue delay or expense;

b) Withhold any further payments to the Contractor until the Work is finished;

c) Upon total performance of the Work, charge the Contractor the amount by which the full cost of finishing the Work as certified by the Engineer/Architect including compensation to the Engineer/Architect for their additional services and a reasonable allowance to cover the cost of any corrections required by **2.26.0 WARRANTY** exceeds the unpaid balance of the Contract Price; or if such cost of finishing the Work is less than the unpaid balance of the Contract Price, pay the Contractor the difference;

d) On expiry of the warranty period, charge the Contractor the amount by which the cost of corrections under **2.26.0 WARRANTY** exceeds the allowance

provided for such corrections, or if the cost of such corrections is less than the allowance, pay the Contractor the difference;

e) Invoke the terms of the Performance Bond if such Bond has been provided under the Contract.

2.6.6 The Contractor's obligation under the Contract as to the performance of the Work up to the time of termination will remain in force after such termination.

2.7.0 CONTRACTOR'S RIGHT TO STOP WORK AND/OR TERMINATE CONTRACT

2.7.1 If the Owner should be adjudged bankrupt or makes a general assignment for the benefit of creditors or if a Receiver is appointed on account of their insolvency, the Contractor may, without prejudice to any other right or remedy they may have, by giving the Owner written notice, terminate the Contract.

2.7.2 If the Work should be stopped or otherwise delayed for a period of thirty (30) days or more under an order of any court or other public authority and providing that such order was not issued as the result of any act or fault of the Contractor or of anyone directly or indirectly employed by him, the Contractor may, without prejudice to any other right or remedy they may have, by giving the Owner fifteen (15) days' written notice, terminate the Contract.

2.7.3 The Contractor may notify the Owner in writing that the Owner is in default of their contractual obligations if:

The Engineer/Architect fails to issue a certificate in accordance with **2.16.0 CERTIFICATES AND PAYMENTS;**

a) The Owner fails to pay the Contractor when due any amount certified by the Engineer/Architect and verified by the audit of the Owner;

b) The Owner violates the provisions of the Contract to a substantial degree.

Such written notice shall advise the Owner that if such default is not corrected within fifteen (15) days from the receipt of the written notice, the Contractor may, without prejudice to any other right or remedy they may have, stop the Work and/or terminate the Contract.

2.7.4 If the Contractor terminates the Contract under the conditions set out above, they shall be entitled to be paid for all work performed including reasonable overhead and profit and for any loss sustained upon products, construction machinery and equipment and other damages as the Contractor may have sustained as a result of the termination of the Contract.

2.8.0 OTHER CONTRACTORS

2.8.1 The Owner reserves the right to let separate contracts in connection with the project of which the Work is part or do certain work by their own forces.

2.8.2 The Owner shall, in such cases, coordinate the Work and insurance coverage of other Contractors as it affects the Work of this Contract.

2.8.3 The Contractor shall coordinate their work with that of other Contractors and connect as specified or shown in the Contract Documents. Any change in the costs incurred by the Contractor in the planning and performance of such work which was not shown or included in the Contract Documents as of the date of signing the Contract, shall be evaluated as provided under 2.14.0 VALUATION AND CERTIFICATION OF CHANGES IN THE WORK and authorized as provided in 2.13.0 CHANGES INTHE WORK AND EXTRA WORK.

2.8.4 The Contractor shall report to the Engineer/Architect any apparent deficiencies in other Contractor's work which would affect this Contract immediately as they come to their attention and shall confirm such report in writing. Failure by the Contractor to so report shall invalidate any claims against the Owner by reason of the deficiencies of other Contractor's work except as to those of which they were not reasonably aware.

2.9.0 ASSIGNMENT

2.9.1 The Contractor shall not assign the Contract or any part thereof or any benefit or interest therein or thereunder without the written consent of the Owner.

2.10.0 SUBCONTRACTORS

2.10.1 The Contractor agrees to preserve and protect the rights of the Owner under the Contract with respect to any work to be performed under subcontract. The Contractor shall:

a) Require their Subcontractors to perform their work in accordance with and subject to the terms and conditions of the Contract Documents; and

b) Be fully responsible to the Owner for acts and omissions of their Subcontractors and of persons directly or indirectly employed by them as for acts and omissions of persons directly employed by them.

The Contractor, therefore, agrees that they will incorporate all the terms and conditions of the Contract Documents into all Subcontractor Agreements they enter into with their Subcontractors.

2.10.2 The Contractor shall employ those Subcontractors proposed by them in writing and accepted by the Owner prior to the signing of the Contract for such portions of the Work as may be designated in the bidding requirements.

2.10.3 The Owner may, for reasonable cause, object to the use of a proposed Subcontractor and require the Contractor to employ one of the other Subcontractors

2.10.4 In the event that the Owner requires a change from any proposed Subcontractor, the Contract price shall be adjusted by the difference in cost occasioned by such required change.

2.10.5 The Contractor shall not be required to employ as a Subcontractor any person or firm to whom they may reasonably object.

2.10.6 The Engineer/Architect may, upon reasonable request and at their discretion, provide to a Subcontractor information as to the percentage of the Subcontractor's work which has been certified for payment.

2.10.7 Nothing contained in the Contract Documents shall create any contractual relationship between any Subcontractor and the Owner.

2.11.0 DISPUTES

2.11.1 Differences between the parties to the Contract as to the interpretation, application or administration of this Contract or any failure to agree where agreement between the parties is called for, herein collectively called disputes, which are not resolved in the first instances by decision of the Engineer/Architect pursuant to the provisions of **2.4.0 ENGINEER/ARCHITECT'S DECISIONS** shall be settled in accordance with the requirement of the General Conditions.

2.11.2 The Claimant shall give written notice of such dispute to the other party no later than fourteen (14) days after the receipt of the Engineer/Architect's decisions given under **2.4.0 ENGINEER/ARCHITECT'S DECISIONS**. Such notice shall set forth particulars of the matters in dispute, the probable scope, extent and value of the dispute and relevant provisions of the Contract Documents. The other party shall reply to such notice no later than fourteen (14) days after they receive or are considered to have received it, setting out in such reply their grounds and other relevant provisions of the Contract Documents.

2.11.3 Pending settlement of the dispute, the Engineer/Architect will give such instructions as, in their opinion, are necessary for the proper performance of the Work or to prevent delays pending settlement of the dispute. The parties shall act immediately according to such instructions, it being understood that by so doing neither party will jeopardize any claim they may have. If it is subsequently determined that such instructions were in error or at variance with the Contract Documents, the Owner shall pay the Contractor cost incurred by the Contractor in carrying out such instructions which they were required to do beyond what the Contract Documents correctly understood and interpreted would have required

them to do, including costs resulting from interruption of the Work.

2.11.4 It is agreed that no act by either party shall be construed as a renunciation or waiver of any of their rights or recourse, provided they have given the notices in accordance with Paragraph 2.11.2 and have carried out the instructions as provided in Paragraph 2.11.3.

2.11.5 If the dispute or claim cannot be resolved to the satisfaction of both parties, either party may refer the matter to such tribunal as the circumstances require.

2.11.6 In recognition of the obligation of the Contractor to perform the disputed work as provided in Paragraph 2.11.3, it is agreed that settlement of dispute proceedings may be commenced immediately following the dispute in accordance with the aforegoing settlement of dispute procedures.

2.12.0 INDEMNIFICATION

2.12.1 The Contractor shall be liable for and shall indemnify and hold harmless the Owner and the Engineer/Architect, their agents and employees from and against all claims, demands, losses, costs, damages, actions, suits or proceedings whatsoever arising under any statute or Common law.

a) In respect of personal injury to or the death of any person whomsoever arising out of or in the course of or caused by the carrying out of the Work; and

b) In respect of any injury or damage whatsoever to any property, real or personal or any chattel real, insofar as such injury or damage arises out of or in the course of or by reason of the carrying out of the Work.

2.12.2 The Contractor shall not be liable under Paragraph 2.12.1 if the injury, death, loss or damage is due to any act or neglect of the Owner or Engineer/Architect, their agents or employees.

2.13.0 CHANGES IN THE WORK AND EXTRA WORK

2.13.1 The Owner may, without invalidating the Contract, make changes by altering, adding to or deducting from the Work, with the Contract Price and the Contract Time being adjusted accordingly; and

2.13.2 No change in the Work shall be made by the Contractor without prior written order from the Owner, and no claim for an addition or deduction to the Contract Price or change in the Contract Time shall be valid unless so ordered and at the same time valued or agreed to be valued as provided in **2.14.0 VALUATION AND CERTIFICATION OF CHANGESIN THE WORK.** Signed faxed copies are acceptable at the discretion of the Owner.

2.14.0 VALUATION AND CERTIFICATION OF CHANGES IN THE WORK

2.14.1 The value of any change shall be determined in one or more of the following methods:

a) By estimate and acceptance in a lump sum;

b) By unit prices subsequently agreed upon;

c) By cost and a fixed or percentage fee.

In the case of changes in the Work valued as outlined in Paragraph 2.14.1(a) (as will be the usual case), the Contractor will submit an itemized estimate of all materials and labour (including Subcontractor's work) to complete the change.

In the case of changes in the Work as valued in Paragraph 2.14.1 (c), the Contractor shall submit detailed invoices, vouchers and time sheets for all materials and labour to complete the change.

The submissions in both cases shall be in the manner acceptable to the Engineer/Architect and will show separately the following percentages for overhead and profit:

(i) The Contractor shall include, in the breakdown, their 15 percent mark-up (10 percent of the estimated cost for the overhead and 5 percent for profit on their portion of the Work

(ii) When work is performed by one of the Contractor's Subcontractors, the Subcontractor's markup shall be 10 percent of the estimated cost for overhead and 5 percent for profit.

(iii) The Contractor shall add 10 percent to the Subcontractor's pricing for their own profit and overhead combined.

Mark-ups for both the Contractor and Subcontractors shall be limited to and considered full compensation for:

(a) all head office costs including salaries (specifically including the costs of superintendence pursuant to **2.28 PROJECT MANAGEMENT & SUPERINTENDENCE**), financing, overhead, profit and risk of undertaking the work.

(b) all normal administration, communications, supervision and coordination generally associated with routine change orders.

(c) all costs associated with the normal preparation of the change order

quotation such as investigation and estimating time, miscellaneous discussions and coordination and negotiations.

(d) costs related to:

i. the purchase or rental of material, plant and equipment;

ii. small tools and supplies;

iii. incidental or routine safety and protective measures, except not including labor and materials associated with special safety processes and procedures;

iv. permits, bonds, insurance, engineering, as-built drawings, project record documents, commissioning and site office facilities. The Contractor will be compensated, without markup, at the end of the Contract, upon presentation of specific invoices or supporting documentation, clearly demonstrating the additional costs incurred for permits, bonds, and insurance associated with the net value of all change order work;

v. and fines and any insurance deductibles payable upon fault of the Contractor in performance of the Work.

2.14.2 Notwithstanding the provisions of Paragraph 2.14.1, in case of changes in the Work, the amount charged for equipment rentals shall be that provided in the rental Contract, and no additional amount shall be paid as markup for overhead or profit for the Contractor or Subcontractor.

When a change in the Work is proposed or required, the Contractor shall present to the Engineer/Architect for approval their claim for the change in the Contract Price and/or change in the Contract Time in a form acceptable to the Engineer/Architect and including the appropriate documentation. The Engineer/Architect shall satisfy themselves as to the correctness of such claim, and when approved by the Owner, a change order will be issued to the Contractor to proceed with the change. The value of Work performed in the change shall be included for payment with the regular certificates for payment. Once a change has been approved as to time, there may be no future claim for time due to this change.

2.14.3 In the case of changes in the Work to be paid for under methods (b) and (c) of Paragraph 2.14.1, the form of presentation of costs and methods of measurement shall be agreed to by the Engineer/Architect and Contractor before proceeding with the change. The Contractor shall keep accurate records, as agreed upon, of quantities or costs and present an account of the cost of the change in the Work, together with vouchers where applicable.

2.14.4 If the method of valuation, measurement and the change in Contract Price and/or

change in Contract Time cannot be promptly agreed upon, and the change is required to be proceeded with, then the valuation, measurement and the change in Contract Price and/or Contract Time will be subject to final determination in the manner set out in **2.11.0 DISPUTES**. In this case, the Engineer/Architect shall, with the consent of the Owner, issue a written authorization for the change setting out the method of valuation and, if by lump sum, their valuation of the change in Contract Price and/or Contract Time.

2.14.5 In the case of a dispute in the valuation of a change authorized in the Work and pending final determination of such value, the Engineer/Architect shall certify the value of the Work performed in accordance with their own evaluation of the change and include the amount with the regular certificates for payment. The Contractor shall keep accurate records of quantities and cost of such work.

2.14.6 It is intended in all matters referred to above that both the Engineer/Architect and Contractor shall act promptly.

2.14.7 Should the Owner direct the Contractor not to correct work that has been damaged or that was not performed in accordance with the Contract Document, an equitable deduction from the Contract amount by the Architect/Engineer shall be made to compensate the Owner for the uncorrected or uncompleted work.

2.14.8 Credits will be based on the net cost of material and labour or the net difference in the unit price quantities.

2.15.0 APPLICATION FOR PAYMENT

2.15.1 Applications for payment on account may be made monthly as the Work progresses.

2.15.2 Applications for payment shall be made monthly on a date to be agreed upon between the Owner and the Contractor, and the amount claimed shall be for the value proportionate to the amount of the Contract, of the Work performed and products delivered to the site at that date.

2.15.3 The Contractor shall submit to the Engineer/Architect, before the first application for payment, a schedule of values of the various parts of the Work aggregating the total amount of the Contract Price and divided so as to facilitate evaluation of applications for payment.

2.15.4 This schedule shall be made out in such form and supported by such evidence as to its correctness as the Engineer/Architect may reasonably direct and, when approved by the Engineer/Architect, shall be used as the basis for application for payment.

2.15.5 When making application for payment, the Contractor shall submit a statement based upon this schedule. Claims for products delivered to the site but not yet

incorporated into the Work shall be supported by such evidence as the Engineer/Architect may reasonably require to establish the value and delivery of the products.

2.15.6 With each monthly claim for payment, except the first, the Contractor shall submit a Statutory Declaration attesting that they have made all payments to Subcontractors, Suppliers, and workers on behalf of whom amounts were included in the previous claim for payment.

2.15.7 Applications for release of holdback monies following the substantial performance of the Work and the application for final payment shall be made at the time in the manner set forth in **2.16.0 CERTIFICATES AND PAYMENTS**.

2.15.8 For **all** projects, it should be clearly understood that the University's policy is as follows:

a) Each Progress Claim must be accompanied by a breakdown indicating amounts included for each Subcontractor;

b) When the University makes a Progress Payment, it is made in prorated amounts on behalf of those Subcontractors for whom amounts have been included in the corresponding Progress Claim;

c) The Contractor submitting the Progress Claim **must** make payment of the amounts included for the various Subcontractors to the various Subcontractors within ten (10) working days of issuance of the Progress Payment by the University. A failure to do so that results in a mechanics lien being filed against the University will result in no future Progress Claims being paid until the lien is vacated.

d) Monthly payment amounts are not final or conclusive as to their value or quality of work performed and are subject to reopening and readjustment

2.15.9 Contractors not following the above procedures will be considered to be in default of their Contract, and the University may proceed in accordance with **Article 2.6.0 OWNER'S RIGHT TO PERFORM WORK, STOP WORK AND/OR TERMINATE CONTRACT** Subsection **2.6.2 (d)** of the General Conditions.

2.16.0 CERTIFICATES AND PAYMENTS

2.16.1 The Engineer/Architect shall, within ten (10) days of receipt of an application for payment from the Contractor submitted in accordance with **2.15.0 APPLICATION FOR PAYMENT**, issue a certificate for payment in the amount applied for or such amount as they shall determine to be properly due. If the Engineer/Architect amends the application, they shall promptly notify the Contractor in writing, giving their reason(s) for the amendment.

2.16.2 The Owner shall, within thirty (30) days of receipt and approval by the Owner of a certificate for payment from the Engineer/Architect, make payment to the Contractor on account.

2.16.3 Notwithstanding any other provisions of the Contract:

a) Where legislation permits and where, upon application by the Contractor, the Engineer/Architect has certified that a Subcontract has been totally performed to their satisfaction prior to the Substantial Performance of this Contract, the Owner may, at their discretion, pay the Contractor the holdback retained for such Subcontractor on the day following the expiration of the Statutory Limitations Period stipulated in the Mechanic's Lien Act applicable to the place of the Work and subject to the following conditions:

(i) A copy of the Contract between the Subcontractor and the General Contractor must be submitted.

(ii) The Subcontract is completed without deficiencies.

(iii) The warranty for the Subcontract will not start until Substantial Performance of the General Contract.

(iv) The General Contractor provides an approved Statutory Declaration that all monies have been paid to the said Subcontractor.

(v) The General Contractor provides an approved Waiver of Lien from this Subcontractor.

(vi) The Contractor and the Subcontractor provide an approved Waiver of Claim for all work associated with this Subcontractor.

(vii) A certificate is issued by the Engineer/Architect indicating that the Subcontract has been totally completed to their satisfaction.

(viii) The Owner will, at that time, release the total amount specified on the Subcontractor's Contract.

2.16.4 Notwithstanding the provisions of Paragraph 16.3 (a) and notwithstanding the wording of such certificate, the Contractor shall ensure that such work is protected pending the Total Performance of the Contract and be responsible for the correction of any defects in it regardless of whether or not they were apparent when such certificates were issued.

2.16.5 The Engineer/Architect shall within ten (10) days of receipt of an application from the Contractor for a Certificate of Substantial Performance make an inspection and assessment of the Work to verify the validity of the application. The Engineer/Architect shall within seven (7) days of their inspection notify the

Contractor of their approval or the reasons for their disapproval of the application. When the Engineer/Architect finds the Work to be substantially performed, they shall issue such a certificate. The date of this certificate shall be the date of Substantial Performance of the Contract. Immediately following the issuance of the Certificate of Substantial Performance, the Engineer/Architect, in consultation with the Contractor, shall establish a reasonable date for the Total Performance of the Contract.

2.16.6 Following the issuance of the Certificate of Substantial Performance and upon receipt from the Contractor of all documentation called for in the Contract Documents, the Engineer/Architect shall issue a Certificate for Payment of holdback monies, providing that no lien or privilege claims against the Work exists, that the Contractor has submitted to the Owner a sworn statement that all accounts for labour, Subcontracts, products, construction machinery and equipment and any other indebtedness which may have been incurred by the Contractor in the Substantial Performance of the Work and for which the Owner might in any way be held responsible, have been paid in full and that the Contractor has submitted to the Owner a waiver of all claims associated with this project except holdback monies properly retained. The holdback monies will become due and payable on the day following the expiration of the Statutory Limitation Period stipulated in the Mechanic's Lien Act applicable to the place of buildings. The Owner may retain out of such holdback monies any sum required by law to satisfy any liens against the Work or other monetary claims against the Contractor which may be enforceable against the Owner.

2.16.7 The Engineer/Architect shall, within ten (10) days of receipt of an application from the Contractor for payment upon Total Performance of the Contract, make an inspection and assessment of the Work to verify the validity of the application. The Engineer/Architect shall, within seven (7) days of their inspection, notify the Contractor of their approval or the reasons for their disapproval of the application. When the Engineer/Architect finds the Work to be totally performed to their satisfaction, they shall issue a Certificate of Total Performance and certify for payment the remaining monies due to the Contractor under the Contract, less any holdback monies which are required to be retained. The date of this certificate shall be the date of Total Performance of the Contract. The Owner shall, within thirty (30) days of issuance of such certificate, make payment to the Contractor in accordance with the provisions of the Contract.

2.16.8 The release of any remaining holdback monies shall become due and payable on the day following the expiration of the Statutory Limitation period stipulated in the Mechanics' Lien Act of the place of building provided that no claims against the Work exists and that the Contractor has submitted to the Owner a sworn statement that all accounts for labour, Subcontractors, products, construction machinery and equipment and any other indebtedness which may have been incurred by the Contractor in the Total Performance of the Work and for which the Owner might in any way be held responsible have been paid in full, except holdback monies properly retained.

2.16.9 No certificate for payment, any payment made thereunder or any partial or entire use of occupancy of the Work by the Owner shall constitute an acceptance of any work or products not in accordance with the Contract Documents.

2.16.10 As of the date of Total Performance of the Work as set out in the Certificate of Total Performance of the Work, 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:

a) Those made in writing prior to the date of the Total Performance of the Work and still unsettled;

b) Those arising from the provisions of **2.12.0 INDEMNIFICATION** or **2.26.0 WARRANTY**;

c) Those made in writing within a period of six (6) years from the date of Substantial Performance of the Work, as set out in the Certificate of Substantial Performance of the Work or within such shorter period as may be prescribed by any Limitation Statute of the Province of Newfoundland and Labrador and arising from any liability of the Contractor for damages resulting from their performance of the Contract with respect to substantial defects or deficiencies in the Work for which the Contractor is proven responsible.

As used herein, "substantial defects or deficiencies" means those defects or deficiencies in the Work which affect the Work to such an extent or in such manner that a significant part or the whole of the Work is unfit for the purpose intended by the Contract Documents.

2.16.11 As of the date of Total Performance of the Work, as set out in the Certificate of Total Performance of Work, 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 those made in writing prior to the Contractor's application for payment upon Total Performance of the Work and still unsettled.

2.16.12 In the event of conflict between the provisions of the General Conditions and **2.24.0 DAMAGES AND MUTUAL RESPONSIBILITY**, the provisions of this General Condition shall govern.

2.16.13 The holdback to be used by the Engineer/Architect when issuing certificates of payment will be ten (10) percent of the value of the Work completed at the date of Contractor's claim.

2.16.14 Notwithstanding any other provision of this Contract, the Owner may:

a) In the event of a claim by the Owner against the Contractor for damages arising out of the performance or non-performance of the Contract, withhold payment of any amount equal to the alleged damages until the liability for damages is established, and no amount of interest will be paid on amounts held under this Clause;

b) Set-off amounts owing by the Contractor to the Owner;

c) Following the issuance of the Certificate of Substantial Performance, withhold payment of an amount equal to twice the cost as estimated by the Engineer/Architect of remedying deficiencies until the issuance of a Certificate of Total Performance, and no amount of interest will be paid on amounts held under this Clause.

2.17.0 TAXES AND DUTIES

2.17.1 Unless otherwise stated in the Supplementary General Conditions, the Contractor shall pay all applicable government sales taxes, goods and services taxes, customs duties and excise taxes with respect to the Contract.

2.17.2 Any increase or decrease in costs to the Contractor due to changes in such taxes and duties after the date of the Agreement and up to the agreed date of completion shall increase or decrease the Contract Price accordingly. For further clarity, changes to legislation or regulations that purport to decrease speed limits of vehicles (including trains or sailing vessels) do not constitute a tax or duty. If the Owner so desires, the Contractor is to cooperate with the Engineer/Architect and Owner and permit access to books and records in order to establish the amount of such taxes involved.

2.17.3 The Contractor shall maintain full records of their estimates and of actual costs to them of the Work, together with all proper open calls, quotations, contracts, correspondence, invoices, receipts, payments to Subcontractors and Suppliers and vouchers relating thereto and shall make them available to audit and inspection by the Owner, the Auditor General for Newfoundland and Labrador or by persons acting on their behalf and shall furnish them with any information which they may require from time to time in connection with such records.

2.18.0 LAWS, NOTICES, PERMITS AND FEES

2.18.1 The laws of the Province of Newfoundland and Labrador shall govern the Work.

2.18.2 The Contractor shall obtain all permits, licenses and certificates and pay all fees required for the performance of the Work which are in force at the date of open call closing with the following exceptions:

a) The Contractor shall obtain building permits for the Work but are not required to pay for said permits.

b) The Contractor shall not include the obtaining of permanent easements or rights of servitude.

2.18.3 The Contractor shall give all required notices and comply with all laws, ordinances, rules, regulations, codes and order of all authorities having jurisdiction relating to the Work, to the preservation of the public health and construction safety which are or become in force during the performance of the Work.

2.18.4 The Contractor shall not be responsible for verifying that the Contract Documents are in compliance with the applicable laws, ordinances, rules, regulations and codes relating to the Work. If the Contract Documents are a variance therewith or changes which necessitate modifications to the Contract Documents are required by the authorities having jurisdiction subsequent to the Open call closing date, the Contractor shall notify the Engineer/Architect in writing requesting direction immediately when any such variance or change is observed by them. The Engineer/Architect will make the changes required to the Contract Documents, and the Contract Price and/or Contract Time shall be adjusted in accordance with **2.13.0 CHANGES IN THE WORK AND EXTRA WORK** and evaluated in accordance with **2.14.0 VALUATION AND CERTIFICATION OF CHANGES IN THE WORK**.

2.18.5 If the Contractor fails to notify the Engineer/Architect in writing and obtain their direction as required in 2.18.4 and performs any work knowing it to be contrary to any laws, ordinances, rules, regulation, codes and orders of any authority having jurisdiction, they shall be responsible for and shall correct any violations thereof and shall bear all costs, expense and damages, attributable to their failure to comply with the provisions of such laws, ordinances, rules, regulations, codes and orders.

2.19.0 PATENT FEES

2.19.1 The Contractor shall pay all royalties and patent license fees required for the performance of the Contract and such royalties or fees shall be deemed to have been included in the Contract Price. They shall hold the Owner harmless from and against all claims, demands, losses, costs, damages, actions, suits or proceedings arising out of the Contractor's performance of the Contract which are attributable to an infringement or an alleged infringement of any patent or invention by the Contractor or anyone for whose acts they may be liable.

2.19.2 The Owner shall hold the Contractor harmless against all claims, demands, losses, costs, damages, actions, suits or proceedings arising out of the Contractor's performance of the Contract which are attributable to an infringement or an alleged

infringement of any patent or invention in executing anything for the purpose of the Contract, the model, plan or design of which was supplied to the Contractor by the Owner.

2.20.0 WORKERS' COMPENSATION

2.20.1 The Contractor shall be registered with and shall remain in good standing with the Workplace Health and Safety Compensation Commission during the term of their Contract.

2.20.2 At any time during the term of the Contract when requested by the Owner, the Contractor shall provide evidence of compliance by themselves and any or all of their Subcontractors.

2.21.0 LIABILITY INSURANCE

2.21.1 Comprehensive General Liability Insurance

a) Without restricting the generality of **2.12.0 INDEMNIFICATION**, the Contractor shall provide and maintain, either by way of a separate policy or by an endorsement to their existing policy, Comprehensive General Liability Insurance acceptable to the Owner and subject to limits set out in detail below, inclusive per occurrence for bodily injury, death and damage to property including loss of use thereof.

b) The insurance shall be in the joint names of the Contractor and the Owner. It shall also cover as Additional Insureds all Subcontractors and anyone employed directly or indirectly by the Contractor or their Subcontractors to perform a part or parts of the Work but excluding Suppliers whose only function is to supply and/or transport products to the project site.

c) The insurance shall also include as Additional Insureds the architectural and engineering consultants of the Owner and Engineer/Architect.

d) The insurance shall preclude subrogation claims by the Insurer against anyone insured thereunder.

e) The Comprehensive General Liability Insurance will not be limited to, but shall include coverage for:

(i) Premises and Operations Liability

(ii) Products or Completed Operations Liability

(iii) Blanket Contractual Liability

(iv) Cross Liability

(v) Elevator and Hoist Liability

(vi) Contingent Employer's Liability

(vii) Personal Injury Liability arising out of false arrest, detention or imprisonment or malicious prosecution, libel, slander or defamation of character, invasion of privacy or wrongful entry

(viii) Shoring, blasting, excavating, underpinning, demolition, pile driving and caisson work, work below ground surface, tunnelling and grading, as applicable

(ix) Liability with respect to non-owned, licensed vehicles.

2.21.2 The Contractor shall provide and maintain liability insurance in respect of owned licensed vehicles subject to limits set out in detail in Article **2.21.0 LIABILITY INSURANCE** subsection **2.21.6.**

2.21.3 All liability insurance shall be maintained continuously until twelve (12) months after the date the Engineer/Architect issues a Certificate of Substantial Performance.

2.21.4 The Contractor shall provide the Owner with evidence of all liability insurance prior to the commencement of the Work and shall promptly provide the Owner with a certified true copy of each insurance certificate.

2.21.5 All liability insurance policies shall contain an endorsement to provide all Additional Insureds with prior notice of changes and cancellations. Such endorsements shall be in the following form:

"It is understood and agreed that the coverage provided by this policy will not be changed or amended in any way nor cancelled until thirty (30) days after written notice of such change or cancellation shall have been given to all Additional Insureds."

2.21.6 The Contractor shall protect themselves and indemnify and save the Owner harmless from any and all claims which may arise from the Contractor's performance or failure of performance of the Contract and for this purpose shall, without restricting the generality of the foregoing, maintain insurance acceptable to the Owner to the following limits:

a) Where the contract value exceeds $100,000 (inclusive of HST)
   - Comprehensive General Liability = $10,000,000.00;
   - Standard Automobile Policy Liability = $5,000,000.00;
   - Contractor's Pollution Liability = $5,000,000.00 per occurrence.

   And if used directly or indirectly in the performance of The Work:

   - Manned Aircraft and Watercraft Liability = $10,000,000.00;

- Unmanned Aerial Vehicle (drone) Liability = $5,000,000.00;

b) Where the contract value is less than $100,000 (inclusive of HST)
- Comprehensive General Liability = $5,000,000.00;
- Standard Automobile Policy Liability = $3,000,000.00;
- Contractor's Pollution Liability = $3,000,000.00 per occurrence.

And if used directly or indirectly in the performance of The Work:

- Manned Aircraft and Watercraft Liability = $10,000,000.00;
- Unmanned Aerial Vehicle (drone) Liability = $5,000,000.00.

Prior to the commencement of any work hereunder, the Contractor shall file with the Owner a copy of each insurance policy and certificate required.

2.22.0 PROPERTY INSURANCE

2.22.1 Property Insurance is required to be provided by the Contractor if one of the following criteria is met:

a) The contract value exceeds $5,000,000.00 (inclusive of HST).

b) The contract is for a new building or extension, regardless of the contract value.

c) The contract is for a renovation and will expose the interior elements of a building to the elements of weather, regardless of the contract value. Including, but not limited to, windows or roofing replacement projects.

2.22.2 The Contractor shall provide and maintain property insurance acceptable to the Owner insuring the full value of the Work in the amount of the replacement cost or the Contract value, whichever is greater, and the full value as stated of products for incorporation into the Work. The insurance shall be in the joint names of the Contractor, the Owner, the Subcontractors as Unnamed Insured or, if they specifically request, as Named Insured. The policies shall preclude subrogation claims by the Insurer against anyone insured thereunder.

2.22.3 Such coverage shall be provided by EITHER an ALL-RISKS Builders' Risk Policy OR by a combination of a Coverage and Malicious Damage Endorsements and a Builder's Risk Difference in Conditions Policy providing equivalent coverage of Piers, Wharves and Docks, Government Structures Policy.

2.22.4 The policies shall insure against all risks of direct loss or damage. Such coverage shall apply to:

a) All products, labour and supplies of any nature whatsoever, the property of

the Insureds or of others for which the Insureds may have assumed responsibility, to be used in or pertaining to the site preparations, demolition of existing structures, erections and/or fabrication and/or reconstruction and/or repair of the insured project, while on the site or in transit, subject to the exclusion of the property specified.

b) The installation, testing and any subsequent use of machinery and equipment including boilers, pressure vessels or vessels under vacuum.

c) Damage to the Work caused by an accident to and/or the explosion of any boiler(s) or pressure vessel(s) forming part of the Work.

Such coverage shall exclude construction machinery, equipment, temporary structural and other temporary facilities, tools and supplies used in the construction of the Work and which are not expendable under the Contract.

2.22.5 The Contractor shall provide the Owner with evidence of all insurance prior to the commencement of the Work and shall promptly provide the Owner with a certified true copy of each insurance policy.

Policies provided shall contain an endorsement to provide all Named Insureds with prior notice of changes and cancellations. Such endorsements shall be in the following form:

"It is understood and agreed that the coverage provided by this policy will not be changed or amended in any way or cancelled until thirty (30) days after written notice of such change or cancellation shall have been given to all Named Insureds."

2.22.6 All such insurance shall be maintained continuously until ten (10) days after the date the Engineer/Architect issues a certificate of Substantial Performance. All such insurance shall provide for the Owner to take occupancy of the Work or any part thereof during the terms of this insurance. Any increase in the cost of this insurance arising out of such occupancy shall be at the Owner's expense.

2.22.7 The policies shall provide that, in the event of a loss, payment for damage to the Work shall be made to the Owner and the Contractor as their respective interests may appear. Damage shall not affect the rights and obligations of either party under the Contract except that the Contractor shall be entitled to such reasonable extension of time for Substantial and Total Performance of the Work as the Engineer/Architect may decide.

2.22.8 The Contractor and/or their Subcontractors, as may be applicable, shall be responsible for any deductible amounts under the policies and for providing such additional insurance as may be required to protect the Insureds against loss on items excluded from the policies.

2.22.9 When this Contract pertains to a new building or structure with a total bid amount greater than $25,000.00, the Contractor shall maintain All Risk Builder's Risk Insurance acceptable to the Owner in the joint names of the Owner and Contractor in the amount of 100 percent of the total value of the Work done and material delivered to the site and payable to the Owner and Contractor as their respective interest may appear.

2.23.0 PROTECTION OF WORK AND PROPERTY

2.23.1 The Contractor shall protect the property adjacent to the project site from damage as the result of their operations under the Contract.

2.23.2 The Contractor shall protect the Work and the Owner's property from damage and shall be responsible for any damage which may arise as the result of their operations under the Contract except damage which occurs as the result of:

a) Errors in the Contract documents; and/or

b) Acts or omissions by the Owner, their agents, employees or other Contractors

2.23.3 Should the Contractor, in the performance of this Contract, damage the Work and/or Owner's property and/or property adjacent to the place of the Work, the Contractor shall be responsible for making good such damage at their own expense or pay all costs incurred by others in making good such damage.

2.23.4 Should any damage occur to the Work and/or Owner's property for which the Contractor is not responsible as provided in of **2.12.0 INDEMNIFICATION**, they shall make good such damage to the Work and, if the Owner so directs, to the Owner's property, and the contract Price and Contract Time shall be adjusted in accordance with in **2.13.0 CHANGES IN THE WORK AND EXTRA WORK** and evaluated in accordance with in **2.14.0 VALUATION AND CERTIFICATION OF CHANGES IN THE WORK**.

2.23.5 The Contractor shall be completely responsible for the safety of the Work as it applies to protection of the public and property and construction of the Work.

The codes that must be followed and enforced for safety are:

a) The National Building Code, Part 8, Safety Measures at Construction and Demolition Sites (Latest Edition);

b) Canadian Code for Construction Safety (Latest Edition) as issued by the Associate Committee of the National Building Code;

c) The Occupational Health and Safety Act (1979) and Regulations.

2.23.6 Any person not following stipulated safety regulations shall be dismissed.

2.24.0 DAMAGES AND MUTUAL RESPONSIBILITY

2.24.1 If either party to this Contract should suffer damage in any manner because of any wrongful act or neglect of the other party or anyone employed by them then they shall be reimbursed by the other party for such damages. The party reimbursing the other party shall be subrogated to the rights of the other party in respect of such wrongful act or neglect if it be that of a third party.

2.24.2 Claims under this Contract shall be made in writing to the party liable within a maximum of thirty (30) days after the first observance of such damage and may be adjusted by agreement or in the manner set out in **2.11.0 DISPUTES**.

2.24.3 If the Contractor has caused damage to any other Contractor on the Work, the Contractor agrees upon due notice to settle with such other Contractor by agreement or arbitration, if they will so settle. If such other Contractor sues the Owner on account of any damage alleged to have been sustained, the Contractor agrees to fully indemnify the Owner to the extent that the Owner is adjudicated to pay any of the damages. The Owner shall notify the Contractor and may require the Contractor to defend the action at the Contractor's expense. If any final order or judgment against the Owner arises therefrom, the Contractor shall pay or satisfy it and pay all costs incurred by the Owner.

2.24.4 If the Contractor becomes liable to pay or satisfy any final order, judgment or award against the Owner then the Contractor, upon undertaking to indemnify the Owner against any and all liability for costs, shall have the right to appeal in the name of the Owner such final order or judgment to any and all courts of competent jurisdiction.

2.24.5 Should the Contractor fail to meet the date to substantially perform the Work, as indicated in the Agreement between the Owner and the Contractor, and is unable to provide justification acceptable to the Owner for the delay then the Contractor will be held liable for any liquidated damage amount indicated in **3.0 SUPPLEMENTARY GENERAL CONDITIONS** and may be held liable for payment to the Owner for other damages and losses suffered by the Owner as a result of the Contractor's delay including additional costs for Engineering/Architectural supervision.

2.25.0 BONDS

2.25.1 The Contractor shall promptly provide the Owner the surety bonds called for in the Open call Documents.

2.25.2 All such bonds shall be issued by a duly incorporated surety company approved by the Owner and authorized to transact a business or surety-ship in the Province of Newfoundland and Labrador.

2.25.3 If bonds are called for in the and Acceptance form, Instructions to Bidders or Supplementary General Conditions, the costs attributable to providing such bonds shall be included in the bid price.

2.25.4 Should the Owner require the provision of a bond or bonds by the Contractor other than those provided for under 2.25.3, the Contract Price shall be increased by all costs attributable to providing such bonds.

2.26.0 WARRANTY

2.26.1 The Contractor shall be responsible for the proper performance of the Work to the extend that the design and specifications permit such performance.

2.26.2 Subject to Paragraph 2.26.1, the Contractor agrees to correct promptly, at their own expense, defects or deficiencies in the Work which appear prior to and during the period of one (1) year from the date of Substantial Performance of the Work or such longer periods as may be specified for certain products or work.

2.26.3 The Contractor shall correct and/or pay for any damage to other work resulting from any corrections required under the conditions of Paragraph 2.26.2.

2.26.4 Neither the Engineer/Architect's final certificate nor payment thereunder shall relieve the Contractor from their responsibility hereunder.

2.26.5 The Owner and/or Engineer/Architect shall give the Contractor written notice of observed defects promptly.

2.27.0 CONTRACTOR'S RESPONSIBILITIES AND CONTROL OF THE WORK

2.27.1 The Contractor shall have complete control of the Work and shall effectively direct and supervise the Work so as to ensure conformance with the requirements of the Contract Documents. They shall be solely responsible for all construction means, methods, techniques, sequences and procedures and for coordinating all parts of the Work under the Contract.

2.27.2 The Contractor shall have the sole responsibility for the design, erection, operation, maintenance and removal of temporary structural and other temporary facilities and the design and execution of construction methods required in their use. The Contractor shall engage and pay for registered professional engineering personnel skilled in the appropriate disciplines to perform these functions where required by law or by the Contract Documents and, in all cases, where such temporary facilities and their method of construction are of such a nature that professional engineering skill is required to produce safe and satisfactory results.

2.27.3 Notwithstanding the provision of Paragraphs 2.27.1 and 2.27.2 above or any provisions to the contrary elsewhere in the Contract Documents where such Contract Documents include designs for temporary structural and other temporary facilities or specify a method of construction in whole or in part, such facilities and methods shall be deemed to comprise part of the overall design of the Work, and the Contractor shall not be held responsible for that part of the design or the specified method of construction. The Contractor shall, however, be responsible for the execution of such design or specified method of construction in the same manner that they are responsible for the execution of the Work.

2.27.4 The Contractor shall carefully examine the Contract Documents and shall promptly report to the Engineer/Architect any error, inconsistency or omission they may discover. The Contractor shall not be held liable for any damage resulting from any such errors, inconsistencies or omissions in the Contract Documents which they may discover, and they shall not proceed with the Work affected until they have received corrected or missing information from the Engineer/Architect.

2.28.0 PROJECT MANAGEMENT AND SUPERINTENDENCE

2.28.1 The Contractor shall employ a competent Project Manager and necessary project team. It is the Contractor's responsibility to ensure their project team is qualified and capable of executing the project work.

2.28.2 The Project Manager shall be satisfactory to the Engineer/Architect and shall not be changed except for good reason and only then after consultation with an agreement by the Engineer/Architect.

For projects with a bid value greater than $5 million dollars, excluding HST, the Project Manager shall have a minimum of ten (10) years' experience on construction projects of similar scale, complexity, type and value.
At the Owner's request, the project manager shall be required to submit a resume and cover letter outlining their work experience. The owner reserves its right to refuse the Contractor's suggested Project Manager in the event that the suggested project manager does not meet the above requirements. Such refusal shall not be exercised unreasonably by the Owner.

2.28.3 The Contractor shall employ a competent Superintendent and necessary assistants who shall be in attendance at the Work site at all times while the Work is being performed.

The Superintendent shall represent the Contractor at the place of work and instructions given to them by the Engineer/Architect shall be held to have been given to the Contractor. Important instructions shall be confirmed to the Contractor in writing, other instructions will be so confirmed if requested.

For projects with a bid value greater than $5 million dollars, excluding HST, the Superintendent shall have a minimum of ten (10) years' experience on construction projects of similar scale, complexity, type and value. The Owner reserves its right to refuse the Contractor's suggested Superintendent in the event that the suggested Superintendent does not meet the above requirements. Such refusal shall not be exercised unreasonably by the Owner.

At the Owner's request, the Superintendent shall be required to submit a resume outlining their work experience.

2.29.0 LABOUR AND PRODUCTS

2.29.1 Unless otherwise stipulated elsewhere in the Contract Documents, the Contractor shall provide and pay for all labour, products, tools, construction equipment and machinery, water, heat, light, power, transportation and other facilities and services necessary for the requirements of the Contract Documents.

2.29.2 All products provided shall be new unless otherwise specified in the Contract Documents. Any products which are not specified shall be of a quality best suited to the purpose required, and their use shall be subject to the approval of the Engineer/Architect.

2.29.3 In carrying out their duties under this Contract, the Contractor shall comply with all Provincial and Federal legislation respecting labour and the employment of labour, where applicable, including the Labour Standards Code and shall not operate in conflict with the Human Rights legislation. In the employment of labour, preference should be given to persons normally residing in Newfoundland and Labrador.

2.29.4 The Contractor and Subcontractors shall maintain and keep available for inspection by the Owner, a record of the names and addresses of all persons employed on the project.

2.29.5 The Contractor shall maintain good order and discipline among their employees engaged on the Work and shall employ on the Work only employees skilled in their various trades.

2.29.6 There shall be no discrimination in the selection of workers for employment on the project in respect to race, religion, views or political affiliation or any other enumerated ground contained in the *Human Rights Act, 2010* of Newfoundland and Labrador, and the office of the Canada Manpower will be used in the recruitment of workers wherever possible.

2.29.7 The Contractor shall pay fair wages and shall pay rates of wages and allowances to the various classes of labour not less favourable than those prevailing in the area where the Work is being performed.

2.29.8 The Contractor shall be aware that the majority of hourly-paid and maintenance workers employed within the University are unionized. It is of utmost importance that any labour force used by the Contractor neither disrupts or be disrupted by any labour conditions existing on the University campus. Failure by the Contractor to familiarize themselves with labour conditions on Campus or disruptions to the Contractor's own labour force because of labour conditions on Campus will not relieve them of their obligations to furnish all labour and materials necessary to carry out the requirements of the Contract.

2.30.0 SUBSURFACE CONDITIONS

2.30.1 The Contractor shall promptly notify the Engineer/Architect in writing if, in their opinion, the subsurface conditions at the project site differ materially from that indicated or reasonably inferred from the Contract Documents.

2.30.2 After prompt investigation, should the Engineer/Architect determine that conditions do differ materially, they shall issue appropriate instructions for changes in the Work as provided for in **2.13.0 CHANGES IN THE WORK AND EXTRA WORK**.

2.31.0 USE OF THE WORK

2.31.1 The Contractor shall confine their apparatus, the storage of products and the operations of their employees to limits indicated by laws, ordinances, permits or by instructions of the Engineer/Architect and shall not unreasonably encumber the premises with their products.

2.31.2 The Contractor shall not load or permit to be loaded any part of the Work with a weight or force that will endanger its safety.

2.31.3 Unless otherwise provided, the Contractor shall, at their own expense and without expense to the Owner, make suitable provision to accommodate all traffic, either pedestrian or vehicular, over or around the project upon which work is being performed in a manner satisfactory to the Engineer/Architect.

2.31.4 The Contractor shall provide and maintain at their own expense such fences, barriers, signs, lights and watchmen as may be necessary to prevent avoidable accidents to University Users or to the public generally.

2.31.5 All work shall be executed with the least possible interference with or disturbance to personnel and the Public. The Contractor shall cooperate with the person in charge of the premises. The Contractor shall ascertain from the Owner's representative the hours during which the work shall be performed, conform to the directions of the representative and to the directions of the said representative in determining the order in which the work shall be done.

2.31.6 The Contractor shall carry out all work required to maintain the building services and to provide necessary access for personnel and vehicles whenever new work affects occupied portions of the building.

2.31.7 Before final completion of the work, the Owner shall be entitled to make use of any portion of the work which is completed and fit for use for the installation of equipment, storage and furniture, supplies, etc., and for occupancy, if such can be arranged without interfering with the progress of the work.

2.32.0 CUTTING AND REMEDIAL WORK

2.32.1 The Contractor shall do all cutting and remedial work that may be required to make the several parts of the Work come together properly and shall coordinate the Work to ensure that this requirement is kept to a minimum.

2.32.2 Should the Owner, the Engineer/Architect, other contractors or anyone employed by them, be responsible for ill-timed work necessitating additional cutting and/or remedial work to be performed, it shall be valued as provided in **2.14.0 VALUATION AND CERTIFICATION OF CHANGES IN THE WORK** and added to the Contract Price.

2.32.3 Cutting and remedial work shall be performed by specialists familiar with the materials affected and shall be performed in a manner to neither damage nor endanger any work.

2.33.0 INSPECTION OF WORK

2.33.1 The Owner, the Engineer/Architect and their authorized representatives shall have access to the Work for inspection wherever it is in preparation or progress. The Contractor shall cooperate to provide reasonable facilities for such access.

2.33.2 If parts of the Work are designated for special tests, inspections or approvals in the Contract Documents or by the Engineer/Architect's instructions or the laws or ordinances of the place of the Work, the Contractor shall give the Engineer/Architect timely notice requesting inspection. Inspection by the Engineer/Architect shall be made promptly. The Contractor shall arrange for inspections by other authorities and shall notify the Engineer/Architect with timely notice of the date and time.

2.33.3 If the Contractor covers or permits to be covered any of the Work that is designated for special tests, inspections or approvals, before such special tests, the Contractor shall, if so instructed by the Engineer/Architect, uncover the Work, have the inspection satisfactorily completed and make good the Work at their own expense.

2.33.4 The Engineer/Architect may order any part of the Work to be specifically examined, should they believe such work not to be in accordance with the

requirements of the Contract Documents. If upon examination such work is found not to be in accordance with the requirements of the Contract Documents, the Contractor shall correct such work and pay the cost of examination and correction. If such work is found to be in accordance with the requirements of the Contract Documents, the Owner will pay the cost of examination and replacement.

2.33.5 The Contractors shall furnish promptly to the Engineer/Architect two (2) copies of all certificates and inspection reports relating to the Work.

2.34.0 REJECTED WORK

2.34.1 Defective work, whether the result of poor workmanship, use of defective products or damage through carelessness or other act or omission of the Contractor and whether incorporated in the Work or not which has been rejected by the Engineer/Architect as failing to conform to the Contract Documents, shall be removed promptly from the premises by the Contractor and replaced and/or re-executed promptly in accordance with the Contract Documents at the Contractor's expense.

2.34.2 Other contractors' work destroyed or damaged by such removals or replacements shall be made good promptly at the Contractor's expense.

2.34.3 If, in the opinion of the Engineer/Architect, it is not expedient to correct defective work not done in accordance with the Contract Documents, the Owner may deduct from the Contract Price the difference in value between the Work as done and that called for by the Contract, the amount of which shall be determined in the first instance by the Engineer/Architect.

2.35.0 SHOP DRAWINGS AND SAMPLES

2.35.1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by the Contractor to illustrate details of a portion of the Work.

2.35.2 The Contractor shall arrange for the preparation of clearly identified shop drawings as called for by the Contract Documents or as the Engineer/Architect may reasonably request.

2.35.3 Prior to submission to the Engineer/Architect, the Contractor shall review all shop drawings. By this review, the Contractor represents that they have determined and verified all field measurements, field construction criteria, materials, catalogue numbers and similar data, or will do so, and that they have checked and coordinated each shop drawing with the requirements of the Work and of the Contract Documents. The Contractor's review of each shop drawing shall be indicated by stamp, date and signature of a responsible person.

The Contractor shall submit shop drawings to the Engineer/Architect for their review with reasonable promptness and in orderly sequence so as to cause no delay in the Work or in the Work of other contractors. If either the Contractor or the Engineer/Architect so requests, they shall jointly prepare a schedule fixing the dates for submission and return of shop drawings. Shop drawings shall be submitted in the form of reproducible transparencies or prints as the Engineer/Architect may direct. At the time of the submission, the Contractor shall notify the Engineer/Architect in writing of any deviations in the shop drawings from the requirements of the Contract Documents.

2.35.4 The Engineer/Architect will review and return shop drawings in accordance with any schedule agreed upon or otherwise with reasonable promptness so as to cause no delay. The Engineer/Architect's review will be for conformity to the design concept and for general arrangements only, and such review shall not relieve the Contractor of responsibility for errors or omissions in the shop drawings or of responsibility for meeting all requirements of the Contract Documents unless a deviation on the shop drawings has been approved in writing by the Engineers/Architects.

2.35.5 The Contractor shall make any changes in shop drawings which the Engineer/ Architect may require consistent with the Contract Documents and resubmit, unless otherwise directed by the Engineer/Architect. When resubmitting, the Contractor shall notify the Engineer/Architect in writing of any deviations other than those requested by the Engineer/Architect. Any required resubmission of shop drawings shall be at the sole expense of the Contractor.

2.35.6 The Contractor shall submit for the Engineer/Architect's approval such standard manufacturer's samples as the Engineer/Architect may reasonably require. Samples shall be labeled as to origin and intended use in the Work and shall conform to the requirements of the Contract Documents.

2.35.7 The Contractor shall provide samples of special products, assemblies or components when so specified. The cost of such samples not specified shall be authorized as an addition to the Contract Price as provided in **2.13.0 CHANGES IN THE WORK AND EXTRA WORK**.

2.36.0 TESTS AND MIX DESIGNS

2.36.1 The Contractor shall furnish to the Engineer/Architect test results and mix designs as may be requested. The testing company must first be approved by the Engineer/Architect.

2.36.2 The cost of tests and mix designs beyond those called for in the Contract Documents or beyond those required by law, ordinances, rules and regulations relating to the Work and the preservation of public health, shall be authorized as an addition to the Contract Price as provided in **2.13.0 CHANGES IN THE WORK**

AND EXTRA WORK.

2.37.0 MATERIALS AND SUBSTITUTIONS

Materials described and named in the specifications with "or approved equal" clause after the Manufacturer's name are so described as to the establish quality only, and substitutions of a similar materials may be made before the award of the Contract provided the Engineer/Architect's approval is obtained. Substitutions after the award

may be considered under special circumstances as indicated in Subsection 1.7.4 in the **INSTRUCTIONS TO Bidders**

2.37.1 Requests for substitutions must be accompanied by sufficient information in the form of shop drawings, manufacturer's literature, samples and other data to permit proper investigation of the substitutes proposed, together with any increase or decrease in price.

2.37.2 Whenever a substitute is proposed for approval, the Contractor shall guarantee that such proposed substitute will not adversely affect the space requirements allocated on the drawings for the material specified, and they shall agree to bear any additional expense incurred due to their use of the proposed substitute.

2.37.3 The Engineer/Architect may accept or reject any or all of the proposed substitutions as they see fit, and their decision on a question of equality shall be final.

2.38.0 TIME OF ESSENCE AND SCHEDULE

2.38.1 Time is of the essence of the Contract.

2.39.0 CASH ALLOWANCE

2.39.1 The Contract Price includes cash allowances, if any, stated in the Contract Documents.

2.39.2 Cash allowances, unless otherwise specified, cover the entire cost to the Contractor of services, products, construction machinery and equipment, freight, unloading, handling, storage, installation and other authorized expenses incurred in performing the Work stipulated under the cash allowances. This also includes the Contractors overhead and profit in connection with such cash allowance.

2.39.3 The cash allowance shall not include HST.

2.39.4 Where costs under a cash allowance exceed the amount of the allowance, the Contractor shall be compensated for any excess incurred and substantiated plus an allowance for overhead and profit as set out in **2.14.0 VALUATION AND**

CERTIFICATION OF CHANGES IN THE WORK.

2.39.5 The Contract Price shall be adjusted by change order to provide for any excess or deficit to each cash allowance.

2.39.6 Progress payments on account of Work authorized under cash allowance shall be included in the Engineer/Architect's monthly certificates for payment.

2.39.7 A schedule shall be prepared jointly by the Engineer/Architect and Contractor to show the items called for under Cash Allowances. They must be authorized by the Owner for ordering purposes so that the progress of the Work will not be delayed.

2.40.0 CLEANUP AND FINAL CLEANING OF THE WORK

2.40.1 The Contractor shall maintain the Work in a tidy condition and free from the accumulation of waste products and debris, other than that caused by the Owner, other contractors or their employees.

2.40.2 When the Work is substantially performed, the Contractor shall remove their surplus products, tools, construction machinery and equipment not required for the performance of the remaining Work. They shall also remove waste products and debris, other than that caused by the Owner, other contractors or their employees, and leave the Work clean and suitable for occupancy by the Owner, unless otherwise specified.

2.40.3 When the Work is totally performed, the Contractor shall remove their surplus products, tools, construction machinery and equipment. They shall also remove waste products and debris other than that caused by the Owner, other contractors or their employees.

3.0 SUPPLEMENTARY GENERAL CONDITIONS

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4.0 SPECIAL CONDITIONS

ALL SECTIONS STRUCK OUT IN SECTION 4.0 ARE NOT INCLUDED IN THE CONTRACT

4.1.0 LAYOUT OF WORK

4.1.1 Other than the original lot lines and a benchmark, both shown on the drawings, establish and maintain all grades, lines, levels and well-built batter boards at all corners of the building. As work progresses, lay out on the forms or rough flooring the exact location of all partitions as a guide to all trades.

4.1.2 Verify all grades, lines, levels and dimensions as shown on the drawings and report any errors or inconsistencies in the above to the Engineer/Architect before commencing Work.

~~4.2.0 JOB SIGN~~

~~**4.2.1** At the start of the job, erect two painted signs as detailed and where located by the Engineer/Architect. This will be the only sign or advertisement permitted on the site unless instructed otherwise by the Engineer/Architect.~~

~~**4.2.2** The signs shall be 8'0" x 8'0" plywood, properly supported. It shall be painted and shall show the names of the building, Owner, Prime Consultant, Major Subconsultants, Contractor and Major Subcontractors. A drawing of the signs to be erected will be supplied by the Engineer/Architect.~~

4.3.0 TEMPORARY OFFICES AND SHEDS

4.3.1 Construct and maintain, until completion of the Contract temporary offices and storage sheds in approved locations on site for the use of staff.

4.3.2 Buildings shall be of weatherproof wood stud and plywood construction completely equipped with adequate lighting, heating and ventilation, and in addition, the Contractor’s office shall be fully furnished with desks, plan tables, storage cabinets, file drawers, chairs, stools and plan racks.

4.3.3 Provide storage sheds for small tools, equipment, perishable materials, etc., as necessary. All buildings shall be equipped with windows for natural light and doors properly fitted and equipped with locks.

4.3.4 Maintain offices and storage sheds in good condition to the approval of the Engineer/Architect from start of Work until final completion of Work or, when directed by the Engineer/Architect, remove offices and sheds from the site and leave areas free of debris and waste materials and in a clean and tidy condition.

4.3.5 Offices and storage sheds required by Trade Contractors, such as mechanical and electrical, shall be provided by the trade requiring them.

~~**4.3.6** Provide an office approximately 120 square feet for the absolute use of the Owner or their representative(s). It shall be properly fitted and furnished with light, heat, telephone, lock and key, shelving, table and chairs and plan rack. The building shall be removed from the site at the completion of the Work.~~

4.4.0 TEMPORARY SERVICES

4.4.1 Light and Power

Furnish all temporary light and power required to provide such intensity of light and sufficient power as necessary for the Work to be carried out under the best conditions. Obtain and pay for all permits and inspection tests required by Provincial and/or Municipal authorities. Pay all charges and maintain fixtures and equipment in good working order. This shall include electric heat.

~~**4.4.2** Telephone~~

~~Install and pay for the operation of one job telephone and one telephone for the use of the Engineer/Architect for the duration of the Contract. Subcontractors requiring individual telephones shall have them installed at their expense. Long distance calls will be at the expense of the party making the calls.~~

4.4.3 Toilets

At the start of operations, provide and maintain in sanitary condition sufficient temporary toilets and washing facilities for the use of personnel on the job. Conform to requirements of the Department of Health and other authorities having jurisdiction. Supply adequate quantities of disinfectant and toilet paper. When building toilets and washing facilities are operable, they may be used under the same conditions as the temporary toilets with the latter being removed, leaving all surfaces and areas hygienically clean and in immaculate condition.

4.4.4 Heat

Provide and maintain in good condition a temporary heating system for use when the building is closed in until the project has been handed over to the Owner. Pay for fuel and maintenance of the system. Maintain temperatures at a minimum of 50^{o} F, (higher if required for special trades). Heating equipment not adequately protected or operated in conditions other than those intended by the manufacturer shall be regarded as temporary. Remove all such equipment and replace with new permanent equipment.

When ready for operation, the permanent heating equipment may be used for temporary heating purposes, subject to the conditions of the Mechanical Division of

the specifications. Protect all permanent heating equipment used for temporary heating purposes. Provide satisfactory site conditions for the proper operation of this equipment.

4.4.5 Water Supply

Provide in two convenient locations outside the building line a fresh water supply for the use of all trades.

Where connection cannot be made to an existing water supply, provide adequate size tanks and keep them filled for use of all trades.

4.5.0 PLANT AND MACHINERY

4.5.1 Provide all framework, scaffolding, ladders, cranes, derricks, planks, screens, gantries, tarpaulins, tools, equipment and machinery for the proper execution of the Work. Scaffolding shall be erected without damage of the structure or the finishes, be removed to suit the installation of work of other trades and be promptly removed at completion.

4.5.2 Where it is the normal practice for the trade to provide its own scaffolding, it shall be included in the Subcontract.

4.6.0 PROTECTION OF PUBLIC AND WORKMEN

4.6.1 Part 8 of the National Building Code of Canada, latest edition, shall apply to this project in its entirety. This covers fencing, barricades, Fire protection, excavation, use of streets or public property, control of vehicular traffic and mechanical methods of demolition.

4.6.2 The latest edition of Canadian Construction Safety Code shall also apply to all phases of this project.

4.6.3 The Workplace Health, Safety and Compensation Commission Regulations shall also apply to all phases of this project.

4.7.0 CONSTRUCTION SCHEDULE

4.7.1 The Contractor shall, within seven (7) days after the Contract is awarded, prepare for the use of the Engineer/Architect and Owner, a construction schedule. It shall indicate as closely as possible the starting and completion dates for the major sections of the Work, together with the Subcontractors' names.

4.7.2 With each monthly progress claim, submit one (1) copy of the original construction schedule marked in red to show the actual construction progress on the date of the submission of the claim. When necessary, provide an updated construction schedule superseding the original.

4.8.0 OPERATIONS AND MAINTENANCE DATA

4.8.1 On completion of the project, submit to the Engineer/Architect one (1) copy of Operations and Maintenance Data and one (1) electronic copy as original editable format.

a) Title page, labelled "Operation and Maintenance Data", project number, project name, date and list of contents.

b) Organize contents into applicable sections of work to parallel project specifications breakdown.

c) Provide electronic document in an acceptable file transfer method (external hard drive or file share), including all original and editable files or, at the direction of the Owner, pdf format.

4.8.2 Include the following information plus data specified in the technical specifications:

a) Maintenance instruction for finished surface and materials.

b) Copy of hardware schedules.

c) Description, operation and maintenance instructions for equipment and systems, including complete list of equipment and parts list. Indicate nameplate information such as make, size capacity and serial number.

d) Names, addresses, email and phone numbers of Subcontractors and Suppliers.

e) Guarantees, warranties and bonds showing:

(i) Name and address of project.

(ii) Guarantee commencement date (date of Final Certification of Completion).

(iii) Duration of guarantee.

(iv) Clear indication of what is being guaranteed and what remedial action will be taken under guarantee.

(v) Signature and Seal of Contractor.

f) Additional materials used in project listed under various sections showing name of manufacturer and source of supply.

4.8.3 Neatly type lists and notes. Use clear drawings, diagrams or manufacturer's literature.

4.8.4 The final certificate will not be issued until requirements of section 4.8have been received and approved by the Engineer/Architect.

4.9.0 COORDINATION OF WORK

4.9.1 The Contractor will coordinate the Work of their Subcontractors and provide necessary instructions and scheduling so as to permit continuous progress in the Work by all trades. They will coordinate work between the Subcontractors on the site to ensure that anchor bolts, plates, attachments, etc., are provided and set in place in a timely manner. They will lay out partitions and assist Subcontractors in establishing the actual location of the fixtures, pipes, outlets, duct conduit, etc., so as to limit the interference of one trade with another. Locations shown on the drawings are approximate. If interference problems are encountered which cannot be resolved on the site, advise the Engineer/Architect before proceeding with the Work. Conceal all mechanical and electrical work unless otherwise indicated.

4.10.0 TRAFFIC MAINTENANCE

4.10.1 Do not close or obstruct streets, sidewalks, driveways, etc., without permission from authorities having jurisdiction. Do not place or store materials in street, sidewalks, parking areas, etc., unless so authorized.

4.11.0 FIRE PROTECTION

4.11.1 The Contractor's fire protection measures shall include:

a) An adequate fire alarm signal, the use of fire-resistant tarpaulins, the daily inspection of temporary heating system by competent staff and regular fire patrol;

b) All temporary wiring shall be done by electricians qualified under the applicable local regulations;

c) Supply and maintenance of fifteen (15) pounds dry chemicals and/or five (5) gallons soda-acid fire extinguishers in such locations that no working crew has to travel more than fifty (50) feet to an extinguisher station. In any case, there shall be not less than one (1) fully charged extinguisher(s) at the job at any time.

4.12.0 JOB MEETINGS

4.12.1 Where the value of the contract exceeds $100,000 (HST excluded) job meetings

shall occur at definitely prescribed times (minimum twice a month), which will be determined after commencement of work, the Contractor shall organize job meetings and send out notices stating time and place to the Owner's representative, the Engineer/Architect, Subconsultants, to all Subcontractors and to other persons whose presences are required at the meetings. They shall take note of all persons attending these meetings and shall, within one (1) week after each job meeting, submit to the Owner, the Engineer/Architect, the Subconsultants and others present, minutes of the meeting which must show any major decisions made and any instructions or information required.

4.12.2 Where the value of the contract is less than $100,000 (HST excluded) job meetings shall occur at the discretion of the Owner's representative but shall not occur fewer than once per month.

4.13.0 AS-BUILT DRAWINGS

4.13.1 The Engineer/Architect will issue to the Contractor three (3) sets of prints of Issued for Construction drawings for the sole purpose of providing "as- built" drawings. The Contractor shall pass these to the relevant Subcontractor who shall keep two (2) sets in their office and one (1) set on the job. As changes occur, the Subcontractor shall make them on the field set. Upon completion of the project, the Subcontractor shall accurately transfer all changes to the two (2) office sets in red ink and pass them to the Engineer/Architect, through the Contractor, for approval. If they are not approved, the Subcontractor shall prepare new sets for resubmission (purchasing additional white prints for this purpose).

14.13.2 As-built drawings shall be digital and shall indicate any and all changes in the contract work.

14.13.3 Provide electronic as-builts in an acceptable file transfer method (external hard drive or file share)or, at the direction of the Owner, pdf format.

14.13.4 The Certificate of Total Performance will not be issued until such drawings have been received and approved.

4.14.0 COMPLETION TIME

4.14.1 The project shall be ready for the use and occupancy by the Owner within the time stated in the Contract Documents. Time is and continues to be of the essence.

4.14.2 Prior to the acceptance by the Owner of the Substantial Performance, the Contractor and the Owner shall agree on a list of deficiencies as prepared by the Engineer/Architect for prompt correction and/or completion.

4.15.0 CLOSE DOWN OF WORK

4.15.1 Should the Work be closed down for any cause, the Contractor shall assume all responsibility for its proper protection during such period. They must protect all foundation work and other work liable to be damaged.

4.16.0 BROKEN GLASS

4.16.1 The Contractor shall be held responsible for any damaged, broken or scratched glass and at completion shall replace all such glass at no additional cost to the Owner.

4.17.0 HOARDING

4.17.1 Before starting excavating, construct and thereafter the Contractor shall maintain all necessary hoarding required by Municipal or Provincial regulations or by other authorities having jurisdiction.

4.18.0 COMMISSIONING

4.18.1 The Contractor is responsible for commissioning the Work to ensure that the various parts are operating in a manner as intended by the Contract Documents. Even through individual components and/or parts of the Work may have been tested and approved prior to the substantial completion, the Contractor must coordinate a final commissioning of the complete Work, including at the place of the Work all their major Subcontractors and Suppliers. The final commissioning will be carried out by the appropriate trades working together in a complementary manner such that the successful operation of the whole Work is completed properly to the satisfaction of the Engineer/Architect. **The Substantial Performance Certificate will not be issued until the final commissioning of the Work has been successfully completed.**

4.19.0 FINAL CLEAN-UP

4.19.1 At the end of the job, thoroughly clean the building of all rubbish and surplus materials.

4.19.2 Make good all damaged areas in the building caused as a result of the Work of this Contract.

4.19.3 Do final cleaning, waxing and polishing of resilient flooring.

5.0 CAMPUS SAFETY AND HEALTH REGULATIONS

Maintaining a healthy and safe environment for all members of the campus community, as well as visitors, is a priority with the University. This involves a commitment from all sectors of the campus community and extends to outside agencies having occasion to come on campus to conduct business.

The following regulations will apply to all work undertaken by contractors and service personnel on any University property.

5.1.0 REGULATIONS, CODES AND STANDARDS

Contractors shall be familiar with and abide by provisions of various safety codes and standards applicable to the work performed and should refer to Article **23. PROTECTION OF WORK AND PROPERTY** in the **General Conditions**.

In particular, strict adherence shall be required to the Provincial Occupational Health and Safety Act and Regulations and the National Building Code of Canada, Part 8.

5.2.0 GENERAL SAFETY REGULATIONS

a) Contractors/service agencies shall ensure that members of the campus community are not endangered by any work or process in which they may be engaged. Work areas shall be adequately barricaded, and if dust or fumes are generated, suitable enclosures shall be installed to contain such emissions.

b) No material shall be stored in such a way as to obstruct walkways or represent a danger to pedestrian traffic.

c) Adequate protection shall be provided to prevent the possibility of materials falling from scaffolding or elevated areas. Areas where materials are being loaded or offloaded shall be barricaded or otherwise protected to prevent unauthorized entry. Where necessary, appropriate warning signs shall be posted.

d) The work areas must be kept reasonably clean and free from debris which could constitute a fire hazard. Care must be taken to ensure that the work process does not activate fire alarm detection devices. (Generation of dust and fumes can activate smoke detectors causing a false alarm).

e) Due consideration shall be given to fire safety in buildings. Flammable materials must be kept away from sources of ignition. No work involving the use of open flame devices must be undertaken around flammable solvents or gases.

f) Do not alter or disturb any materials believed to contain asbestos materials (unless this is a duly authorized part of the project). Should suspect materials be encountered, consult with University officials before proceeding.

g) Material Safety Data Sheets shall be procured for any hazardous product used on campus. Such sheets shall be made readily available for consultation as required under the Workplace Hazardous Materials Information System.

NOTE: The above regulations are not to be considered all-inclusive and are considered to be complementary to the safety requirements outlined in the agreement between the Owner and the Contractor/Service Agency. Certain conditions and circumstances may require adherence to additional safety regulations.

As a general requirement, contract/service personnel are expected to conduct all work on campus in a professional and safe manner and to give priority to the welfare of members of the campus community.

6.0 CONTRACTOR PERFORMANCE EVALUATION

6.1.0 The purpose of this process is to maintain an acceptable level of performance with external contractors carrying out work for the Department of Facilities Management.

6.2.0 A record of the performance of external contractors will be maintained to identify the following:

a) Those contractors who by virtue of satisfactory performance will continue to be eligible to submit bids for work at the University;

b) Those contractors whose performance is considered unsatisfactory and will be advised of the need to improve performance to remain eligible to submit bids for work at the University;

c) Those contractors whose record of unsatisfactory performance will render them ineligible to submit bids for work at the University.

6.3.0 Contractors' performance will be evaluated on a points rating system relative to quality of work performed, timeliness in completing work and management/administration of contracts/work and safety parameters.

7.0 SIGNATURE PAGE

Open Call for Bid for: Memorial University (the Owner) Open Call Number: _____

Project Name: _____ Project Number: _____

Contractor's Full Business Name:

_____

Contractor's Full Business Mailing Address:

_____

Phone Number: _____ Email: _____

Signature(s) **Title(s)**

Contractor:

_____ _____
Signature

_____ I have authority to bind the corporation.
Print Name

Witness:

_____
Signature

_____ _____
Print Name

Signed of Behalf of Memorial University (the Owner):

_____ _____
Signature

_____ I have authority to bind the corporation.
Print Name

Witness:

_____ _____
Signature

_____
Print Name

This Stipulated Price Contract is signed at St. John's, NL on this ____ day of _____, 20 ____.

Department of Facilities Management
Memorial University of Newfoundland
St. John's, Newfoundland

PROFESSIONAL ENGINEER — REGISTERED — NEWFOUNDLAND & LABRADOR
PEG Newfoundland and Labrador
TREVOR M. BLACKLER
SIGNATURE
April 2, 2026
DATE

REGISTERED PROFESSIONAL ENGINEER — PROVINCE OF NEWFOUNDLAND
PEG Newfoundland and Labrador
DAVE ENNIS
SIGNATURE
April 2, 2026
DATE

OCEAN SCIENCE CENTRE-AHU-2 REPLACEMENT

PROJECT SPECIFICATION

MUN FILE: OS-506-23

PROVINCE OF NEWFOUNDLAND
pegnl — PROFESSIONAL ENGINEERS AND GEOSCIENTISTS NEWFOUNDLAND & LABRADOR
PERMIT HOLDER
This Permit Allows
CORE ENGINEERING INC.
MIRC: 04896
To practice Professional Engineering in Newfoundland and Labrador.
Permit No. as issued by PEGNL D0209 which is valid for the year 2026.

PROVINCE OF NEWFOUNDLAND
pegnl — PROFESSIONAL ENGINEERS AND GEOSCIENTISTS NEWFOUNDLAND & LABRADOR
PERMIT HOLDER
This Permit Allows
CORE ENGINEERING INC.
MIRC: 03823
To practice Professional Engineering in Newfoundland and Labrador.
Permit No. as issued by PEGNL D0209 which is valid for the year 2026.

Issued for Tender
April 02, 2026

Prepared by:

CORE ENGINEERING INC.
A MEMBER OF BPA

DIVISION 1 - GENERAL REQUIREMENTS

DIVISION 2 - EXISTING CONDITIONS

DIVISION 23 - HEATING, VENTILATION AND AIR CONDITIONING (HVAC)

DIVISION 28 - ELECTRONIC SAFETY AND SECURITY

END OF SECTION

Mechanical

M-1.1 Partial Ground Floor Plan - Ventilation Demolition Layout
M-2.1 Partial Ground Floor Plan - New Ventilation Layout
M-2.2 New Ahu 3d Views
M-2.3 Ahu Details
M-3.1 Partial Basement and Ground Floor Plans - Piping Demolition Layout
M-3.2 Partial Basement and Ground Floor Plans - New Piping Layout
M-4.1 Partial Ground Floor Plan - Controls Layout
M-5.1 Demolition and New Piping Flow Schematic
M-6.1 Mechanical Details
M-7.1 Control Schematics
M-8.1 Mechanical Legend and Schedules

Electrical

E1.1 Level 1 and 2 - Electrical Layout Demolition and New
E2.1 Electrical Details
E3.1 Electrical Controls

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

1. Types of items described in this Section:

2. Types of items described in this Section:
    1. Work Covered By the Contract Documents.
    2. Type of Contract.
    3. Work Phases.
    4. Work Under Other Contracts.
    5. Products Ordered In Advance.
    6. Owner-Furnished Products.
    7. Use of Premises.
    8. Owner's Occupancy Requirements.
    9. Work Restrictions.
    10. Interpretation Of Documents
    11. Specification Formats and Conventions.
    12. Project Management and Coordination.
    13. Construction Progress Documentation.
    14. Photographic Documentation.
    15. Substitution Procedures.
    16. Submittal Procedures.
    17. Environmental Procedures.
    18. Wildlife Protection.
    19. Quality Requirements.
    20. Regulatory Requirements.
    21. Temporary Facilities and Control.
    22. Temporary Barriers and Enclosures.
    23. Product Requirements.
    24. Execution.
    25. Construction Waste Management And Disposal.
    26. Closeout Procedures.
    27. List of Incomplete Items (Punch List)
    28. Operation and Maintenance Data.
    29. Project Record Documents.
    30. Demonstration and Training.

3. Types of items you will not find described in this Section:
    1. Health and Safety Requirements

1.3 WORK COVERED BY CONTRACT DOCUMENTS

1. Project Identification: OS-506-23 Ocean Sciences Centre AHU-2 Replacement
    1. Project Location: Main Campus, Memorial University, St. John’s, NL.

2. Owner: Memorial University of Newfoundland

1. Owner's Representative: Department of Facilities Management, Tel. 709-864-4331

3. The Work consists of the following:

.1 The Work includes Work of this Contract comprises general construction renovation and replacement of a built up AHU and supporting systems hot water space heating systems located at the Ocean Science Center in logy bay and further identified as OS-506-23 Ocean Sciences Centre AHU-2 Replacement

.2 All work associated with demolition, asbestos abatement, lead paint, hording and maintaining clear passageways for the Owner.

.3 Demolition and installation of new AHU and all services shall take place during June 15 to September 15 2016 during the heating shutdown. The new system is to be operational and tested by September 15th.

.4 Overtime and weekend work will be required.

.5 Coordination will be required between the successful bidder and the Owner. The work will involve shutting down critical infrastructure that provide heat and ventilation to the entire building and the contractor may have to perform these shutdowns on weekends, in the middle of the night or during atypical hours in order to accommodate continuation of services of the building. Multiple shutdowns may be required to complete the work. Meeting the project schedule may require overtime, double shift, multiple shifts, after hours and weekend work; which is to be included in the contract price. The contractor will be expected to work as necessary to complete the work in accordance with the above requirements.

.6 No unplanned disruption to owner operations or services will be acceptable as this can negatively impact campus operation.

.7 Asbestos and lead is present The contractor is to familiarize themselves with the facility asbestos plan and other hazardous material information contained in the appendix identified areas. Refer to asbestos abatement specification and Asbestos Management Plan.

.1 Additionally, all painted surfaces including AHU are to be assumed to be lead based paint. Demolition of these items are to follow the lead abetment procedures. AHU insulation shall be assumed to be asbestos, contractor to verify.

.8 Work covered by the contract documents includes Commissioning of the facility as per Section 01 91 13 – Commissioning (Cx) Requirements including engagement of third party structural engineer for verification of equipment structural support.

.9 Refer below to further detail within the technical description of work.

1.4 TYPE OF CONTRACT

1. Project will be constructed under a single prime contract.

1.5 WORK PHASES

1. The Work shall be conducted in a single phase.

.10 Technical description of work

.1 This work generally consists of demolition and renovations to replace the main AHU serving the Ocean Science Center. This system is a dual deck system and will be replaced with the same.

.2 The AHU is the source of heating for the facility. The replacement AHU will have to be installed when the outdoor air temperature (OAT) is about 20°C, between the months of June 15 and September 15.

.3 The AHU and other necessary materials will have to be procured prior to the start of demolition of the AHU to minimize downtime.

.4 The mechanical space in which the existing AHU is located and the new will be installed is very congested and access paths are narrow. The existing AHU will have to be dismantled and removed piece by piece. The new AHU will have to be assembled/fabricated piece by piece. The size of pieces will be limited by the pathways to bring materials into the space.

.5 Hazardous materials such as lead paint and asbestos are present. Refer to specification and drawings for further requirements.

.6 The work requires removal and replacement of existing piping and other items in the path of the new piping.

.7 The work will require portions ceiling services including lighting to be removed and reinstated to accommodate the work.

.8 The Contractor shall start coordination planning and coordination shutdowns with MUN immediately after notification of award. The contractor shall submit a shutdown plan that is documented for all to review.

.9 All work and shutdowns are to be scheduled on a Gantt chart and coordinated well in advance with MUN and updated monthly and when requested. All safety requirements are to be met and documented, and all welding procedures are to be submitted to Service NL well in advance to meet the schedules.

.10 Service NL inspections and all testing shall be coordinated by the contractor.

.11 The contractor shall undertake any and all preparatory work including relocation of pipe, conduit, welding exhaust ducting etc in advance to make the installation to go smoothly. The contractor is encouraged to visit and examine the area prior to bidding.

1.6 WORK UNDER OTHER CONTRACTS

1. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract. Coordinate the Work of this Contract with work performed under separate contracts.

2. Preceding Work: Owner has awarded / will award separate contract(s) for the following construction operations at Project site. Those operations are scheduled to be substantially complete before work under this Contract begins.
   1. No proceeding work planned.

3. Concurrent Work: Owner has awarded / will award separate contract(s) for the following construction operations at Project site. Those operations will be conducted simultaneously with work under this Contract.
   1. No concurrent work planned.

1.7 PRODUCTS ORDERED IN ADVANCE

1. General: Owner has negotiated Purchase Orders with suppliers of material and equipment to be incorporated into the Work. Owner will assign these Purchase Orders to Contractor. Costs for receiving, handling, storage if required, and installation of material and equipment are included in the Contract Sum.
   1. Contractor's responsibilities are same as if Contractor had negotiated Purchase Orders, including responsibility to renegotiate purchase and to execute final Purchase-Order agreements.

2. List of Products Ordered in Advance:

1. None.

1.8 OWNER-FURNISHED PRODUCTS

1. Owner will furnish products indicated. The Work includes providing support systems to receive Owner's equipment and making plumbing, mechanical, and electrical connections.
    1. Owner will arrange for and deliver Shop Drawings, Product Data, and Samples to Contractor.
    2. Owner will arrange and pay for delivery of Owner-furnished items according to Contractor's Construction Schedule.
    3. After delivery, Owner will inspect delivered items for damage. Contractor shall be present for and assist in Owner's inspection.
    4. If Owner-furnished items are damaged, defective, or missing, Owner will arrange for replacement.
    5. Owner will arrange for manufacturer's field services and for delivery of manufacturer's warranties to Contractor.
    6. Owner will furnish Contractor the earliest possible delivery date for Owner-furnished products. Using Owner-furnished earliest possible delivery dates, Contractor shall designate delivery dates of Owner-furnished items in Contractor's Construction Schedule.
    7. Contractor shall review Shop Drawings, Product Data, and Samples and return them to Owner's Representative noting discrepancies or anticipated problems in use of product.
    8. Contractor is responsible for receiving, unloading, and handling Owner-furnished items at Project site.
    9. Contractor is responsible for protecting Owner-furnished items from damage during storage and handling, including damage from exposure to the elements.
    10. If Owner-furnished items are damaged as a result of Contractor's operations, Contractor shall repair or replace them.
    11. Contractor shall install and otherwise incorporate Owner-furnished items into the Work.

2. Owner-Furnished Products:
    1. No Owner-furnished products.

1.9 USE OF PREMISES

1. General: Contractor shall have full use of premises for construction operations, including use of Project site, during construction period. Contractor's use of premises is limited only by Owner's right to perform work or to retain other contractors on portions of Project.

2. General: Contractor shall have limited use of premises for construction operations as indicated on Drawings by the Contract limits.

3. Use of Site: Limit use of premises to areas under construction. Do not disturb portions of Project site beyond areas in which the Work is indicated.
    1. Owner Occupancy: Allow for Owner occupancy of Project site and use by the public.
    2. Driveways and Entrances: Keep driveways parking garage, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
        a. Schedule deliveries to minimize use of driveways and entrances.
        b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

4. Use of Existing Building: If the work involves construction in an existing building, maintain the existing building in a weather tight condition throughout construction period. Repair damage caused by construction operations. Protect building and its occupants during construction period.

1.10 OWNER'S OCCUPANCY REQUIREMENTS

1. Full Owner Occupancy: Owner will occupy site and existing building during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits, unless otherwise indicated.
    1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
    2. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.

1.11 WORK RESTRICTIONS

1. On-Site Work Hours: Work shall be generally performed inside the existing building during normal business working hours, Monday through Friday, except otherwise indicated.
    1. Weekend Hours: **Contractor to notify Owner's representative 48hrs prior to scheduling.**
    2. Early Morning Hours: **Contractor to notify Owner's representative 48hrs prior to scheduling.**
    3. Hours for Utility Shutdowns: **Dependant on Scope of shutdown. Contractor to notify Owner's representative 2 weeks prior to scheduling.**
    4. Hours for Core Drilling and other noise generating activities: **To be scheduled after regular work hours. Contractor to notify Owner's representative 48hrs prior to scheduling.**

2. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
    1. Notify Owner's Representative not less than two days in advance of proposed utility interruptions.
    2. Do not proceed with utility interruptions without Owner's Representative's written permission.

3. No smoking is permitted on MUN Campus.

1.12 INTERPRETATION OF DOCUMENTS

1. In the event of discrepancies or conflicts in interpreting the Plans (drawings) and Specifications,
    1. Supplementary General Conditions take precedence over all other documents.
    2. General Conditions take precedence over drawings and specifications.
    3. Division 1 Sections take precedence over technical specification sections in other Divisions;
    4. Legends and schedules take precedence over drawings and Specifications, whether they are bound with the specifications or integral with the drawings;
    5. Specifications take precedence over all other drawings;

2. Plans (drawings) and Specifications are complementary. When work is shown or mentioned on the drawings but is not indicated in the Specifications, or when work is indicated in the Specifications but is not shown or mentioned on the Drawings, it shall nevertheless be included in the Contract.

1.13 SPECIFICATION FORMATS AND CONVENTIONS

1. Specification Format: The Specifications are organized into Divisions and Sections using the 50-division format and CSI/CSC's *MasterFormat* numbering system.
    1. Section Identification: The Specifications use Section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete because all available Section numbers are not used. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of Sections in the Contract Documents.
    2. Division 01: Sections in Division 01 govern the execution of the Work of all Sections in the Specifications.

2. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
    1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
    2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.

3. The words *shall*, *shall be*, or *shall comply with*, depending on the context, are implied where a colon (:) is used within a sentence or phrase.

1.14 PROJECT MANAGEMENT AND COORDINATION

1. Coordination
    1. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.

2. Administrative and supervisory personnel
    1. General: In addition to Project superintendent, provide other administrative and supervisory personnel as required for proper performance of the Work.
    2. Maintain same superintendent on Project for duration of Project. Immediately notify Owner`s Representative if superintendent should become unavailable to work and immediately replace with an alternate person acceptable to the Owner`s Representative.

3. Project meetings
    1. General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.
    2. Minutes: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Owner`s Representative, within three days of the meeting.
    3. Progress Meetings: Conduct progress meetings at monthly intervals. Coordinate dates of meetings with preparation of payment requests.

1.15 Requests For Interpretation (RFIs)
1. Procedure: Immediately on discovery of the need for interpretation of the Contract Documents, and if not possible to request interpretation at Project meeting, prepare and submit an RFI in the form specified.
    a. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
2. Allow seven working days for Owner`s Representative's response for each RFI.
3. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Owner`s Representative in writing within 10 days of receipt of the RFI response.

1.16 CONSTRUCTION PROGRESS DOCUMENTATION

1. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal Gantt-chart-type, Contractor's Construction Schedule within 30 days of date established for the Notice of Award.
    1. Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.
    2. At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.

2. Reports
    1. Daily Construction Reports: Prepare a daily construction report and submit to Owner`s Representative each week recording the following information concerning events at Project site:
        a. List of subcontractors at Project site.
        b. List of separate contractors at Project site.
        c. Approximate count of personnel at Project site.
        d. Equipment at Project site.
        e. Material deliveries.
        f. High and low temperatures and general weather conditions.
        g. Accidents.
        h. Meetings and significant decisions.
        i. Unusual events.
        j. Stoppages, delays, shortages, and losses.
        k. Meter readings and similar recordings.
        l. Emergency procedures.
        m. Orders and requests of authorities having jurisdiction.
        n. Change Orders received and implemented.
        o. Construction Change Directives received and implemented.
        p. Services connected and disconnected.
        q. Equipment or system tests and start-ups.
        r. Partial Completions and occupancies.
        s. Substantial Completions authorized.
    2. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare and submit a detailed report. Submit with a request for interpretation. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

1.17 PHOTOGRAPHIC DOCUMENTATION

1. Preconstruction Photographs: Before starting construction take, digital photographs of Project site and surrounding areas, including existing items to remain during construction, from different vantage points.

2. Periodic Construction Photographs: Take digital photographs weekly, with timing each month adjusted to coincide with the cut-off date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.

3. Submit photos to Owner`s representative on monthly basis to coincide with the each Application for Payment. Submission shall be electronic and specific method shall be coordinated at kickoff or first opportunity there after.

1.18 SUBSTITUTION PROCEDURES

1. Substitution Requests: Submit PDF copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
    1. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
        a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
        b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
        c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable specification section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics,

warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.

d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
e. Samples, where applicable or requested.
f. Certificates and qualification data, where applicable or requested.
g. List of similar installations for completed projects with project names and addresses and names and addresses of Owner's Representatives and owners.
h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
i. Research reports evidencing compliance with building code in effect for Project.
j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
k. Cost information, including a proposal of change, if any, in the Contract Sum.
l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

2. Owner's Representative's Action: If necessary, Owner's Representative will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Owner's Representative will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
   a. Forms of Acceptance: Change Order, Construction Change Directive, or Owner's Representative's Supplemental Instructions for minor changes in the Work.
   b. Use product specified if Owner's Representative does not issue a decision on use of a proposed substitution within time allocated.

2. Substitutions for Cause: Submit requests for substitution immediately upon discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.
   1. Conditions: Owner's Representative will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Owner's Representative will return requests without action, except to record noncompliance with these requirements:
      a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
      b. Substitution request is fully documented and properly submitted.
      c. Requested substitution will not adversely affect Contractor's construction schedule.
      d. Requested substitution has received necessary approvals of authorities having jurisdiction.
      e. Requested substitution is compatible with other portions of the Work.
      f. Requested substitution has been coordinated with other portions of the Work.
      g. Requested substitution provides specified warranty.
      h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

3. Substitutions for Convenience: Owner's Representative will consider requests for substitution if received within 60 days after the Notice of Award. Requests received after that time may be considered or rejected at discretion of Owner's Representative.

1. Conditions: Owner's Representative will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Owner's Representative will return requests without action, except to record noncompliance with these requirements:
    a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume.
    b. Requested substitution does not require extensive revisions to the Contract Documents.
    c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
    d. Substitution request is fully documented and properly submitted.
    e. Requested substitution will not adversely affect Contractor's construction schedule.
    f. Requested substitution has received necessary approvals of authorities having jurisdiction.
    g. Requested substitution is compatible with other portions of the Work.
    h. Requested substitution has been coordinated with other portions of the Work.
    i. Requested substitution provides specified warranty.

1.19 SUBMITTAL PROCEDURES

1. Contractor's Review
    1. Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Owner`s Representative.

2. Preferred Size for Paper Submittals
    1. Provide electronic submittals on sheets no less than 8 ½ x 11” Whenever practical, provide electronic submittals on sheet size not greater than 11 x 17”. In all cases ease of readability of submittal content by Engineer shall take precedent over providing information on preferred sheet size.

3. Submittal Procedures
    1. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
        a. Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.
    2. Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Owner`s Representative's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
        a. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Owner`s Representative will advise Contractor when a submittal being processed must be delayed for coordination.
        b. Resubmittal Review: Allow 15 days for review of each resubmittal.
        c. Sequential Review: Where sequential review of submittals by Owner`s Representative's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.
    3. Owner`s Representative will review each submittal, make marks to indicate corrections or modifications required, and return it. Owner`s Representative will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action, as follows:
        a. REVIEWED – NO COMMENTS
        b. REVIEWED WITH COMMENTS. REVISE & RESUBMIT PRIOR TO START OF WROK.
        c. REVIEVED WITH COMMENTS. PROCEED WITH WORK SUBJECT TO IMPLEMENTATION OF NOTED COMMENTS, REVISE AND RESUBMIT.
        d. NOT ACCEPTED.

1.20 ENVIRONMENTAL PROCEDURES

1. Definitions
    1. 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 the environment or adversely affect health of persons, animals, or plant life when released into the environment.

2. Fires and burning of rubbish on site not permitted.

3. Store, handle, and dispose of hazardous materials in accordance with applicable federal and provincial laws, regulations, codes and guidelines. Store in location that will prevent spillage into the environment

4. Provide temporary drainage and pumping as necessary to keep excavations and site free from water.
    1. Do not pump water containing suspended materials into waterways, sewer or drainage systems.

1.21 QUALITY REQUIREMENTS

1. Conflicting Requirements
    1. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Owner`s Representative for a decision before proceeding.
    2. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Owner`s Representative for a decision before proceeding.

2. Quality Control
    1. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
        a. Payment for these services will be made by the Owner.
        b. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.
    2. Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
        a. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
        b. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
        c. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.

1.22 REGULATORY REQUIREMENTS

1. Perform Work in accordance with National Building Code of Canada (NBC) including all amendments up to tender closing date and other codes of provincial or local application provided that in case of conflict or discrepancy, more stringent requirements apply.

2. Meet or exceed requirements of:
    1. Contract documents.

2. Specified standards, codes, and referenced documents.

1.23 TEMPORARY FACILITIES AND CONTROLS

1. Temporary Utility Installation
   1. General: Install temporary service or connect to existing service.
      a. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
   2. Sanitary Facilities: If the Owner has existing toilet facilities these may be used as long as these facilities are kept cleaned and maintained in a condition acceptable to the Owner. Otherwise provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
   3. Water Service: If the Owner has existing water service it may be used as long as it does not impact on the Owner`s need. Otherwise install water service and distribution piping in sizes and pressures adequate for construction.
   4. Sewers and Drainage: Provide temporary utilities as required to remove effluent lawfully.
   5. Heating: Provide temporary heating as required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
   6. Ventilation and Humidity Control: Provide temporary ventilation as required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
   7. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
      a. Install electric power service overhead, unless otherwise indicated.
      b. If the Owner has an existing power source, the contractor may access it for temporary power provided it does not impact the Owner`s needs.
   8. Lighting: Provide temporary lighting with local switching as required to provide adequate illumination for construction operations, observations, inspections, and traffic conditions.
   9. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
   10. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weather tight enclosure for building exterior.

2. Operation, Termination, and Removal
   1. Maintain facilities in good operating condition until removal.
   2. Remove each temporary facility when need for its service has ended.

1.24 TEMPORARY BARRIERS AND ENCLOSURES

1. Hoarding
   1. For work involving the excavation for new foundations or the erection of new structures outside of an enclosure, provide hoarding.

2. Weather Enclosures
   1. Provide weather tight closures to unfinished door and window openings, tops of shafts and other openings in floors and roofs.

3. 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.

4. Protection Of Building Finishes
   1. Provide protection for finished and partially finished building finishes and equipment during performance of work.
   2. Provide necessary screens, covers, and hoardings.
   3. Be responsible for damage incurred due to lack of or improper protection.

1.25 PRODUCT REQUIREMENTS

1. 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 Owner`s Representative in writing, of conflicts between specifications and manufacturer's instructions, so that Owner`s Representative may establish course of action.

2. Quality
   1. Products, materials, equipment and articles (referred to as products throughout specifications) incorporated in Work shall be new, not damaged or defective, and of best quality (compatible with specifications) for purpose intended. If requested, furnish evidence as to type, source, and quality of products provided.
   2. Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.
   3. Should any dispute arise as to quality or fitness of products, decision rests strictly with Owner`s Representative based upon requirements of Contract Documents.
   4. Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.

3. Product Warranties
   1. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

4. Product Selection Procedures
   1. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, that are new at time of installation.

1.26 EXECUTION

1. Materials
   1. Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
   2. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to the Owner`s Representative for the visual and functional performance of in-place materials.

2. Installation
   1. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
      a. Make vertical work plumb and make horizontal work level.

b. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
c. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
d. Maintain minimum headroom clearance of 2440 mm in occupied spaces and in unoccupied spaces.

2. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
3. Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
   a. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Owner`s Representative.

3. Cutting And Patching
   1. Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
      a. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
   2. Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

4. Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.

5. Progress Cleaning
   1. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
   2. Site: Maintain Project site free of waste materials and debris.

6. Correction Of The Work
   1. Repair or remove and replace defective construction. Restore damaged substrates and finishes.
   2. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
   3. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

7. Protection Of Installed Construction
   1. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
   2. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1.27 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

1. Waste Reduction
   1. Reduce construction waste during installation work. Undertake practices which will minimize waste and optimize full use of new materials on site, such as:
      a. Use of a central cutting area to allow for easy access to off-cuts;
      b. Use of off-cuts for blocking and bridging elsewhere.
      c. Use of effective and strategically placed facilities on site for storage and staging of left-over or partially cut materials (such as gypsum board, plywood, ceiling tiles, insulation etc...) to allow for easy incorporation into

2. Material Source Separation Process
    1. Perform demolition and removal of existing building components and equipment following a systematic deconstruction process.
    2. Separate materials and equipment at source, carefully dismantling, labelling and stockpiling alike items for the following purposes:
        a. Reinstallation into the work where indicated.
        b. Salvaging reusable items not needed in project which Contractor may sell to other parties. Sale of such items not permitted on site.
        c. Sending as many items as possible to locally available recycling facility.
        d. Segregating remaining waste and debris into various individual waste categories for disposal in a *non-mixed state* as recommended by waste processing/landfill sites.

3. Disposal Requirements
    1. Dispose of waste only at approved waste processing facility or landfill sites approved by authority having jurisdiction.

1.28 CLOSEOUT PROCEDURES

1. Substantial Completion
    1. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.
        a. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
        b. Advise Owner of pending insurance changeover requirements.
        c. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
        d. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
        e. Prepare and submit Project Record Documents, operation and maintenance manuals, Final Completion construction photographs, damage or settlement surveys, property surveys, and similar final record information.
        f. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
        g. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
        h. Complete start-up testing of systems.
        i. Submit test/adjust/balance records.
        j. Terminate and remove temporary facilities from Project site, along with mock-ups, construction tools, and similar elements.
        k. Advise Owner of changeover in heat and other utilities.
        l. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
        m. Complete final cleaning requirements, including touch-up painting.
        n. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
    2. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Owner`s Representative will either proceed with inspection or notify Contractor of unfulfilled requirements. Owner`s Representative will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Owner`s Representative, that must be completed or corrected before certificate will be issued.
    3. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

2. Final Completion

1. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:
    a. Submit a final Application for Payment according to the General Conditions.
    b. Submit certified copy of Owner`s Representative's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Owner`s Representative. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
    c. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
    d. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
2. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Owner`s Representative will either proceed with inspection or notify Contractor of unfulfilled requirements. Owner`s Representative will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
    a. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

3. Final Cleaning
    1. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
    2. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1.29 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

1. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
    1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
    2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
    3. Include the following information at the top of each page:
        a. Project name.
        b. Date.
        c. Name of Owner's Representative.
        d. Name of Contractor.
        e. Page number.
    4. Submit list of incomplete items in the following format:
        a. Three paper copies of product schedule or list, unless otherwise indicated.

1.30 WARRANTIES

1. Submittal Time: Submit written warranties on request of Owner's Representative for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.

2. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
    1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 215-by-280-mm paper.
    2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.

3. Identify each binder on the front and spine with the typed or printed title *WARRANTIES*, Project name, and name of Contractor.

3. Provide additional copies of each warranty to include in operation and maintenance manuals.

1.31 OPERATION AND MAINTENANCE DATA

1. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

2. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

3. Manual Contents: Operations and maintenance manual content is specified in individual specification sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
   1. Where applicable, clarify and update reviewed manual content to correspond to modifications and field conditions.

4. Format: Submit operations and maintenance manuals in the following format:
   1. PDF electronic file. Assemble each manual into a composite electronically-indexed file. Submit on digital media acceptable to Owner's Representative.
      a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically-linked operation and maintenance directory.
      b. Enable inserted reviewer comments on draft submittals.

1.32 PROJECT RECORD DOCUMENTS

1. Record Drawings
   1. Maintain one set of blue- or black-line white prints of the Contract Drawings and Shop Drawings.
   2. Mark Record Prints to show the actual installation where installation varies from that shown originally.
   3. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
      a. Accurately record information in an understandable drawing technique.
      b. Record data as soon as possible after obtaining it. Record and check the mark-up before enclosing concealed installations.
   4. Content: Types of items requiring marking include, but are not limited to, the following:
      a. Dimensional changes to Drawings.
      b. Revisions to details shown on Drawings.
      c. Depths of foundations below first floor.
      d. Locations and depths of underground utilities.
      e. Revisions to routing of piping and conduits.
      f. Revisions to electrical circuitry.
      g. Actual equipment locations.
      h. Duct size and routing.
      i. Locations of concealed internal utilities.
      j. Changes made by Change Order or Change Directive.
      k. Changes made following Owner`s Representative's written orders.
      l. Details not on the original Contract Drawings.
      m. Field records for variable and concealed conditions.
      n. Record information on the Work that is shown only schematically.

5. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.
6. Mark record sets with erasable, red-coloured pencil. Use other colours to distinguish between changes for different categories of the Work at same location.
7. Mark important additional information that was either shown schematically or omitted from original Drawings.
8. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
9. Submit record drawings to Owner`s Representative prior to requesting Substantial Completion inspection.

1.33 DEMOSTRATION AND TRAINING

1. Demonstrate start-up, operation, control, adjustment, troubleshooting, servicing, and maintenance of each item of maintenance of each item of equipment.

2. Instruct personnel in all phases of operation and maintenance using operation and maintenance manuals as the basis of instruction.

3. Review contents of manual in detail to explain all aspects of operation and maintenance.

4. Prepare and insert additional data in operations and maintenance manuals when the need for additional data becomes apparent during instructions.

5. The GC shall be responsible for training coordination and scheduling and ultimately for ensuring that training is completed.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

.1 Connecting to existing services.

.2 Special scheduling requirements.

1.2 RELATED SECTIONS

.1 Section 01 35 30 – Infection Control

.2 Section 01 32 00 – Construct Progress Documentation.

.3 Section 01 56 00 - Temporary Barriers and Enclosures.

.4 Owner's Policies as referenced herein.

1.3 EXISTING SERVICES

.1 Notify Owner's Representative and utility companies of intended interruption of services and obtain required permission.

.2 Where Work involves breaking into or connecting to existing services, give Owner's Representative a notice of three (3) working days for necessary interruption of mechanical or electrical service throughout course of work. Keep duration of interruptions minimum. Carry out interruptions after normal working hours of occupants, preferably on weekends.

.3 Provide for pedestrian and vehicular traffic.

1.4 SCHEDULE OF WORK

.1 Schedule all demolition, cutting and altering existing work, drilling and power activated hammering outside of normal operating office and health care service hours of 8:30 a.m. to 5:00 p.m. daily, Monday through Friday.

.2 Schedule all work in co-ordination with Hospital staff.

.3 Prepare work schedules and submit to the Owner for approval.

.4 Should the contractor not be able to complete the shutdown work in 2026 summer months, the contractor shall be responsible for preservation and storage of all equipment, ensuring the heating system is operational and all additional costs to complete the work in summer 2027.

1.5 USE OF AND ACCESS TO SITE

.1 Contractor's use of site is generally restricted as follows:

.1 Storage of materials, set up of Contractor owned or leased plant, equipment, trailers, vehicles and the like is to be confined to sites and locations as designated by the Owner within the property boundaries of the facility.

.2 All employees of the Prime Contractor and those of his Sub-contractors and suppliers are to enter and exit the site using the shortest distance route available. In all cases, the Contractor is to carry out all work in accordance with Section 01 35 00 – Infection Control.

.3 Parking for vehicles owned or leased by the Contractor's employees and his subcontractor's employees is to be designated by the Owner and limited to the number of parking spaces which the Owner sets from time to time.

.4 Execute work with least possible interference or disturbance to normal use of premises. Make arrangements with Infrastructure Support Representative to facilitate work as stated.

.5 Maintain existing services to building and provide for personnel and vehicle access.

.6 Infrastructure Support Representative will assign sanitary facilities for use by Contractor's personnel. Keep facilities clean at all times.

.7 Use only existing elevators designated by Infrastructure Support for moving workers and material, where applicable.

.8 Protect walls of passenger elevators, to approval of Infrastructure Support Site Representative prior to use.

.9 Accept liability for any damages, safety of equipment and overloading of existing equipment.

.2 The Contractor is to maintain security and separation barriers around the work areas.

.3 The Contractor is to ensure that all barriers are in compliance with Occupational Health and Safety Acts and Regulations, Infection Control, Owner Policies and Security requirements specified in other sections of the Contract Documents.

1.6 SPECIAL REQUIREMENTS

.1 Ensure that Contractor personnel employed on site become familiar with and obey regulations including safety, fire, traffic, no smoking and security regulations.

.2 Keep within limits of work and avenues of ingress and egress as specified and as approved by the Infrastructure Support Representative.

.3 Ingress and egress of Contractor vehicles at site is limited to areas as designated by the Infrastructure Support Site Representative.

.4 Tie ins and shutdowns on High temperature Hot Water shall be coordinated with HSC Eastern Health Staff and MUN Annex Staff. Shutdowns shall be planned well in advance and shall coincide

with Annex planned shutdowns. The contractor should not plan on being able to have a shutdown specifically for this work and must plan around Annex planned shutdowns.

.5 Tie ins and shutdowns on Heating water systems shall be coordinated with HSC Eastern Health Staff. Shutdowns shall be coordinated to ensure that systems relying on hot water for heating and tempering/reheating are accommodated and that owner operations can continue uninterrupted.

1.7 SECURITY CLEARANCES & SITE ACCESS

.1 Personnel employed on this project may be subjected to security checks. Obtain clearance, as instructed, for each individual who will be required to enter a Eastern Health Facility

.2 Contractor is to contact the Infrastructure Site Supervisor and complete the Site Access Form(s). Contractor and Contractor's employees are required to wear at all times while working on or within Eastern Health facilities, a Contractor's I.D. card. These cards have to be signed out each day at the beginning of the contractor's work day and return to the Infrastructure Support Site Supervisor at the end of the work day.

.3 Contractor's I.D. card is to be worn at all times. Contractor and/or contractor's employees not wearing the Contractor's I.D. card will be asked to leave the Eastern Health premises.

.4 Lost of stolen I.D. cars are to be reported to the Infrastructure Site Supervisors and the cost of replacing the cards will be deducted from the Contractor's final payment for the project.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

.1 Types of items described in this Section:
  .1 Administrative and procedural requirements governing allowances.
    .1 Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when direction will be provided to the Contractor. If necessary, additional requirements will be issued by Change Order.
  .2 Types of allowances include the following:
    .1 Revise list below to suit Project.
    .2 Lump-sum allowances.
    .3 Unit-cost allowances.
    .4 Quantity allowances.
    .5 Contingency allowances.
    .6 Testing and inspecting allowances.

.2 Types of items you will not find described in this Section:
  .1 Procedures for using unit prices.
  .2 Procedures governing the use of allowances for testing and inspecting.
  .3 Divisions 02 through 49 Sections for items of Work covered by allowances.

1.3 SELECTION AND PURCHASE

.1 At the earliest practical date after award of the Contract, advise Owner's Representative of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.

.2 At Owner's Representative's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.

.3 Purchase products and systems selected by Owner's Representative from the designated supplier.

1.4 SUBMITTALS

.1 Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.

.2 Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.

.3 Submit time sheets and other documentation to show labour time and cost for installation of allowance items that include installation as part of the allowance.

.4 Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.5 COORDINATION

.1 Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

1.6 QUANTITY ALLOWANCES

.1 Allowance shall include cost to Contractor of specific products and materials selected by Owner's Representative under allowance and shall include freight, and delivery to Project site.

.2 Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labour, installation, overhead and profit, and similar costs related to products and materials selected by Owner's Representative under allowance shall be included as part of the Contract Sum and not part of the allowance.

.3 Unused Materials: Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.

.1 If requested by Owner's Representative, retain and prepare unused material for storage by Owner. Deliver unused material to Owner's storage space as directed.

1.7 CONTINGENCY ALLOWANCES

.1 Use the contingency allowance only as directed by Owner's Representative for Owner's purposes and only by Change Orders that indicate amounts to be charged to the allowance.

.2 Contractor's overhead, profit, and related costs for products and equipment ordered by Owner under the contingency allowance are included in the allowance and are not part of the Contract Sum. These costs include delivery, installation, insurance, equipment rental, and similar costs.

.3 Change Orders authorizing use of funds from the contingency allowance will include Contractor's related costs and reasonable overhead and profit margins.

.4 At Project closeout, credit unused amounts remaining in the contingency allowance to Owner by Change Order.

.5 The cash allowance shall not include HST.

1.8 TESTING AND INSPECTING ALLOWANCES

.1 Testing and inspecting allowances include the cost of engaging testing agencies, actual tests and inspections, and reporting results.

.2 The allowance does not include incidental labour required to assist the testing agency or costs for retesting if previous tests and inspections result in failure. The cost for incidental labour to assist the testing agency shall be included in the Contract Sum.

.3 At Project closeout, credit unused amounts remaining in the testing and inspecting allowance to Owner by Change Order.

1.9 ADJUSTMENT OF ALLOWANCES

.1 Allowance Adjustment: To adjust allowance amounts, prepare a Change Order proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.

.1 Include installation costs in purchase amount only where indicated as part of the allowance.

.2 If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other margins claimed.

.3 Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.

.2 Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or Contractor's handling, labour, installation, overhead, and profit.

.1 Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in the Contract Documents.

.2 No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

.1 Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 SCHEDULE OF ALLOWANCES

.1 Control Devices and Installation Allowance:

.1 Include a controls allowance of $35,000.00 for use according to Owner’s instructions for Items under division 25.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

.1 Types of items described in this Section:
  .1 Administrative and procedural requirements for substitutions.

.2 Types of items you will not find described in this Section:
  .1 Products selected under an allowance.
  .2 Requirements for submitting comparable product submittals for products by listed manufacturers.
  .3 Divisions 02 through 49 Sections for specific requirements and limitations for substitutions.

1.3 DEFINITIONS

.1 Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
  .1 Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
  .2 Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 SUBMITTALS

.1 Substitution Requests: Submit request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
  .1 Documentation: Show compliance with requirements for substitutions and the following, as applicable:
    .1 Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
    .2 Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
    .3 Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable specification section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
    .4 Product Data, including drawings and descriptions of products and fabrication and installation procedures.
    .5 Samples, where applicable or requested.
    .6 Certificates and qualification data, where applicable or requested.
    .7 List of similar installations for completed projects with project names and addresses and names and addresses of Owner's Representatives and owners.
    .8 Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
    .9 Research reports evidencing compliance with building code in effect for Project.
    .10 Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of

construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.

.11 Cost information, including a proposal of change, if any, in the Contract Sum.

.12 Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.

.13 Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

.2 Owner's Representative's Action: If necessary, Owner's Representative will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Owner's Representative will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

.1 Forms of Acceptance: Change Order, Construction Change Directive, or Owner's Representative's Supplemental Instructions for minor changes in the Work.

.2 Use product specified if Owner's Representative does not issue a decision on use of a proposed substitution within time allocated.

1.5 QUALITY ASSURANCE

.1 Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage qualified testing agency to perform compatibility tests recommended by manufacturers.

1.6 PROCEDURES

.1 Coordination: Modify or adjust affected work as necessary to integrate work of the approved substitutions.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

.1 Substitutions for Cause: Submit requests for substitution immediately upon discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.

.1 Conditions: Owner's Representative will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Owner's Representative will return requests without action, except to record noncompliance with these requirements:

.1 Requested substitution is consistent with the Contract Documents and will produce indicated results.

.2 Substitution request is fully documented and properly submitted.

.3 Requested substitution will not adversely affect Contractor's construction schedule.

.4 Requested substitution has received necessary approvals of authorities having jurisdiction.

.5 Requested substitution is compatible with other portions of the Work.

.6 Requested substitution has been coordinated with other portions of the Work.

.7 Requested substitution provides specified warranty.

.8 If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

.2 Substitutions for Convenience: Owner's Representative will consider requests for substitution if received within 60 days after the Notice of Award. Requests received after that time may be considered or rejected at discretion of Owner's Representative.

.1 Conditions: Owner's Representative will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Owner's Representative will return requests without action, except to record noncompliance with these requirements:

.1 Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Owner's Representative for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.

.2 Requested substitution does not require extensive revisions to the Contract Documents.

.3 Requested substitution is consistent with the Contract Documents and will produce indicated results.

.4 Substitution request is fully documented and properly submitted.

.5 Requested substitution will not adversely affect Contractor's construction schedule.

.6 Requested substitution has received necessary approvals of authorities having jurisdiction.

.7 Requested substitution is compatible with other portions of the Work.

.8 Requested substitution has been coordinated with other portions of the Work.

.9 Requested substitution provides specified warranty.

.10 If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 3 - EXECUTION (Not Used)

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

.1 Types of items described in this Section:
  .1 Administrative and procedural requirements for handling and processing Contract modifications.

.2 Types of items you will not find described in this Section:
  .1 Administrative procedures for handling requests for substitutions made after Contract award.

1.3 MINOR CHANGES IN THE WORK

.1 Owner's Representative will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time.

1.4 CONTENPLATED CHANGE ORDERS

.1 Owner-Initiated Contemplated Change Order: Owner's Representative will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
  .1 Proposal Requests issued by Owner's Representative are not instructions either to stop work in progress or to execute the proposed change.
  .2 Within time specified in Proposal Request or 7 days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
    .1 Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
    .2 Indicate applicable delivery charges, equipment rental, and amounts of trade discounts.
    .3 Include costs of labour and supervision directly attributable to the change.
    .4 Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
    .5 Quotation Form: Use forms acceptable to Owner's Representative.

.2 Contractor-Initiated Contemplated Change Order: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Owner's Representative.
  .1 Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
  .2 Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
  .3 Indicate applicable delivery charges, equipment rental, and amounts of trade discounts.
  .4 Include costs of labour and supervision directly attributable to the change.
  .5 Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
  .6 Comply with requirements in Division 01 Section *Substitution Procedures* if the proposed change requires substitution of one product or system for product or system specified.

.7 Proposal Request Form: Use form acceptable to Owner's Representative.

1.5 ADMINISTRATIVE CHANGE ORDERS

.1 Allowance Adjustment: Refer to Division 01 Section *Allowances* for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect actual costs of allowances.

.2 Unit Price Adjustment: Refer to Division 01 Section *Unit Prices* for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect measured scope of unit price work.

1.6 CHANGE ORDER PROCEDURES

.1 On Owner's approval of a Proposal Request, Owner's Representative will issue a Change Order for signatures of Owner and Contractor.

1.7 CONSTRUCTION CHANGE DIRECTIVE

.1 Construction Change Directive: Owner's Representative may issue a Construction Change Directive as may be permitted in the Contract. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
.1 Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

.2 Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
.1 After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

.1 Types of items described in this Section:
  .1 Administrative and procedural requirements necessary to prepare and process Applications for Payment.

.2 Types of items you will not find described in this Section:
  .1 Procedural requirements governing the handling and processing of allowances.
  .2 Administrative procedures for handling changes to the contract.
  .3 Administrative requirements governing the preparation and submittal of the contractor's construction schedule.
  .4 Administrative requirements governing the preparation and submittal of the submittal schedule.
  .5 Administrative requirements governing submittal of cost breakdown information required for leed documentation.

1.3 DEFINITIONS

.1 Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.4 SCHEDULE OF VALUES

.1 Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.
  .1 Correlate line items in the schedule of values with other required administrative forms and schedules, including the following:
    .1 Application for Payment forms with continuation sheets.
    .2 Submittal schedule.
    .3 Items required to be indicated as separate activities in Contractor's construction schedule.
  .2 Submit the schedule of values to Owner's Representative at earliest possible date but no later than seven days before the date scheduled for submittal of initial Applications for Payment.

.2 Format and Content: Use the Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.
  .1 Arrange the schedule of values in tabular form with separate columns to indicate the following for each item listed:
    .1 Related Specification Section or Division.
    .2 Description of the Work.
    .3 Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
  .2 Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Provide multiple line items for principal subcontract amounts in excess of five percent of Contract Sum.
    .1 Include separate line items under principal subcontracts for sustainability documentation for LEED certification, if applicable, and other project closeout requirements in an amount totalling not less than five percent of the Contract Sum and subcontract amount.
  .3 Round amounts to nearest whole dollar; total shall equal the Contract Sum.

.4 Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
  .1 Differentiate between items stored on-site and items stored off-site. If required, include evidence of insurance.
.5 Allowances: Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
.6 Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
  .1 Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.
.7 Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.5 APPLICATIONS FOR PAYMENT

.1 Each Application for Payment shall be consistent with previous applications and payments as certified by Owner's Representative and paid for by Owner.
  .1 Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

.2 Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.

.3 Application for Payment Forms: Use forms acceptable to Owner's Representative and Owner for Applications for Payment. Submit forms for approval with initial submittal of schedule of values.

.4 Application Preparation: Complete every entry on form. Execute by a person authorized to sign legal documents on behalf of Contractor. Owner's Representative will return incomplete applications without action.
  .1 Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
  .2 Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
  .3 Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
  .4 Indicate separate amounts for work being carried out under Owner-requested project acceleration.

.5 Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
  .1 Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
  .2 Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
  .3 Provide summary documentation for stored materials indicating the following:
    .1 Materials previously stored and included in previous Applications for Payment.
    .2 Work completed for this Application utilizing previously stored materials.
    .3 Additional materials stored with this Application.
    .4 Total materials remaining stored, including materials with this Application.

.6 Transmittal: Submit two signed original copies of each Application for Payment to Owner's Representative by a method ensuring receipt within 24 hours. Provide current Letter of Good Standing from Work Place Health and Safety authority.
  .1 Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

.7 Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
  .1 List of subcontractors.
  .2 Schedule of values.
  .3 Contractor's construction schedule (preliminary if not final).
  .4 Products list (preliminary if not final).
  .5 Schedule of unit prices.
  .6 Submittal schedule (preliminary if not final).
  .7 List of Contractor's staff assignments.
  .8 List of Contractor's principal consultants.
  .9 Copies of building permits.
  .10 Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
  .11 Initial progress report.
  .12 Report of preconstruction conference.

.8 Application for Payment at Substantial Completion: After issuing the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
  .1 Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.

.9 Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
  .1 Evidence of completion of Project closeout requirements.
  .2 Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
  .3 Updated final statement, accounting for final changes to the Contract Sum.
  .4 Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

.1 Types of items described in this Section:
  .1 Administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
    .1 General project coordination procedures.
    .2 Administrative and supervisory personnel.
    .3 Coordination drawings.
    .4 Requests for Information (RFIs).
    .5 Project Web Site.
    .6 Project meetings.

.2 Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.

.3 Types of items you will not find described in this Section:
  .1 Description of the division of work among separate contracts and responsibility for coordination activities not in this Section.
  .2 Preparing and submitting Contractor's construction schedule.
  .3 Procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
  .4 Coordinating closeout of the Contract.
  .5 Coordinating the Work with Owner's commissioning authority.

1.3 DEFINITIONS

.1 RFI: Request from Owner, Owner's Representative, or Contractor seeking information from each other during construction.

1.4 COORDINATION

.1 Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.
  .1 Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
  .2 Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
  .3 Make adequate provisions to accommodate items scheduled for later installation.

.2 Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
  .1 Preparation of Contractor's construction schedule.
  .2 Preparation of the schedule of values.
  .3 Installation and removal of temporary facilities and controls.

.4 Delivery and processing of submittals.
.5 Progress meetings.
.6 Preinstallation conferences.
.7 Project closeout activities.
.8 Startup and adjustment of systems.
.9 Project closeout activities.

.3 Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.
.1 Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. Refer to other Sections for disposition of salvaged materials that are designated as Owner's property.

1.5 COORDINATION DRAWINGS

.1 Coordination Drawings, General: Prepare coordination drawings in accordance with requirements in individual Sections, where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
.1 Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
.1 Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
.2 Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
.3 Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
.4 Show location and size of access doors required for access to concealed dampers, valves, and other controls.
.5 Indicate required installation sequences.
.6 Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Owner's Representative indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

.2 Coordination Drawing Organization: Organize coordination drawings as follows:
.1 Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire protection, fire alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
.2 Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
.3 Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire protection, fire alarm, and electrical equipment.
.4 Structural Penetrations: Indicate penetrations and openings required for all disciplines.
.5 Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
.6 Mechanical and Plumbing Work: Show the following:
.1 Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.

.2 Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
.3 Fire-rated enclosures around ductwork.

.7 Electrical Work: Show the following:
.1 Runs of vertical and horizontal conduit 1-1/4 inch diameter and larger.
.2 Light fixture, exit light, emergency battery pack, smoke detector, and other fire alarm locations.
.3 Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
.4 Location of pull boxes and junction boxes, dimensioned from column center lines.

.8 Fire Protection System: Show the following:
.1 Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.

.9 Review: Owner's Representative will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are the Contractor's responsibility. If the Owner's Representative determines that the coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, the Owner's Representative will so inform the Contractor, who shall make changes as directed and resubmit.

.10 Coordination Drawing Prints: Prepare coordination drawing prints in accordance with requirements of Division 01 Section *Submittal Procedures*.

1.6 KEY PERSONNEL

.1 Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and email addresses. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.
.1 Post copies of list in project meeting rooms, in any temporary field office, and by any and all temporary telephones. Keep list current at all times.

1.7 REQUESTS FOR INFORMATION (RFIs)

.1 General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
.1 Owner's Representative will return RFIs submitted to Owner's Representative by other entities controlled by Contractor with no response.
.2 Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

.2 Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
.1 Project name.
.2 Project number.
.3 Date.
.4 Name of Contractor.
.5 Name of Owner's Representative.
.6 RFI number, numbered sequentially.
.7 RFI subject.
.8 Specification Section number and title and related paragraphs, as appropriate.
.9 Drawing number and detail references, as appropriate.
.10 Field dimensions and conditions, as appropriate.
.11 Contractor's suggested resolution. If Contractor's solution(s) impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
.12 Contractor's signature.

.13 Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
.1 Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

.3 RFI Forms: Contractor's form acceptable to the Owner's Representative.

.4 Owner's Representative's Action: Owner's Representative will review each RFI, determine action required, and respond. Allow seven working days for Owner's Representative's response for each RFI. RFIs received by Owner's Representative after 1:00 p.m. will be considered as received the following working day.
.1 The following RFIs will be returned without action:
.1 Requests for approval of submittals.
.2 Requests for approval of substitutions.
.3 Requests for coordination information already indicated in the Contract Documents.
.4 Requests for adjustments in the Contract Time or the Contract Sum.
.5 Requests for interpretation of Owner's Representative's actions on submittals.
.6 Incomplete RFIs or inaccurately prepared RFIs.
.2 Owner's Representative's action may include a request for additional information, in which case Owner's Representative's time for response will date from time of receipt of additional information.
.3 Owner's Representative's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 01 Section *Contract Modification Procedures*.
.1 If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Owner's Representative in writing within 10 days of receipt of the RFI response.

.5 On receipt of Owner's Representative's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Owner's Representative within seven days if Contractor disagrees with response.

1.8 PROJECT MEETINGS

.1 General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.
.1 Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Owner's Representative of scheduled meeting dates and times.
.2 Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
.3 Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Owner's Representative, within three days of the meeting.

.2 Preconstruction Conference: Owner's Representative will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Owner's Representative, but no later than 15 days after execution of the Agreement.
.1 Conduct the conference to review responsibilities and personnel assignments.
.2 Attendees: Authorized representatives of Owner, Owner's Commissioning Authority if applicable, Owner's Representative, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
.3 Agenda: Discuss items of significance that could affect progress, including the following:
.1 Tentative construction schedule.
.2 Phasing.
.3 Critical work sequencing and long-lead items.
.4 Designation of key personnel and their duties.
.5 Lines of communications.

.6 Procedures for processing field decisions and Change Orders.
.7 Procedures for RFIs.
.8 Procedures for testing and inspecting.
.9 Procedures for processing Applications for Payment.
.10 Distribution of the Contract Documents.
.11 Submittal procedures.
.12 Sustainable design requirements.
.13 Preparation of record documents.
.14 Use of the premises and existing building.
.15 Work restrictions.
.16 Working hours.
.17 Owner's occupancy requirements.
.18 Responsibility for temporary facilities and controls.
.19 Procedures for moisture and mold control.
.20 Procedures for disruptions and shutdowns.
.21 Construction waste management and recycling.
.22 Parking availability.
.23 Office, work, and storage areas.
.24 Equipment deliveries and priorities.
.25 First aid.
.26 Security.
.27 Progress cleaning.

.4 Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

.3 Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.

.1 Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Owner's Representative , and Owner's Commissioning Authority if applicable, of scheduled meeting dates.

.2 Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:

.1 Contract Documents.
.2 Options.
.3 Related RFIs.
.4 Related Change Orders.
.5 Purchases.
.6 Deliveries.
.7 Submittals.
.8 Review of mockups.
.9 Possible conflicts.
.10 Compatibility problems.
.11 Time schedules.
.12 Weather limitations.
.13 Manufacturer's written recommendations.
.14 Warranty requirements.
.15 Compatibility of materials.
.16 Acceptability of substrates.
.17 Temporary facilities and controls.
.18 Space and access limitations.
.19 Regulations of authorities having jurisdiction.
.20 Testing and inspecting requirements.

.21 Installation procedures.
.22 Coordination with other work.
.23 Required performance results.
.24 Protection of adjacent work.
.25 Protection of construction and personnel.

.3 Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.

.4 Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.

.5 Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

.4 Project Closeout Conference: Schedule and conduct a Project closeout conference, at a time convenient to Owner and Owner's Representative, but no later than thirty days prior to the scheduled date of Substantial Completion.

.1 Conduct the conference to review requirements and responsibilities related to Project closeout.

.2 Attendees: Authorized representatives of Owner, Owner's Commissioning Authority if applicable, Owner's Representative, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.

.3 Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:

.1 Preparation of record documents.
.2 Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
.3 Submittal of written warranties.
.4 Requirements for preparing sustainable design documentation.
.5 Requirements for preparing operations and maintenance data.
.6 Requirements for demonstration and training.
.7 Preparation of Contractor's punch list.
.8 Procedures for processing Applications for Payment at Substantial Completion and for final payment.
.9 Submittal procedures.
.10 Coordination of separate contracts.
.11 Owner's partial occupancy requirements.
.12 Installation of Owner's furniture, fixtures, and equipment.
.13 Responsibility for removing temporary facilities and controls.

.4 Minutes: Entity conducting meeting will record and distribute meeting minutes.

.5 Progress Meetings: Conduct progress meetings at monthly intervals.

.1 Coordinate dates of meetings with preparation of payment requests.

.2 Attendees: In addition to representatives of Owner, Owner's Commissioning Authority if applicable and Owner's Representative, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.

.3 Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

.1 Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

.1 Review schedule for next period.

.2 Review present and future needs of each entity present, including the following:
- .1 Interface requirements.
- .2 Sequence of operations.
- .3 Status of submittals.
- .4 Deliveries.
- .5 Off-site fabrication.
- .6 Access.
- .7 Site utilization.
- .8 Temporary facilities and controls.
- .9 Progress cleaning.
- .10 Quality and work standards.
- .11 Status of correction of deficient items.
- .12 Field observations.
- .13 Status of RFIs.
- .14 Status of proposal requests.
- .15 Pending changes.
- .16 Status of Change Orders.
- .17 Pending claims and disputes.
- .18 Documentation of information for payment requests.

.4 Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.

.1 Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

.1 Types of items described in this Section:
  .1 Administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
    .1 Start-up construction schedule.
    .2 Contractor's construction schedule.
    .3 Daily construction reports.
    .4 Material location reports.
    .5 Field condition reports.
    .6 Special reports.

.2 Types of items you will not find described in this Section:
  .1 Procedures for submitting schedules and reports.
  .2 Requirements for submitting a schedule of tests and inspections.

1.3 SUBMITTALS

.1 Format for Submittals: Submit required submittals in the following format:
  .1 Three paper copies, one pdf and one editable copy.

.2 Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.

.3 Daily Construction Reports: Submit at weekly intervals.

.4 Field Condition Reports: Submit at time of discovery of differing conditions.

.5 Special Reports: Submit at time of unusual event.

1.4 COORDINATION

.1 Coordinate Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.
  .1 Secure time commitments for performing critical elements of the Work from entities involved.
  .2 Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

.1 Time Frame: Extend schedule from date established for commencement of the Work to date of final completion.
  .1 Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

.2 Activities: Treat each story or separate area as a separate numbered activity for each principal element of the Work. Comply with the following:
- .1 Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Owner's Representative.
- .2 Procurement Activities: Include procurement process activities for any long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
- .3 Submittal Review Time: Include review and resubmittal times indicated in Division 01 Section *Submittal Procedures* in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
- .4 Start-up and Testing Time: Include not less than 10 days for start-up and testing.
- .5 Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Owner's Representative's administrative procedures necessary for certification of Substantial Completion.
- .6 Punch List and Final Completion: Include not more than 30 days for punch list and final completion.

.3 Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
- .1 Phasing: Arrange list of activities on schedule by phase.
- .2 Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
- .3 Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Division 01 Section *Summary*. Delivery dates indicated stipulate the earliest possible delivery date.
- .4 Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Division 01 Section *Summary*. Delivery dates indicated stipulate the earliest possible delivery date.
- .5 Work Stages: Indicate important stages of construction for each major portion of the Work

.4 Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, Construction Start Date, Substantial Completion, and final completion.

2.2 START-UP CONSTRUCTION SCHEDULE

.1 Bar-Chart Schedule: Submit start-up horizontal bar-chart-type construction schedule within seven days of date established for commencement of the Work.

.2 Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

2.3 CONTRACTOR'S CONSTRUCTION SCHEDULE (GANTT CHART)

.1 Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal Gantt-chart-type, Contractor's construction schedule within 30 days of date established for commencement of the Work. Base schedule on the start-up construction schedule and additional information received since the start of Project.

.2 Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.
- .1 For construction activities that require three months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

2.4 REPORTS

.1 Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
- .1 List of subcontractors at Project site.
- .2 List of separate contractors at Project site.
- .3 Approximate count of personnel at Project site.
- .4 Equipment at Project site.
- .5 Material deliveries.
- .6 High and low temperatures and general weather conditions, including presence of rain or snow.
- .7 Accidents.
- .8 Meetings and significant decisions.
- .9 Unusual events (refer to special reports).
- .10 Stoppages, delays, shortages, and losses.
- .11 Meter readings and similar recordings.
- .12 Emergency procedures.
- .13 Orders and requests of authorities having jurisdiction.
- .14 Change Orders received and implemented.
- .15 Construction Change Directives received and implemented.
- .16 Services connected and disconnected.
- .17 Equipment or system tests and startups.
- .18 Partial completions and occupancies.
- .19 Substantial Completions authorized.

.2 Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.5 SPECIAL REPORTS

.1 General: Submit special reports directly to Owner within one day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.

.2 Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

.1 Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule before each regularly scheduled progress meeting.
- .1 Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
- .2 Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
- .3 As the Work progresses, indicate final completion percentage for each activity.

.2 Distribution: Distribute copies of approved schedule to Owner's Representative Owner, 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

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

.1 Types of items described in this Section:
  .1 Administrative and procedural requirements for the following:
    .1 Preconstruction photographs.
    .2 Periodic construction photographs.

.2 Types of items you will not find described in this Section:
  .1 Final completion construction photographs.
  .2 Preconstruction video recordings.
  .3 Periodic construction video recordings.
  .4 Web-based construction photographic documentation.
  .5 Procedures for unit prices for extra photographs.
  .6 Procedures for submitting photographic documentation.
  .7 Procedures for submitting photographic documentation as project record documents at project closeout.
  .8 Submitting video recordings of demonstration of equipment and training of owner's personnel.
  .9 Photographic documentation before building demolition operations commence.
  .10 Photographic documentation before selective demolition operations commence.
  .11 Photographic documentation before site clearing operations commence.

1.3 SUBMITTALS

.1 Digital Photographs: Submit image files within three days of taking photographs.
  .1 Identification: Provide the following information with submission:
    .1 Name of Project.
    .2 Name of Contractor.
    .3 Date photograph was taken.
    .4 Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.

1.4 USAGE RIGHTS

.1 Obtain and transfer copyright usage rights from photographer to Owner for unlimited reproduction of photographic documentation.

PART 2 - PRODUCTS

2.1 PHOTOGRAPHIC MEDIA

.1 Digital Images: Provide images in JPG format, produced by a digital camera with minimum sensor size of 6 megapixels.

PART 3 - EXECUTION

3.1 CONSTRUCTION PHOTOGRAPHS

.1 General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.

.2 Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
- .1 Date and Time: Include date and time in file name for each image.
- .2 Field Office Images: Maintain one set of images accessible in any field office at Project site, available at all times for reference. Identify images in the same manner as those submitted to Owner's Representative.

.3 Preconstruction Photographs: Before starting construction, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Owner's Representative.
- .1 Take not less than 20 photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.
- .2 Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.

.4 Periodic Construction Photographs: Take not less than 20 photographs monthly, coinciding with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.

.5 Owner's Representative-Directed Construction Photographs: From time to time, Owner's Representative will instruct photographer about number and frequency of photographs and general directions on vantage points. Select actual vantage points and take photographs to show the status of construction and progress since last photographs were taken.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

.1 Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

.2 Related Sections:
- .1 Division 01 Section *Payment Procedures* for submitting Applications for Payment and the schedule of values.
- .2 Division 01 Section *Construction Progress Documentation* for submitting schedules and reports, including Contractor's construction schedule.
- .3 Division 01 Section *Operation and Maintenance Data* for submitting operation and maintenance manuals.
- .4 Division 01 Section *Project Record Documents* for submitting record Drawings, record Specifications, and record Product Data.
- .5 Division 01 Section *Demonstration and Training* for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.3 DEFINITIONS

.1 Action Submittals: Written and graphic information and physical samples that require Owner's Representative's responsive action. Action submittals are those submittals indicated in individual Specification Sections as action submittals.

.2 Informational Submittals: Written and graphic information and physical samples that do not require Owner's Representative's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as informational submittals.

.3 File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.

.4 Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.4 ACTION SUBMITTALS

.1 Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or modifications to submittals noted by the Owner's Representative and additional time for handling and reviewing submittals required by those corrections.
- .1 Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
- .2 Initial Submittal: Submit concurrently with start-up construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
- .3 Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.

.1 Submit revised submittal schedule to reflect changes in current status and timing for submittals.

.4 Format: Arrange the following information in a tabular format:

.1 Scheduled date for first submittal.
.2 Specification Section number and title.
.3 Submittal category: Action, informational.
.4 Name of subcontractor.
.5 Description of the Work covered.
.6 Scheduled date for Owner's Representative's final release or approval.

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

.1 Owner's Representative's Digital Data Files: Electronic copies of PDF Drawings of the Contract Drawings will be provided by Owner's Representative for Contractor's use in preparing submittals.

.1 Owner's Representative will furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawings.

.1 Owner's Representative makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.

.2 Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

.1 Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
.2 Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
.3 Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.

.3 Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Owner's Representative's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

.1 Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Owner's Representative will advise Contractor when a submittal being processed must be delayed for coordination.
.2 Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
.3 Resubmittal Review: Allow 15 days for review of each resubmittal.
.4 Sequential Review: Where sequential review of submittals by Owner's Representative's consultants, Owner, or other parties is required, allow 21 days for initial review of each submittal.

.4 Identification and Information: Place a permanent label or title block on each submittal item for identification.

.1 Indicate name of firm or entity that prepared each submittal on label or title block.
.2 Include the following information for processing and recording action taken:

.1 Project name.
.2 Date.
.3 Name of Owner's Representative.
.4 Name of Contractor.
.5 Name of subcontractor.
.6 Name of supplier.
.7 Name of manufacturer.
.8 Submittal number or other unique identifier, including revision identifier.

.1 Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 06 10 00.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 06 10 00.01.A).

.9 Number and title of appropriate Specification Section.

.10 Drawing number and detail references, as appropriate.
.11 Location(s) where product is to be installed, as appropriate.
.12 Other necessary identification.

.5 Options: Identify options requiring selection by the Owner's Representative.

.6 Deviations: Identify deviations from the Contract Documents on submittals.

.7 Transmittal: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Owner's Representative will discard submittals received from sources other than Contractor.
.1 Transmittal Form: Provide locations on form for the following information:
.1 Project name.
.2 Date.
.3 Category and type of submittal.
.4 Submittal purpose and description.
.5 Specification Section number and title.
.6 Indication of full or partial submittal.
.7 Remarks.
.8 Signature of transmitter.
.2 On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Owner's Representative on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

.8 Resubmittals: Make resubmittal in same form and number of copies as initial submittal.
.1 Note date and content of previous submittal.
.2 Note date and content of revision in label or title block and clearly indicate extent of revision.
.3 Resubmit submittals until they are marked with approval notation from Owner's Representative's action stamp.

.9 Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

.10 Use for Construction: Use only final submittals that are marked with approval notation from Owner's Representative's action stamp.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

.1 General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
.1 Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Division 01 Section *Closeout Procedures*.
.2 Test and Inspection Reports Submittals: Comply with requirements specified in Division 01 Section *Quality Requirements*.

.2 Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
.1 If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.

.2 Mark each copy of each submittal to show which products and options are applicable.

.3 Include the following information, as applicable:

.1 Manufacturer's catalog cuts.

.2 Manufacturer's product specifications.

.3 Standard color charts.

.4 Statement of compliance with specified referenced standards.

.5 Testing by recognized testing agency.

.6 Application of testing agency labels and seals.

.7 Notation of coordination requirements.

.8 Availability and delivery time information.

.4 For equipment, include the following in addition to the above, as applicable:

.1 Wiring diagrams showing factory-installed wiring.

.2 Printed performance curves.

.3 Operational range diagrams.

.4 Clearances required to other construction, if not indicated on accompanying Shop Drawings.

.5 Submit Product Data before or concurrent with Samples.

.3 Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

.1 Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

.1 Identification of products.

.2 Schedules.

.3 Compliance with specified standards.

.4 Notation of coordination requirements.

.5 Notation of dimensions established by field measurement.

.6 Relationship and attachment to adjoining construction clearly indicated.

.7 Seal and signature of professional engineer if specified.

.2 Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings whenever possible on sheets not larger than 11 x17"

.4 Contractor's Construction Schedule: Comply with requirements specified in Division 01 Section *Construction Progress Documentation*.

.5 Application for Payment: Comply with requirements specified in Division 01 Section *Payment Procedures*.

.6 Schedule of Values: Comply with requirements specified in Division 01 Section *Payment Procedures*.

.7 Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

.1 Name, address, and telephone number of entity performing subcontract or supplying products.

.2 Number and title of related Specification Section(s) covered by subcontract.

.3 Drawing number and detail references, as appropriate, covered by subcontract.

.8 Coordination Drawings: Comply with requirements specified in Division 01 Section *Project Management and Coordination*.

.9 Schedule of Tests and Inspections: Comply with requirements specified in Division 01 Section *Quality Requirements*.

.10 Maintenance Data: Comply with requirements specified in Division 01 Section *Operation and Maintenance Data*.

2.2 DELEGATED-DESIGN SERVICES

.1 Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
  .1 If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Owner's Representative.
  .2 Provide submittals and certificates sealed with by a professional identified by the Section who is licensed to practice in the project's jurisdiction; signifying compliance with the performance and design criteria in the Contract Documents. Indicate list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

.1 Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Owner's Representative.

.2 Project Closeout and Maintenance/Material Submittals: Refer to requirements in Division 01 Section *Closeout Procedures*.

.3 Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 OWNER'S REPRESENTATIVE'S ACTION

.1 General: Owner's Representative will not review submittals that do not bear Contractor's approval stamp and will return them without action.

.2 Action Submittals: Owner's Representative will review each submittal, make marks to indicate corrections or modifications required, and return it. Owner's Representative will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.

.3 Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Types of items described in this Section:

1. Health and safety requirements for projects located in Newfoundland and Labrador.

1.3 REFERENCES

A. Code and standards referenced in this section refer to the latest edition thereof.

B. Canadian Standards Association (CSA)

1. CSA S269.1 Falsework for Construction Purposes.
2. CAN/CSA-Z259.1 Safety Belts and Lanyards.
3. CAN/CSA-Z259.10 Full body Harnesses.
4. CAN/CSA-Z259.11 Shock Absorbers for Personal Fall Arrest Systems.
5. CAN/CSA-Z259.2, Fall Arresting Devices, Personnel Lowering Devices and Lifelines.
6. FCC No. 301 Standard for Construction Operations.
7. CSA Z275.2 Occupational Safety Code for Diving Operations.
8. CSA Z275.4 Competency Standard for Divers Operations.

C. FCC No. 302 Standard for Welding and Cutting.

D. Transportation of Dangerous Goods Act Regulations.

E. Newfoundland Occupational Health and Safety Act, Amended

F. Consolidated Newfoundland and Regulations 1149 WMIS Regulations Under the Occupational Health and Safety Act

G. Consolidated Newfoundland and Regulations 1165 Occupational Health and Safety Regulations under the Occupational Health and Safety Act.

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

I. National Building Code of Canada.

1.4 SUBMITTALS

A. At least 10 (ten) working days prior to commencing any site work: submit to Owner’s Representative copies of:

1. A complete Site Specific Hazard Assessment and Safety Program Table of Contents.

2. Including requirments as outlined by the Department of Envrionmental Health & Safety, See APPENDIX A.

B. Acceptance of the Project Health and Safety Hazard Assessment and Management Plan and other submitted documents by the Owner's Representative shall only be viewed as acknowledgement that the contractor has submitted the required documentation under this specification section.

C. Owner's Representative makes no representation and provides no warranty for the accuracy, completeness and legislative compliance of the Project Health and Safety Hazard Management Plan and other submitted documents by this acceptance.

D. Responsibility for errors and omissions in the Project Health and Safety Hazard Assessment and Management Plan and other submitted documents is not relieved by acceptance by Owner's Representative.

1.5 OCCUPATIONAL HEALTH AND SAFETY (PROJECT HEALTH AND SAFETY HAZARD ASSESSMENT AND MANAGEMENT PLANS)

A. Conduct operations in accordance with latest edition of the Newfoundland Occupational Health and Safety (OH&S) Act and Regulations.

B. Prepare a detailed Project Health and Safety Hazard Assessment and Management Plan for the Owner. Assessment shall identify, evaluate and control job specific hazards and the necessary control measures to be implemented for managing hazards.

C. Provide a copy of the Project Health and Safety Hazard Assessment and Management Plan upon request to Occupational Health and Safety Branch, Department of Labour, Province of Newfoundland and Labrador and the Owner.

D. The written Health and Safety Hazard Assessment and Management Plan shall incorporate the following:

1. A site-specific health and safety plan, refer to clause 1.6 Site-Specific Health and Safety Hazard Assessment and Management Plan of this section for requirements.
2. An organizational structure which shall establish the specific chain of command and specify the overall responsibilities of contractor's employees at the work site.
3. A comprehensive work plan which shall:

    a. define work tasks and objectives of site activities/operations and the logistics and resources required to reach these tasks and objectives
    b. establish personnel requirements for implementing the plan, and
    c. establish site specific training and notification requirements and schedules.

4. A personal protected equipment (PPE) Program which shall detail PPE:

    a. Selection criteria based on site hazards.
    b. Use, maintenance, inspection and storage requirements and procedures.
    c. Decontamination and disposal procedures.
    d. Inspection procedures prior to during and after use, and other appropriate medical considerations.
    e. Limitations during temperature extremes, heat stress and other appropriate medical consideration.

5. An emergency response procedure, refer to Clause 1.7 Supervision and Emergency Response Procedure of this section for requirements.

6. A hazard communication program for informing workers, visitors and individuals outside of the work area as required.
7. A diving program which shall contain standard operating procedures to be followed in the diving operation.
8. A health and safety training program.
9. General safety rules.

E. Periodically review and modify as required each component of the Project Health and Safety Hazard Assessment and Management Plan when a new hazard is identified during completion of work and when an error or omission is identified in any part of the Project Health and Safety Hazard Assessment and Management Plan.

F. Implement all requirements of the Project Health and Safety Hazard Assessment and Management Plan.

1. Ensure that every person entering the project site is informed of requirements under the Project Health and Safety Hazard Assessment and Management Plan.
2. Take all necessary measures to immediately implement any engineering controls, administrative contacts, personal protective equipment required or termination of work procedures to ensure compliance with the Project Health and Safety Hazard Assessment and Management Plan.

1.6 SITE SPECIFIC HEALTH AND SAFETY PLAN

A. Prepare a detailed site Specific Project Health and Safety Plan which shall:

1. Contain certain hazard assessment results.
2. Identify engineering and administrative demonstrative controls (work-practices and procedures) to be implemented for managing identified and potential hazards, and comply with applicable federal and provincial legislation and more stringent requirements that have been specified in these specifications.

B. Review for completeness the hazard assessment results immediately prior to commencing work, when a new hazard is identified during completion of work and when an error or omission is identified.

1. Be solely responsible for investigating, evaluation and managing any report of actual or potential hazards.
2. Retain copies of all completed hazard assessments at the project site and make available to the Owner's Representative immediately upon request.

1.7 SUPERVISION AND EMERGENCY RESCUE PROCEDURE

A. Carry out work under the direct supervision of competent persons responsible for safety by ensuring the work complies with the appropriate section of OH&S Act and Regulations

B. Assign a sufficient number of supervisory personnel to the work site.

C. Provide a suitable means of communications for workers required to work alone.

D. Develop an emergency rescue plan for the job site and ensure that supervisors and workers are trained in the emergency rescue plan.

E. The emergency response plan shall address, as a minimum:

1. Pre-emergency planning.
2. Personnel roles, lines of authority and communication.
3. Emergency recognition and prevention.

4. Safe distances and places of refuge.
5. Site security and control
6. Evacuation routes and procedures
7. Decontamination procedures which are not covered by the site specific safety and health plan.
8. Emergency medical treatment and first aid.
9. Emergency alarm, notification and response procedures including procedures for reporting incidents to local, provincial and federal government departments.
10. PPE and emergency equipment.
11. Procedures for handling emergency incidents.
12. Site specific emergency response training requirements and schedules.
13. For diving operation, include procedures for:

    a. Managing deteriorating environmental conditions.
    b. Managing unexpected weather or sea-state condition.
    c. Evacuation of diver(s) under pressures greater that atmospheric pressure.
    d. In-water emergency transfers.
    e. Managing failing of equipment below the surface that impairs the ability of a diver to complete a dive.
    f. Managing failure of any major component of diving plant or equipment.
    g. Emergency signalling between divers involved in the diving program and between the diver(s) and the attendants using umbilical, tethers or other suitable methods.
    h. Mobilizing stand-by divers.
    i. Mobilizing crafts, stand-by boats and any other devices to be used for rescue.
    j. Contacting evacuation, rescue, treatment facilities and medical services that will be used in the diving program.
    k. Operation of emergency power and lighting facilities.

F. The emergency response procedures shall be rehearsed regularly as part of the overall training program.

G. Provide adequate first aid facilities for the jobsite and ensure that a minimum number of workers are trained in first aid in accordance with the First Aid Regulations.

1.8 CONTRACTORS SAFETY OFFICER

A. The contractor’s Safety Officer will be solely responsible for the implementation and monitoring of the Project Health and Safety Hazard Assessment and Management Plan, and will have the authority to implement health and safety changes as directed by the Owner’s Representative. The Safety Officer shall have as a minimum:

1. Completed training in hazardous occurrence management and response/protocols.
2. Completed training in the use, maintenance of fall protection systems.
3. Completed training in the design and construction of scaffolding.
4. Completed training in confined space entry protocols and techniques.
5. Completed training in First Aid.
6. Have working knowledge of occupational safety and health regulations.
7. Be responsible for completing Contractor's Health and Safety Training Sessions and ensuring that personnel not successfully completing required training are not permitted to enter site to perform Work.
8. Be responsible for implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan.
9. Be on site during execution of Work and report directly to and be under direction of site supervisor.

1.9 HEALTH AND SAFETY COMMITTEE

A. Establish an Occupational Health and Safety Committee where ten or more workers are employed on the job site as per the OH&S Act and Regulations.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.

C. 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.

1.10 RESPONSIBILITY

A. 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.

B. 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.

1.11 UNFORESEEN HAZARDS

A. Should any unforeseen or peculiar safety-related factor, hazard, or condition become evident during performance of Work, follow procedures in place for Employee's Right to Refuse Work in accordance with Acts and Regulations of Province having jurisdiction. Advise Owner’s Representative verbally and in writing.

1.12 INSTRUCTION AND TRAINING

A. Workers shall not participate in or supervise any activity on the work site until they have been trained to a level required by this job function and responsibility. Training shall as a minimum thoroughly cover the following:

1. Federal and Provincial Health and Safety Legislation requirements including roles and responsibilities of workers and person(s) responsible for implementing, monitoring and enforcing health and safety requirements.
2. Safety and health hazards associated with working on a contaminated site including recognition of symptoms and signs which might indicate over exposure to hazards.
3. Limitations, use, maintenance and disinfection-decontamination of personal protective equipment associated with completing work.
4. Limitations, use, maintenance and care of engineering controls and equipment.
5. Limitations and use of emergency notifications and response equipment including emergency response protocol.
6. Work practices and procedures to minimize the risk of an accident and hazardous occurrence from exposure to a hazard.

B. Provide and maintain training of workers, as required, by Federal and Provincial legislation.

C. Provide copies of all safety training certificates, upon request, to Owner’s Representative for review, and to be maintained on the worker when they enter the work site.

D. Authorized visitors shall not access the work site until they have been:

1. Notified of the names of persons responsible for implementing, monitoring and enforcing the Health and Safety Hazard Assessment and Management Plan.
2. Briefed on safety and health hazards present on the site.
3. Instructed in the proper use and limitations of personal protective equipment.
4. Briefed as the emergency response protocol including notification and evacuation process.
5. Informed of practices and procedures to minimize risks from hazards and applicable to activities performed by visitors.

1.13 CONSTRUCTION SAFETY MEASURES

A. Observe construction safety measures of National Building Code, latest edition, Provincial Government, OH&S Act and Regulations, Workplace Health and Safety and Compensation Commission and Municipal Authority provided that in any case of conflict or discrepancy more stringent requirements shall apply.

B. Administer the project in a manner that will ensure, at all times, full compliance with Federal and Provincial Acts, regulations and applicable safety codes and the site Health and Safety Hazard Assessment and Management Plan.

C. Provide Owner's Representative with copies of all orders, directions and any other documentation, issued by the Provincial Department of Government Services, Occupational Health and Safety branch immediately after receipt.

1.14 POSTING OF DOCUMENTS

A. Ensure applicable items, articles, notices and orders are posted in conspicuous location on site in accordance with Acts and Regulations of Province and authority having jurisdiction, and in consultation with Owner's Representative.

1.15 HEALTH AND SAFETY MONITORING

A. Periodic inspections of the contractor's work may be carried out by the Owner's Representative to maintain compliance with the Health and Safety Program. Inspections will include visual inspections as well as testing and sampling as required.

B. The contractor shall be responsible for any and all costs associated with delays as a result of contractor's failure to comply with the requirements outlined in this section.

1.16 CORRECTION OF NON-COMPLIANCE

A. Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Owner's Representative.

B. Provide Owner's Representative with written report of action taken to correct non-compliance of health and safety issues identified.

C. Owner's Representative may stop work if non-compliance of health and safety regulations is not corrected.

1.17 WHMIS

A. Ensure that all controlled products are in accordance with the Workplace Hazardous Materials Information System (WHMIS) Regulations and Chemical Substances of the OH&S Act and Regulations regarding use, handling, labelling, storage, and disposal of hazardous materials.

B. Deliver copies of relevant (Material) Safety Data Sheets (SDS) to job site and the Owner's Representative. The SDS must be acceptable to Labour Canada and Health and Welfare Canada for all controlled products that will be used in the performance of this work.

C. Train workers required to use or work in close proximity to controlled products as per OH&S Act and Regulations.

D. Label controlled products at jobsite as per OH&S and Regulations.

E. Provide appropriate emergency facilities as specified in the SDS where workers might be exposed to contact with chemicals, e.g. eye-wash facilities, emergency shower.

1. Workers to be trained in use of such emergency equipment.

F. Contractor shall provide appropriate personal protective equipment as specified in the SDS where workers are required to use controlled products.

1. Properly fit workers for personal protective equipment
2. Train workers in care, use and maintenance of personal protective equipment.

G. No controlled products are to be brought on-site without prior approved SDS.

H. The SDS are to remain on site at all times.

1.18 OVERLOADING

A. Ensure no part of work or associated equipment is subjected to loading that will endanger its safety or will cause permanent deformation.

1.19 FALSEWORK

A. Design and construct falsework in accordance with CSA S269.1.

1.20 SCAFFOLDING

A. Design, erect and maintain scaffolding in accordance with CSA S269.2 and Sections 91-97 of the OH&S Act and Regulations.

B. Ensure that fall-restraint or fall-arrest devices are used by all workers working at elevations greater than 3.05 metres above grade or floor level in accordance with CSA Z259.

1.21 PERSONAL PROTECTIVE EQUIPMENT

A. Ensure workers on the jobsite use personal protective equipment appropriate to the hazards identified in the Hazard Assessment and Management Plan and those workers are trained in the proper care, use, and maintenance of such equipment.

B. PPE selections shall be based on an evaluation of the performance characteristics of the PPE relative to the requirements and limitations of the site, task-specific conditions, duration and hazards and potential hazards identified on site.

C. Provide workers and visitors to the site with proper respiratory protection equipment.

1. No work shall be performed in an area where an airborne contaminant exceeds one half (½) the IDLH concentration.
2. Respiratory protection shall be provided in accordance with the requirements of the Occupational Health and Safety Branch, Department of Labour of the Province of Newfoundland and Labrador and these specifications.
3. Establish, implement and maintain a respirator inspection and maintenance program.
4. Copies of all respirator owners' maintenance manuals shall be kept at all times at the contractor's site office.

D. Provide and maintain a supply of dermal protection equipment to allow visitors and all workers proper dermal protection.

1. Dermal protection shall be sufficient to act as a protective barrier between the skin and an airborne contaminant or hazardous material. Dermal protection shall also be provided for all physical hazards.
2. Dermal protection equipment shall not be used after exceeding 75% of the break through time. The break through time shall be based on the contaminant which requires the least amount of time to break through the protective equipment
3. Copies of all dermal protection user specifications, owners and maintenance manuals shall be kept at all times at the contractor's site office.
4. Establish, implement and maintain air inspection program to ensure proper dermal protection in accordance with CSA, NIOSH, U.S. EPA and manufacturer's requirements.

E. Provide all workers and up to two (2) visitors to the site with proper hearing protection. Workers and visitors shall not be exposed to noise levels greater than 85 dB (A) over an eight hour shift without proper hearing protection.

F. Provide all workers and up to two (2) visitors to the site with CSA approved eye protection sufficient to act as a protective barrier between the eye and airborne contaminants, hazardous materials and physical hazard.

G. Provide workers and up to two (2) visitors to the site with CSA approved hard hats.

1.22 EXCAVATION SAFETY

A. Protect excavations more than 1.25 metres deep against cave-ins or wall collapse by side wall sloping to the appropriate angle of repose, an engineered shoring/sheathing system or an approved trench box.

1. Provide a ladder which can extend from the bottom of the excavation to at least 0.91 metres above the top of the excavation.

B. Ensure that all excavations less than 1.25 metres deep are effectively protected when hazardous ground movement may be expected.

C. Design trench boxes, certified by a registered Professional Engineer, and fabricated by a reputable manufacturer. Provide the manufacturer's Depth Certificate Statement permanently affixed. Use trench boxes in strict accordance with manufacturer's instructions and depth certification data.

D. For excavations deeper than six (6) metres, provide a certificate from a registered Professional Engineer stating that the protection methods proposed have been properly designed in accordance with accepted engineering practice. The engineer's certificate shall verify that the trench boxes, if used, are properly designed and constructed to suit the depth and soil conditions.

1. Ensure that the superintendent and every crew chief, foreperson and lead hand engaged in trenching operations or working in trenches have in his/her possession a copy of the Department of Labour's "Trench Excavation Safety Guide".

1.23 CONFINED SPACE WORK

A. Comply with requirements of Canada Occupational Safety and Health Regulations, Part XI and Consolidated Regulations Newfoundland and Labrador (CRNL) OH&S 1165/96.

B. Provide approved air monitoring equipment where workers are working in confined spaces and ensure any test equipment to be used is calibrated, in good working order and used by trained persons.

C. Develop a confined space entry program specific to the nature of work performed and in accordance with OH&S Act and Regulations and ensure supervisors and workers are trained in the confined space entry program.

1. Ensure that personal protective equipment and emergency rescue equipment appropriate to the nature of the work being performed is provided and used.

D. Provide and maintain training of workers, as required by the Federal and Provincial Legislation.

E. Provide Owner's Representative with a copy of an "Entry Permit" for each entry into the confined space to ensure compliance with Federal and Provincial Legislation.

1.24 HAZARDOUS MATERIALS

A. Should material resembling hazardous materials (asbestos/mould) be encountered during the execution of work and notify Owner's Representative. Do not proceed until written instructions have been received from Owner's Representative.

B. Unless otherwise noted, for hazardous materials abatement and repair, employ the services of a recognized Environmental Consultant to provide all air monitoring and testing services for regulatory requirements.

1.25 HEAVY EQUIPMENT

A. Ensure mobile equipment used on jobsite is of the type specified in OH&S Act and Regulations fitted with a Roll Over Protective (ROP) Structure.

B. Provide certificate of training in Power Line Hazards for operators of heavy equipment.

C. Obtain written clearance from the power utility where equipment is used in close proximity to (within 5.5 metres) overhead or underground power lines.

D. Equip cranes with:

1. A mechanism which will effectively prevent the hook assembly from running into the top boom pulley.
2. A legible load chart.
3. A maintenance log book.

1.26 WORK STOPPAGE

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

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

APPENDIX "A" Contractor Safety Management Element – November 2018

Contractor Safety Management Element

November 2018

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1.0 Purpose

This element establishes the requirements for the administration and monitoring of contractor health and safety programs and activities at Memorial University. These measures shall ensure that contractors understand their collective responsibility with respect to the Occupational Health & Safety Act and Regulations, Memorial University policy and this element.

2.0 Scope

This procedure shall apply to all work done for Memorial University of Newfoundland with respect to the provision of services as outlined below. Memorial University reserves the right to exempt a Contractor from this element, in whole or in part, based upon an evaluation of the risk of the work being conducted. This evaluation must comply with the hazard identification and risk management element.

3.0 Definitions

Act: Newfoundland & Labrador Occupational Health & Safety Act, latest edition.

Contract: A documented agreement between Memorial University and a contractor.

Contractor: The principal contractor, person, partnership, or corporation bound to execute the work under the contract and defined as such in the agreement is responsible for the supervision of the work so as to ensure the work is carried out in accordance with the contract.

Project Management Team: The group assigned by the University to act on behalf of the owner with respect to the execution of Contractor work.

Principal Contractor: The person primarily responsible for the carrying out of a contract.

Regulations: Newfoundland & Labrador Occupational Health & Safety Regulations, latest edition.

Subcontractor: A person, firm or corporation having a direct contract with the Contractor or subcontractor(s) to perform a part or parts of the work included in the contract, or to supply products worked to a special design according to the contract documents, but does not include one who merely supplies products not so worked.

Owner: The Owner, Engineer/Architect are the persons, firms or corporation identified as such in the Contract. The term Owner, Engineer/Architect means, respectively, each of the Owner, Engineer/Architect and their authorized representatives as designated by each such party in writing.

Work: The services and job procedure completion that is described in the contract.

4.0 Roles and Responsibilities

4.1 Project Management Team

Will monitor the Contractor's performance for health and safety compliance. Monitoring activities may include but are not limited to:

- planned and unplanned workplace inspections;
- attendance of meetings;
- communications of safety related issues and topics, as deemed necessary;
- review of contractor records, inspections, work practices and documentation; and
- complete audits to verify that contractors and subcontractors are meeting their legislative, procedural and contractual responsibilities.

4.2 Contractors

Will comply with applicable Federal and Provincial legislation and applicable MUN safety procedures. Contractor responsibilities include but not limited to:

- report all incidents immediately to the required University project team followed by a written incident report within 24 hours;
- be responsible for the safety of subcontractors including those not under their employ;
- stop work if the conditions are such that work cannot be performed safely;
- perform evaluation, monitoring of the workplace to identify potential hazards and associated risks and ensure corrective actions are implemented;
- ensure daily task specific hazard assessments are completed; and
- maintain the accountability of persons responsible for the reporting and correction of hazards.

5.0 Procedure

5.1 Considerations prior to signing of contract

5.1.1 Prior to signing of contract, the preferred General Contractor shall provide proof of compliance with 5.2.1.

Within seven (7) calendar days after a pre-signing start up meeting the General Contractor shall provide proof of compliance of themselves and their subcontractors with 5.2.1 as well as provide the information requested in Section 5.2.2(a) (b).

5.2 Requirements

5.2.1 All Contractors, and their Subcontractors, shall be required to submit confirmation of a current third party occupational health and safety program certification (Letter of Assurance). These may include, but not be limited to, Certificate of Recognition (COR), OHSAS 18001, and CSA Z.1000.

5.2.2 Contractors shall also provide the following:

(a) health and safety policy statement;

(b) safety program table of contents; and

(c) site hazard assessment;

The hazard assessment shall be updated by the General Contractor and re-submitted whenever the conditions, work practices or work forces change to the extent that new hazards can be identified.

5.2.3 In lieu of a Subcontractors 3rd party program, Contractors shall be required to integrate the Subcontractor(s) into the Contractors program and provide proof of same.

5.2.4 Memorial reserves the right to request and audit the full safety program of Contractors and Subcontractors and their associated documentation. This documentation may include, but not be limited to the following:

(a) safety program and/or manual

(b) applicable documented safe work practices;

(c) inspection reports and schedules;

(d) required employee safety training certifications and qualifications; and

(e) updated list of OHS Committee and/or a worker health and safety representative, or workplace health and safety designate.

Request for submission shall be complied with within 7 calendar days of a written request from Memorial's Environmental Health and Safety unit.

5.2.5 Memorial reserves the right to:

(1) Reject any Contractor that fails to meet the requirements or schedules outlined herein;

(2) The University reserves the right to stop any work or portion of work where the risk presents an immediate danger.

5.3 Schedule of Submissions

5.3.1 General Contractors and their sub-contractors who have complied with 5.1.1 will be permitted to commence physical work on the site however no work shall be performed by the General Contractor, their sub-contractors until such a time as they comply with 5.1.1.

6.0 Post-Contract Evaluation

The Project Management Team will determine the extent of the evaluation of the Contractor's safety performance at the completion of the contract. This evaluation will be conducted by way of a standard contractor safety evaluation form and will be supported by objective evidence documented during the term of the Contract. The records of the evaluation must be retained with the project owner.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DEFINITIONS

.1 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 the environment or adversely affect health of persons, animals, or plant life when released into the environment.

1.3 FIRES

.1 Fires and burning of rubbish on site not permitted.

1.4 HAZARDOUS MATERIAL HANDLING

.1 Store and handle hazardous materials in accordance with applicable federal and provincial laws, regulations, codes and guidelines. Store in location that will prevent spillage into the environment

.2 Label containers to WHMIS requirements and keep MSDS data sheets on site for all hazardous materials.

.3 Maintain inventory of hazardous materials and hazardous waste stored on site. List items by product name, quantity and date when storage began.

.4 Store and handle flammable and combustible materials in accordance with National Fire Code.

.5 Transport hazardous materials in accordance with federal Transportation of Dangerous Goods Regulations and applicable Provincial regulations.

1.5 DISPOSAL OF WASTES

.1 Do not bury rubbish and waste materials on site. Dispose in accordance with project waste management requirements

.2 Do not dispose of hazardous waste or volatile materials, such as mineral spirits, paints, thinners, oil or fuel into waterways, storm or sanitary sewers or waste landfill sites.

.3 Dispose of hazardous waste in accordance with applicable federal and provincial laws, regulations, codes and guidelines.

1.6 DRAINAGE

.1 Provide temporary drainage and pumping as necessary to keep excavations and site free from water.

.2 Do not pump water containing suspended materials into waterways, sewer or drainage systems.

.3 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with governing regulations and requirements.

.4 Provide control devices such as filter fabrics, sediment traps and settling ponds to control drainage and prevent erosion of adjacent lands. Maintain in good order for duration of work. .

1.7 POLLUTION CONTROL

.1 Maintain temporary erosion and pollution control features installed under this contract.

.2 Control emissions from equipment and plant to local authorities emission requirements.

.3 Prevent sandblasting and other extraneous materials from contaminating air beyond application area, by providing temporary enclosures.

.4 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads and around entire construction site.

.5 Have appropriate emergency spill response equipment and rapid clean-up kit on site located adjacent to hazardous materials storage area. Provide personal protective equipment required for clean-up.

.6 Report, spills of petroleum and other hazardous materials as well as accidents having potential of polluting the environment to Federal and Provincial Department of the Environment.

.7 Notify Owner's Representative and submit a written spill report to Owner's Representative within 24 hours of occurrence.

END OF SECTION 01 35 43

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

.1 Types of items described in this Section:
  .1 Administrative and procedural requirements for quality assurance and quality control.

.2 Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
  .1 Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
  .2 Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
  .3 Requirements for Contractor to provide quality-assurance and -control services required by Owner's Representative, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

.3 Types of items you will not find described in this Section:
  .1 Allowances for testing and inspecting allowances.
  .2 Developing a schedule of required tests and inspections.
  .3 Divisions 02 through 49 Sections for specific test and inspection requirements.

1.3 DEFINITIONS

.1 Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

.2 Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Owner's Representative.

.3 Mock-ups: Full size physical assemblies that are constructed on-site. Mock-ups are constructed to verify selections made under sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mock-ups are not Samples. Unless otherwise indicated, approved mock-ups establish the standard by which the Work will be judged.

.4 Preconstruction Testing: Tests and inspections performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.

.5 Product Testing: Tests and inspections that are performed by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

.6 Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.

.7 Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

.8 Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

.9 Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
.1 Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade or trades.

.10 Experienced: When used with an entity or individual, *experienced* means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 CONFLICTING REQUIREMENTS

.1 Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Owner's Representative for a decision before proceeding.

.2 Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Owner's Representative for a decision before proceeding.

1.5 SUBMITTALS

.1 Shop Drawings: For laboratory mock-ups, provide plans, sections, and elevations, indicating materials and size of mock-up construction.
.1 Indicate manufacturer and model number of individual components.
.2 Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

1.6 SUBMITTALS

.1 Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.

.2 Contractor's Quality-Control Manager Qualifications: For supervisory personnel.

.3 Testing Agency Qualifications: For testing agencies specified in *Quality Assurance* Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

.4 Schedule of Tests and Inspections: Prepare in tabular form and include the following:
.1 Specification Section number and title.
.2 Entity responsible for performing tests and inspections.
.3 Description of test and inspection.
.4 Identification of applicable standards.

.5 Identification of test and inspection methods.
.6 Number of tests and inspections required.
.7 Time schedule or time span for tests and inspections.
.8 Requirements for obtaining samples.
.9 Unique characteristics of each quality-control service.

1.7 CONTRACTOR'S QUALITY-CONTROL PLAN

.1 Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice of Award, and not less than five days prior to preconstruction conference. Submit in format acceptable to Owner's Representative. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities. Coordinate with Contractor's construction schedule.

.2 Quality-Control Personnel Qualifications: Engage qualified full-time personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.
.1 Project quality-control manager may also serve as Project superintendent .

.3 Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.

.4 Testing and Inspection: Include in quality-control plan a comprehensive schedule of Work requiring testing or inspection, including the following:
.1 Contractor-performed tests and inspections including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections.
.2 Owner-performed tests and inspections indicated in the Contract Documents, including tests and inspections indicated to be performed by the Commissioning Authority, if applicable.

.5 Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements and approved mock-ups.

.6 Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results. Include work Owner's Representative has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.8 REPORTS AND DOCUMENTS

.1 Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
.1 Date of issue.
.2 Project title and number.
.3 Name, address, and telephone number of testing agency.
.4 Dates and locations of samples and tests or inspections.
.5 Names of individuals making tests and inspections.
.6 Description of the Work and test and inspection method.
.7 Identification of product and Specification Section.
.8 Complete test or inspection data.
.9 Test and inspection results and an interpretation of test results.
.10 Record of temperature and weather conditions at time of sample taking and testing and inspecting.

.11 Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
.12 Name and signature of laboratory inspector.
.13 Recommendations on retesting and reinspecting.

.2 Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
.1 Name, address, and telephone number of technical representative making report.
.2 Statement on condition of substrates and their acceptability for installation of product.
.3 Statement that products at Project site comply with requirements.
.4 Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
.5 Results of operational and other tests and a statement of whether observed performance complies with requirements.
.6 Statement whether conditions, products, and installation will affect warranty.
.7 Other required items indicated in individual Specification Sections.

.3 Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
.1 Name, address, and telephone number of factory-authorized service representative making report.
.2 Statement that equipment complies with requirements.
.3 Results of operational and other tests and a statement of whether observed performance complies with requirements.
.4 Statement whether conditions, products, and installation will affect warranty.
.5 Other required items indicated in individual Specification Sections.

.4 Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.9 QUALITY ASSURANCE

.1 General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

.2 Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

.3 Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

.4 Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

.5 Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.

.6 Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
.1 Requirements of authorities having jurisdiction shall supersede requirements for specialists.

.7 Testing Agency Qualifications: An independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.

.8 Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

.9 Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

.10 Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
.1 Contractor responsibilities include the following:
.1 Provide test specimens representative of proposed products and construction.
.2 Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
.3 Provide sizes and configurations of test assemblies, mock-ups, and laboratory mock-ups to adequately demonstrate capability of products to comply with performance requirements.
.4 Build site-assembled test assemblies and mock-ups using installers who will perform same tasks for Project.
.5 Build laboratory mock-ups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
.6 When testing is complete, remove test specimens, assemblies, mock-ups; do not reuse products on Project.
.2 Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Owner's Representative, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

.11 Mock-ups: Before installing portions of the Work requiring mock-ups, build mock-ups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
.1 Build mock-ups in location and of size indicated or, if not indicated, as directed by Owner's Representative.
.2 Notify Owner's Representative seven days in advance of dates and times when mock-ups will be constructed.
.3 Employ supervisory personnel who will oversee mock-up construction. Employ workers that will be employed during the construction at the Project.
.4 Demonstrate the proposed range of aesthetic effects and workmanship.
.5 Obtain Owner's Representative's approval of mock-ups before starting work, fabrication, or construction.
.1 Allow seven days for initial review and each re-review of each mock-up.
.6 Maintain mock-ups during construction in an undisturbed condition as a standard for judging the completed Work.
.7 Demolish and remove mock-ups when directed, unless otherwise indicated.

1.10 QUALITY CONTROL

.1 Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
  .1 Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
  .2 Payment for these services will be made from testing and inspecting allowances, as authorized by Change Orders; or made directly by the Owner.
  .3 Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.

.2 Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.
  .1 Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
  .2 Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
    .1 Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
  .3 Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
  .4 Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in triplicate, of each quality-control service.
  .5 Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
  .6 Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

.3 Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 01 Section *Submittal Procedures*.

.4 Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

.5 Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

.6 Testing Agency Responsibilities: Cooperate with Owner's Representative and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
  .1 Notify Owner's Representative and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
  .2 Determine the location from which test samples will be taken and in which in-situ tests are conducted.
  .3 Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
  .4 Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
  .5 Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
  .6 Do not perform any duties of Contractor.

.7 Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
- .1 Access to the Work.
- .2 Incidental labor and facilities necessary to facilitate tests and inspections.
- .3 Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
- .4 Facilities for storage and field curing of test samples.
- .5 Preliminary design mix proposed for use for material mixes that require control by testing agency.
- .6 Security and protection for samples and for testing and inspecting equipment at Project site.

.8 Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
- .1 Schedule times for tests, inspections, obtaining samples, and similar activities.

.9 Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Coordinate and submit concurrently with Contractor's construction schedule. Update as the Work progresses. .
- .1 Distribution: Distribute schedule to Owner, Owner's Representative, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

.1 Prepare a record of tests and inspections. Include the following:
- .1 Date test or inspection was conducted.
- .2 Description of the Work tested or inspected.
- .3 Date test or inspection results were transmitted to Owner's Representative.
- .4 Identification of testing agency or special inspector conducting test or inspection.

.2 Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for Owner's Representative's reference during normal working hours.

3.2 REPAIR AND PROTECTION

.1 General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
- .1 Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Division 01 Section *Execution*.

.2 Protect construction exposed by or for quality-control service activities.

.3 Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Types of items described in this Section:
   1. References and Codes.

1.3 REFERENCES AND CODES

A. Perform Work in accordance with National Building Code of Canada (NBCC) including all amendments up to tender closing date and other codes of provincial or local application provided that in case of conflict or discrepancy, more stringent requirements apply.

B. Meet or exceed requirements of:
   1. Contract documents.
   2. Specified standards, codes, and referenced documents.

1.4 NATIONAL PARKS ACT

A. For projects located within boundaries of a National Park, perform Work in accordance with National Parks Act.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DEFINITIONS

.1 General: Basic Contract definitions are included in the Conditions of the Contract.

.2 *Approved*: When used to convey Owner's Representative's action on Contractor's submittals, applications, and requests, *approved* is limited to Owner's Representative's duties and responsibilities as stated in the Conditions of the Contract.

.3 *Directed*: A command or instruction by Owner's Representative. Other terms including *requested*, *authorized*, *selected*, *required*, and *permitted* have the same meaning as *directed*.

.4 *Indicated*: Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including *shown*, *noted*, *scheduled*, and *specified* have the same meaning as *indicated*.

.5 *Regulations*: Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

.6 *Furnish*: Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

.7 *Install*: Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

.8 *Provide*: Furnish and install, complete and ready for the intended use.

.9 *Project Site*: Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.3 INDUSTRY STANDARDS

.1 Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

.2 Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

.3 Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

.1 Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.4 ABBREVIATIONS AND ACRONYMS

.1 Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

.1 AA - Aluminium Association, 900 19th Street N.W., Washington, D.C., U.S.A. 20006 URL http://www.aluminum.org

.2 AASHTO - American Association of State Highway and Transportation Officials, 444 N Capitol Street N.W., Suite 249, Washington, D.C., U.S.A. 20001 URL http://www.aashto.org

.3 ACEC Association of Consulting Engineers of Canada,130 Albert Street, Ottawa, ON. K1P 5G4 URL http://www.acec.ca .

.4 AHA - American Hardboard Association, 1210W Northwest Hwy., Palatine, Illinois, U.S.A. 60067 URL : http://www.areat.com

.5 AITC - American Institute of Timber Construction, 7012 S. Revere Parkway, Suite 140, Englewood, Colorado, U.S.A. 80112 URL http://www.aitc-glulam.org

.6 AMCA - Air Movement and Control Association Inc., 30 West University Drive, Arlington Heights, Illinois, U.S.A. 60004-1893 URL http://www.amca.org

.7 ANSI - American National Standards Institute, 11 West 42nd Street, New York, New York, U.S.A. 10036 URL http://www.ansi.org

.8 APA - The Engineered Wood Association, P.O. Box 11700, Tacoma, Washington, U.S.A. 98411-0700 URL http://www.apawood.org

.9 API - American Petroleum Institute,1220 L St. Northwest, Washington, D.C., U.S.A. 20005-4070 URL http://www.api.org

.10 ARI - Air Conditioning and Refrigeration Institute, 4301 North Fairfax Drive, Suite 425, Arlington, Virginia, U.S.A. 22203 URL http://www.ari.org

.11 ASHRAE - American Society of Heating, Refrigeration and Air-Conditioning Engineers, 1791 Tullie Circle NE, Atlanta, Georgia, U.S.A. 30329 URL http://www.ashrae.org

.12 ASME - American Society of Mechanical Engineers, United Engineering Centre, Three Park Avenue, New York, New York, U.S.A. 10016-5990 URL http://www.asme.org

.13 ASPT Association for Asphalt Paving Technologists, 400 Selby Avenue, Suite 1, St. Paul, MN 55102 U.S.A. URL http://www.asphalt.org

.14 ASTM - American Society for Testing and Materials, 100 Barr Harbor Drive West, Conshohocken, Pennsylvania 19428-2959 URL http://www.astm.org

.15 AWCI - Association of the Wall and Ceiling Industries International, 803 West Broad Street, Suite 600, Falls Church, UA, U.S.A. 22046 URL http://www.awci.org

.16 AWMAC - Architectural Woodwork Manufacturers Association of Canada, 516 4 Street West, High River, Alberta T1V 1B6 URL http://www.awmac.com

.17 AWPA - American Wire Producer's Association, 6232 Roudsby, Alexandria, VA U.S.A. 22315-5285 URL http://www.awpa.org

.18 AWPA - American Wood Preservers' Association, P.O. Box 5690, Grandbury Texas, U.S.A. 76049-0690 URL http://www.awap.com

.19 AWS - American Welding Society, 550 N.W. LeJeune Road, Miami, Florida U.S.A. 33126 URL http://www.amweld.org

.20 AWWA - American Water Works Association, 6666 W. Quincy Avenue, Denver, Colorado, U.S.A. 80235 URL http://www.awwa.org

.21 CCA Canadian Construction Association,75 Albert St., Suite 400 Ottawa, Ontario, K1P 5E7 URL http://www.cca-acc.com

.22 CCDC Canadian Construction Documents Committee, Refer to ACEC, CCA, CSC or RAIC

.23 CITC Canadian Institute of Timber Construction, 200 Cooper Street, Ottawa, Ontario K2P 0G1

.24 CFFM - Canadian Forces Fire Marshal, 101 Colonel By Drive, 8NT MGen George R. Pearkes Bldg., Ottawa, Ontario K1A 0K2

.25 CGA - Canadian Gas Association, 20 Eglinton Avenue West, Suite 1305, Toronto, Ontario M4R 1K8 URL http://www.cga.ca

.26 CGSB - Canadian General Standards Board, Place du Portage, Phase III, 6B1, 11 Laurier Street, Hull, Quebec K1A 1G6 URL http://w3.pwgsc.gc.ca/cgsb

.27 CISC - Canadian Institute of Steel Construction, 201 Consumers Road, Suite 300, Willowdale, Ontario M2J 4G8 URL http://www.buildingweb.com/CISC

.28 CLA - Canadian Lumbermen's Association, 27 Goulburn Avenue, Ottawa, Ontario, K1N 8C7 URL http://www.cla.ca.ca

.29 CNLA - Canadian Nursery Landscape Association, RR #4, Stn. Main, 7856 Fifth Street, Milton, Ontario. L9T 2X8 URL http://www.canadanursery.com

.30 CRCA - Canadian Roofing Contractors Association, 155 Queen Street, Suite 130C, Ottawa, Ontario K1P 6L1 URL http://www.roofingcanada.com

.31 CSA - Canadian Standards Association International, 178 Rexdale Blvd., Toronto, Ontario M9W 1R3 URL http://www.csa-international.org

.32 CSC - Construction Specifications Canada, 100 Lombard Street, Suite 200, Toronto, Ontario M5C 1M3 URL http://www.csc-dcc.ca

.33 CSDFMA - Canadian Steel Door and Frame Manufacturing Association One Yonge Street, Suite 1400, Toronto, Ontario M5E 1J9

.34 CSPI - Corrugated Steel Pipe Institute, 201 Consumers Road, Suite 306, Willowdale, Ontario M2J 4G8

.35 CSSBI - Canadian Sheet Steel Building Institute, 652 Bishop St. N., Unit 2A, Cambridge, Ontario N3H 4V6 URL http://www.cssbi.ca

.36 CUFCA Canadian Urethane Foam Contractor's Association

.37 CWC - Canadian Wood Council, 1400 Blair Place, Suite 210, Ottawa, Ontario K1J 9B8 URL http://www.cwc.ca

.38 EC - Environment Canada, Conservation and Protection, Ottawa, Ontario KIA 0H3 URL http://www.ec.gc.ca

.39 EEMAC - Electrical and Electronic Manufacturers' Association of Canada, 5800 Explorer Drive, Suite 200, Mississauga, Ontario L4W 5K9 URL http://www.electrofed.ca

.40 EIMA EIFS Industry Manufacturer's Association, 3000 Corporate Center Drive, Suite 270, Morrow, Georgia U.S.A. 30260 URL http://www.eifsfacts.com

.41 FCC - Fire Commissioner of Canada, Place du Portage, Phase II, 165 rue Hotel de Ville, Hull Quebec K1A 0J2 URL http://www.hrdc-drhc.gc.ca

.42 IEEE - Institute of Electrical and Electronics Engineers, 345 East 47th Street, New York, New York U.S.A. 10017 URL http://www.ieee.org

.43 MPI - The Master Painters Institute, 4090 Graveley Street, Burnaby, BC V5C 3T6 URL http://www.paintinfo.com

.44 MSS - Manufacturers Standardization Society of the Valve and Fittings Industry, 127 Park Street, N.E., Vienna, Virginia U.S.A.22180

.45 NAAMM - National Association of Architectural Metal Manufacturers, 8 South Michigan Avenue, Suite 1000, Chicago, Illinois U.S.A. 60603 URL http://www.naamm.org

.46 NABA - National Air Barrier Association, 400-283 Bannatyne Avenue, Winnipeg, Manitoba R3B 3B2

.47 NEMA - National Electrical Manufacturers Association,1300 N. 17th Street, Suite 1847, Rosslyn, Virginia 22209 URL http://www.nema.org

.48 NFPA - National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101Quincy, Massachusetts, U.S.A. 02269-9101 URL http://www.nfpa.org

.49 NFSA - National Fire Sprinkler Association, 40 Jon Barrett Road, P.O. Box 1000, Patterson, New York, U.S.A. 12563 URL http://www.nfsa.org

.50 NHLA - National Hardwood Lumber Association, P.O. Box 34518, Memphis, Tennessee, U.S.A 38184-0518 URL http://www.natlhardwood.org

.51 NLGA - National Lumber Grades Authority, 406 First Capital Place, New Westminster, B.C. V3M 6G2

.52 NRC - National Research Council, Montreal Road, Ottawa, Ontario K1A 0S2 URL http://www.nrc.gc.ca

.53 NSPE National Society of Professional Engineers, 1420 King Street, Alexandria, VA U.S.A. 22314-2794 URL http://www.nspe.org

.54 PCI - Prestressed Concrete Institute, 209 W. Jackson Blvd., Suite 500, Chicago, Illinois, U.S.A. 60606 URL http://www.pci.org

.55 PEI - Porcelain Enamel Institute, P.O. Box 158541, 4004 Hillsboro Pike, Suite 224-B Nashville, TN, U.S.A. 37215 URL http://www.porecelainenamel.com

.56 QPL - Qualification Program List, c/o Canadian General Standards Board, Place du Portage, Phase III, 6B1, 11 Laurier Street, Hull, Quebec K1A 1G6 URL http://www.pwgsc.gc.ca/cgsb

.57 RAIC Royal Architectural Institute of Canada, 55 Murray Street, Suite 330, Ottawa, Ontario, K1N 5M3 URL http://www.raic.org

.58 SCC - Standards Council of Canada, 200 Albert Street, Suite 2000, Ottawa, Ontario K1P 6N7 URL http://www.scc.ca

.59 SSPC - The Society for Protective Coatings, 40 24th Street, Pittsburgh, Pennsylvania 15222-4656 URL http://www.sspc.org

.60 TPI - Truss Plate Institute, 583 D'Onofrio Drive, Suite 200, Madison, WI, U.S.A. 53719 URL http://www.tpinst.org

.61 TTMAC - Terrazzo, Tile and Marble Association of Canada, 30 Capston Gate, Unit 5 Concord, Ontario L4K 3E8 URL http://www.ttmac.com

.62 UL - Underwriters' Laboratories, 333 Pfingsten Road, Northbrook, Illinois, U.S.A. 60062 URL http://www.ul.com

.63 ULC - Underwriters' Laboratories of Canada, 7 Crouse Road, Toronto, Ontario M1R 3A9 URL http://www.ulc.ca

.2 Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

.1 NBCC – National Building Code of Canada

.2 NFCC – National Fire Code of Canada

.3 NFPA 101 - National Fire protection Association Life Safety Code

.3 Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

.1 PWGSC – Public Works and Government Services Canada

.2 DND – Department of National Defence.

.4 Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

.1 -

.5 Provincial Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

.1 -

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

.1 Types of items described in this Section:
  .1 Requirements for temporary utilities, support facilities, and security and protection facilities.

.2 Types of items you will not find described in this Section:
  .1 Work restrictions and limitations on utility interruptions.
  .2 Disposal of ground water at project site.
  .3 Construction and maintenance of cement concrete pavement for temporary roads and paved areas.

1.3 USE CHARGES

.1 General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's Representative, occupants of Project, testing agencies, and authorities having jurisdiction.

.2 Water and Sewer Service from Existing System: If the Owner has an existing waters system available to use, it is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

.3 Electric Power Service from Existing System: If the Owner has an existing electric power system available to use, it is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.4 SUBMITTALS

.1 Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage, including delivery, handling, and storage provisions for materials subject to water absorption or water damage, discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water damaged Work.

.2 Dust-Control and HVAC-Control Plan: Submit coordination drawing and narrative as required to describe the dust-control and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:
  .1 Locations of dust-control partitions at each phase of the work.
  .2 HVAC system isolation schematic drawing.
  .3 Location of proposed air filtration system discharge.
  .4 Other dust-control measures.
  .5 Waste management plan.

1.5 QUALITY ASSURANCE

.1 Electric Service: Comply with requirements of local utility company and authorities having jurisdiction and regulations for temporary electric service. Install service to comply with National Electrical Code of Canada.

.2 Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

.3 Accessible Temporary Egress: For Work on existing buildings that current has wheel chair access, maintain access.

1.6 PROJECT CONDITIONS

.1 Temporary Use of Permanent Facilities: Engage installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Chain-Link Fencing: Minimum 50 mm , 3.8 mm thick, galvanized steel, chain-link fabric fencing; minimum 1.8 m high with galvanized steel pipe posts; minimum 60 mm OD line posts and 73 mm OD corner and pull posts.

.2 Portable Chain-Link Fencing: Minimum 50 mm , 3.8 mm thick, galvanized steel, chain-link fabric fencing; minimum 1.8 m high with galvanized steel pipe posts; minimum 60 mm OD line posts and 73 mm OD corner and pull posts, with 42 mm OD top and bottom rails. Provide concrete bases for supporting posts.

.3 Wood Enclosure Fence: Plywood, 2.4 m high, framed with four 50-by-100 mm rails, wood posts spaced not more than 2.4 m apart.

.4 Polyethylene Sheet: Reinforced, fire-resistive sheet, 0.25 mm minimum thickness, with flame-spread rating of 15 or less per ASTM E 84.

.5 Dust Control Adhesive-Surface Walk-off Mats: Provide mats minimum 914 by 1624 mm.

.6 Insulation: Unfaced mineral-fibre blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

2.2 TEMPORARY FACILITIES

2.3 EQUIPMENT

.1 Fire Extinguishers: Portable, ULC rated; with class and extinguishing agent as required by locations and classes of fire exposures.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

.1 Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
  .1 Locate facilities to limit site disturbance as specified in Division 01 Section *Summary*.

.2 Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

.1 General: Install temporary service or connect to existing service.
  .1 Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

.2 Sewers and Drainage:
  .1 For work on existing buildings equipped with sufficient sewers and drainage to meet the Owner's needs and the needs for construction, connect to Owner's existing sewers as required.
  .2 For all other projects: Provide service of size and capacity needed for construction to remove effluent lawfully.

.3 Water Service: Install water distribution piping in sizes and pressures adequate for construction.
  .1 For work on existing buildings equipped with an water service to meet the Owner's needs and the needs for construction, connect to Owner's existing water service as required.

.4 Sanitary Facilities:
  .1 For work on existing buildings with adequate sanitary facilities to meet the Owner's need and the needs for construction, Use of Owner's existing sanitary facilities will be permitted, as long as facilities are cleaned and maintained in a condition acceptable to Owner.

.5 Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.
  .1 Prior to commencing work, isolate the HVAC system in area where work is to be performed in accordance with approved coordination drawings.
    .1 Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
    .2 Maintain negative air pressure within work area using HEPA-equipped air filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.
  .2 Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust containment devices.
  .3 Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.

.6 Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
  .1 Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.

.7 Electric Power Service: Provide electric power distribution system of sufficient size, capacity, and power characteristics required for construction operations.
  .1 For work on existing buildings equipped with an adequate electric service to meet the Owner's needs and the needs for construction, connect to Owner's existing electric power service and maintain equipment in a condition acceptable to Owner.

.8 Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
  .1 Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

3.3 SUPPORT FACILITIES INSTALLATION

.1 Parking: Owner does not provide parking for construction personnel. Provide temporary parking areas for construction personnel as needed.

.2 Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel as needed.
.1 Truck cranes and similar devices used for hoisting materials are considered *tools and equipment* and not temporary facilities.

.3 Use of Existing Stairs: For projects where the use of existing stairs is desirable, use of Owner's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.
.1 Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas so no evidence remains of correction work.

.4 Requirements for Temporary Use of Any New Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

.1 Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.

.2 Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

.3 Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as may be required by authorities having jurisdiction.

.4 Covered Walkway: Where the Owner or members of the public must walk immediately adjacent to or through the construction work site and in other locations specifically indicated or required by authorities having jurisdiction erect protective covered walkway for passage of individuals through or adjacent to Project site. Coordinate with entrance gates, other facilities, and obstructions. Comply with regulations of authorities having jurisdiction.
.1 Construct covered walkways using scaffold or shoring framing.
.2 Provide overhead decking, protective enclosure walls, handrails, barricades, warning signs, exit signs, lights, safe and well-drained walkways, and similar provisions for protection and safe passage.
.3 Paint and maintain appearance of walkway for duration of the Work.
.4 Where heating or cooling is needed and permanent enclosure is not complete, insulate temporary enclosures.

.5 Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by Owner and tenants from fumes and noise.
.1 In only locations specifically indicated construct dustproof partitions with gypsum wallboard with joints taped on occupied side.
.2 In all other locations construct dustproof partitions with one layer of 0.15 mm polyethylene sheet. Overlap and tape full length of joints.
.3 Where fire-resistance-rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.
.4 Protect air-handling equipment.
.5 Provide walk-off mats at each entrance through temporary partition.

.6 Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.

.1 Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.

.2 Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

3.5 MOISTURE AND MOLD CONTROL

.1 Contractor's Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.

.2 Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:

.1 Control moisture and humidity inside building by maintaining effective dry-in conditions.

.2 Use permanent HVAC system to control humidity.

.3 Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.

.1 Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48hours are considered defective.

.2 Remove materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.6 OPERATION, TERMINATION, AND REMOVAL

.1 Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

.2 Maintenance: Maintain facilities in good operating condition until removal.

.1 Maintain operation of temporary enclosures, heating, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

.3 Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

.1 At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Division 01 Section *Closeout Procedures*.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

.1 Barriers.

.2 Fire Routes.

1.2 RELATED SECTIONS

.1 Sections 01 51 00 – Temporary Utilities.

.2 Section 01 52 00 – Construction Facilities.

1.3 INSTALLATION AND REMOVAL

.1 Provide temporary controls in order to execute Work expeditiously.

.2 Remove from site all such work after use.

1.4 HOARDING

.1 Erect temporary site enclosures using 38 x 89 mm construction grade lumber framing at 600 mm centres and 1200 x 2400 x 13 mm exterior grade fir plywood to CSA O121.

.2 Apply plywood panels vertically flush and butt jointed.

.3 Provide at least one pedestrian door as directed and conforming. Equip gates with locks and keys.

.4 Erect and maintain pedestrian walkways including roof and side covers, complete with signs and electrical lighting as required by law.

1.5 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.

1.6 ACCESS TO SITE

.1 Provide and maintain access as may be required for access to Work.

1.7 FIRE ROUTES

.1 Maintain access to property including overhead clearances for use by emergency response vehicles.

1.8 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.

1.9 PROTECTION OF BUILDING FINISHES

.1 Provide protection for finished and partially finished building finishes and equipment during performance of Work.

.2 Provide necessary screens, covers, and hoardings.

.3 Confirm with Engineer/Architect locations and installation schedule 3 days prior to installation.

.4 Be responsible for damage incurred due to lack of or improper protection.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

.1 Types of items described in this Section:
  .1 Administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

.2 Types of items you will not find described in this Section:
  .1 Products selected under an allowance.
  .2 Procedures for requests for substitutions.
  .3 Applicable industry standards for products specified.

1.3 DEFINITIONS

.1 Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term *product* includes the terms *material*, *equipment*, *system*, and terms of similar intent.
  .1 Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
  .2 New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
  .3 Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

.2 Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words *basis-of-design product*, including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.4 SUBMITTALS

.1 Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
  .1 Include data to indicate compliance with the requirements specified in *Comparable Products* Article.
  .2 Owner's Representative's Action: If necessary, Owner's Representative will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Owner's Representative will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
    .1 Form of Approval: As specified in Division 01 Section *Submittal Procedures*.
    .2 Use product specified if Owner's Representative does not issue a decision on use of a comparable product request within time allocated.

.2 Basis-of-Design Product Specification Submittal: Comply with requirements in Division 01 Section *Submittal Procedures*. Show compliance with requirements.

1.5 QUALITY ASSURANCE

.1 Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

.2 Delivery and Handling:
- .1 Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
- .2 Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
- .3 Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
- .4 Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

.3 Storage:
- .1 Store products to allow for inspection and measurement of quantity or counting of units.
- .2 Store materials in a manner that will not endanger Project structure.
- .3 Store products that are subject to damage by the elements, under cover in a weather tight enclosure above ground, with ventilation adequate to prevent condensation.
- .4 Store foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
- .5 Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
- .6 Protect stored products from damage and liquids from freezing.
- .7 Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.7 PRODUCT WARRANTIES

.1 Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
- .1 Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
- .2 Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

.2 Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
- .1 Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
- .2 Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.

.3 Refer to Divisions 02 through 49. Sections for specific content requirements and particular requirements for submitting special warranties.

.3 Submittal Time: Comply with requirements in Division 01 Section *Closeout Procedures*.

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

.1 General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
.1 Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
.2 Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
.3 Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
.4 Where products are accompanied by the term *as selected*, Owner's Representative will make selection.
.5 Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
.6 Or Equal: For products specified by name and accompanied by the term *or equal*, or *or approved equal*, or *or approved*, comply with requirements in *Comparable Products* Article to obtain approval for use of an unnamed product.

.2 Product Selection Procedures:
.1 Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
.2 Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
.3 Products:
.1 Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience may be considered at the sole discretion of the Owner's Representative.
.2 Nonrestricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in *Comparable Products* Article for consideration of an unnamed product.
.4 Manufacturers:
.1 Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience may be considered at the sole discretion of the Owner's Representative.
.2 Nonrestricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in *Comparable Products* Article for consideration of an unnamed manufacturer's product.
.5 Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions,

and other characteristics that are based on the product named. Comply with requirements in *Comparable Products* Article for consideration of an unnamed product by one of the other named manufacturers.

.3 Visual Matching Specification: Where Specifications require *match Owner's Representative's sample*, provide a product that complies with requirements and matches Owner's Representative's sample. Owner's Representative's decision will be final on whether a proposed product matches.

.1 If no product available within specified category matches and complies with other specified requirements, comply with requirements in Division 01 Section *Substitution Procedures* for proposal of product.

.4 Visual Selection Specification: Where Specifications include the phrase *as selected by Owner's Representative from manufacturer's full range* or similar phrase, select a product that complies with requirements. Owner's Representative will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

.1 Conditions for Consideration: Owner's Representative will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Owner's Representative may return requests without action, except to record noncompliance with these requirements:

.1 Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.

.2 Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.

.3 Evidence that proposed product provides specified warranty.

.4 List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.

.5 Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

.1 Types of items described in this Section:
  .1 General administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
    .1 Construction layout.
    .2 Field engineering and surveying.
    .3 Installation of the Work.
    .4 Cutting and patching.
    .5 Coordination of Owner-installed products.
    .6 Progress cleaning.
    .7 Starting and adjusting.
    .8 Protection of installed construction.
    .9 Correction of the Work.

.2 Types of items you will not find described in this Section:
  .1 Procedures for submitting surveys.
  .2 Procedures for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.
  .3 Demolition and removal of selected portions of the building.
  .4 Patching penetrations in fire-rated construction.

1.3 DEFINITIONS

.1 Cutting: Removal of in-place construction necessary to permit installation or performance of other work.

.2 Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.4 QUALITY ASSURANCE

.1 Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
  .1 Structural Elements: When cutting and patching structural elements, notify Owner's Representative of locations and details of cutting and await directions from the Owner's Representative before proceeding. Shore, brace, and support structural element during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection
  .2 Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
  .3 Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
  .4 Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Owner's Representative's

opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

.2 Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

.3 Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 General: Comply with requirements specified in other Sections.

.2 In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
.1 If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to the Owner's Representative for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Existing Conditions: The existence and location of utilities and construction indicated as existing are not guaranteed. Before beginning site work, investigate and verify the existence and location of mechanical and electrical systems, and other construction affecting the Work.
.1 Before construction, verify the location and elevation at points of connection of systems.

.2 Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
.1 Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
.2 Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
.3 Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
.4 Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

.1 Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

.2 Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

.3 Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of the Contractor, submit a request for

information to Owner's Representative according to requirements in Division 01 Section *Project Management and Coordination*.

3.3 CONSTRUCTION LAYOUT

.1 Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Owner's Representative promptly.

.2 General: Engage a land surveyor to lay out the Work using accepted surveying practices.
- .1 Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
- .2 Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
- .3 Inform installers of lines and levels to which they must comply.
- .4 Check the location, level and plumb, of every major element as the Work progresses.
- .5 Notify Owner's Representative when deviations from required lines and levels exceed allowable tolerances.
- .6 Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

.3 Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.

.4 Building Lines and Levels: Locate and lay out control lines and levels for structures, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels.

3.4 INSTALLATION

.1 General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
- .1 Make vertical work plumb and make horizontal work level.
- .2 Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
- .3 Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
- .4 Maintain minimum headroom clearance of 2440 mm in occupied spaces and 2300 mm in unoccupied spaces, unless otherwise indicated.

.2 Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

.3 Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

.4 Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

.5 Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

.6 Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
- .1 Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Owner's Representative.
- .2 Allow for building movement, including thermal expansion and contraction.

.3 Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

.7 Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

.8 Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.5 CUTTING AND PATCHING

.1 Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
.1 Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

.2 Temporary Support: Provide temporary support of work to be cut.

.3 Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

.4 Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching in accordance with requirements of Division 01 Section "Summary."

.5 Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.

.6 Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
.1 In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
.2 Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
.3 Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
.4 Excavating and Backfilling: Comply with requirements in applicable Division 31 Sections where required by cutting and patching operations.
.5 Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
.6 Proceed with patching after construction operations requiring cutting are complete.

.7 Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.
.1 Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
.2 Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
.1 Clean piping, conduit, and similar features before applying paint or other finishing materials.
.2 Restore damaged pipe covering to its original condition.

.3 Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

.1 Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

.4 Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.

.5 Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weather tight condition.

.8 Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.6 OWNER-INSTALLED PRODUCTS

.1 Site Access: Provide access to Project site for Owner's construction personnel.

.2 Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.

.1 Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.

.2 Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.7 PROGRESS CLEANING

.1 General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

.1 Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.

.2 Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 27 deg C.

.3 Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

.1 Utilize containers intended for holding waste materials of type to be stored.

.2 Site: Maintain Project site free of waste materials and debris.

.3 Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

.1 Remove liquid spills promptly.

.2 Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

.4 Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

.5 Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

.6 Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

.7 Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Division 01 Section *Construction Waste Management and Disposal*.

.8 During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

.9 Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

.10 Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.8 STARTING AND ADJUSTING

.1 Coordinate startup and adjusting of equipment and operating components with requirements in Division 01 Section *General Commissioning Requirements*.

.2 Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

.3 Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

.4 Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

.5 Manufacturer's Field Service: Comply with qualification requirements in Division 01 Section *Quality Requirements*.

3.9 PROTECTION OF INSTALLED CONSTRUCTION

.1 Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

.2 Comply with manufacturer's written instructions for temperature and relative humidity.

3.10 CORRECTION OF THE WORK

.1 Repair or remove and replace defective construction. Restore damaged substrates and finishes.
.1 Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

.2 Restore permanent facilities used during construction to their specified condition.

.3 Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

.4 Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

.5 Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL

.1 Conduct cleaning and disposal operations to comply with local ordinances and anti- pollution laws.

.2 Store volatile waste in covered metal containers and remove from premises at end of each working day.

.3 Provide adequate ventilation during use of volatile or noxious substances. Use for building ventilation systems is not permitted for this purpose.

1.2 RELATED SECTION

.1 Section 01 77 00 - Closeout Procedures.

1.3 PROJECT CLEANLINESS

.1 Maintain Work in tidy condition, free from accumulation of waste products and debris, other than that caused by Owner or other Contractors.

.2 Remove waste materials and debris from site at the end of each working day. Do not burn waste materials on site.

.3 Clear snow and ice from access to building.

.4 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

.5 Provide on-site containers for collection of waste materials and debris.

.6 Clean interior areas prior to start of finish work, maintain areas free of dust and other contaminants during finishing operations.

.7 Store volatile waste in covered metal containers, and remove from premises at end of each working day.

.8 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.

.9 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.

.10 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

1.4 FINAL CLEANING

.1 Refer to General Conditions.

.2 When Work is Substantially Performed, remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.

.3 Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.

.4 When the Work is Totally Performed, remove surplus products, tools, construction machinery and equipment. Remove waste products and debris other than that caused by the Owner or other Contractors.

.5 Remove waste materials from the site at regularly scheduled times or dispose of as directed by the Engineer/Architect. Do not burn waste materials on site.

.6 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

.7 Leave the work broom clean before the inspection process commences.

.8 Clean and polish glass, mirrors, hardware, wall tile, stainless steel, chrome, porcelain enamel, baked enamel, plastic laminate, and mechanical and electrical fixtures. Replace broken, scratched or disfigured glass.

.9 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fitments, walls, floors and ceilings.

.10 Clean lighting reflectors, lenses, and other lighting surfaces.

.11 Vacuum clean and dust building interiors, behind grilles, louvres and screens.

.12 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.

.13 Remove dirt and other disfiguration from exterior surfaces.

.14 Clean and sweep roofs.

.15 Sweep and wash clean paved areas.

.16 Clean equipment and fixtures to a sanitary condition; clean or replace filters of mechanical equipment.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

.1 Types of items described in this Section:
  .1 Requirement to carry out work placing maximum emphasis on the areas of:
    .1 Waste reduction;
    .2 Diversion of waste from landfill; and
    .3 Material Recycling.

.2 Types of items you will not find described in this Section:
  .1 Environment Procedures.

1.2 WASTE MANAGEMENT PLAN

.1 Prior to commencement of work, prepare waste Management Workplan.

.2 Workplan to include:
  .1 Material source separation process.
  .2 Procedures for sending recyclables to recycling facilities.
  .3 Procedures for sending non-salvageable items and waste to approved waste processing facility or landfill site.
  .4 Training and supervising workforce on waste management at site.

.3 Workplan to incorporate waste management requirements specified herein and in other sections of the Specifications.

.4 Develop Workplan in collaboration with all subcontractors to ensure all waste management issues and opportunities are addressed.

.5 Implement and manage all aspects of Waste Management Workplan for duration of work.

.6 Revise Plan as work progresses addressing new opportunities for diversion of waste from landfill.

1.3 WASTE REDUCTION

.1 Based on waste audit, develop waste reduction program.

.2 Structure program to prioritize actions, with waste reduction as first priority, followed by salvage and recycling effort, then disposal as solid waste.

.3 Identify materials and equipment to be:
  .1 Sent to recycling facility.
  .2 Disposed of in approved landfill site.

1.4 MATERIAL SOURCE SEPARATION PROCESS

.1 Develop and implement material source separation process at commencement of work as part of mobilization and waste management at site.

.2 Provide on-site facilities to collect, handle and store anticipated quantities of reusable, salvageable, and recyclable materials.

.1 Use suitable containers for individual collection of items based on intended purpose.
.2 Locate to facilitate deposit but without hindering daily operations of existing building tenants.
.3 Clearly mark containers and stockpiles as to purpose and use.

.3 Establish methods whereby hazardous and toxic waste materials, and their containers, encountered or used in the course work are properly isolated, stored on site and disposed in accordance with applicable laws and regulations from authorities having jurisdiction.

1.5 WORKER TRAINING AND SUPERVISION

.1 Provide adequate training to workforce, through meetings and demonstrations, to emphasize purpose and worker responsibilities in carrying out the Waste Management Plan.

.2 Post a copy of Plan in a prominent location on site for review by workers.

1.6 DISPOSAL REQUIREMENTS

.1 Burying or burning of rubbish and waste materials is prohibited.

.2 Disposal of waste, volatile materials, mineral spirits, oil, or paint thinner into waterways, storm, or sanitary sewers is prohibited.

.3 Dispose of waste only at approved waste processing facility or landfill sites approved by authority having jurisdiction.

.4 Contact the authority having jurisdiction prior to commencement of work, to determine what, if any, demolition and construction waste materials have been banned from disposal in landfills and at transfer stations. Take appropriate action to isolate such banned materials at site of work and dispose in strict accordance with provincial and municipal regulations.

.5 Transport waste intended for landfill in separated condition, following rules and recommendations of Landfill Operator in support of their effort to divert, recycle and reduce amount of solid waste placed in landfill.

.6 Collect, bundle and transport salvaged materials to be recycled in separated categories and condition as directed by recycling facility. Ship materials only to approved recycling facilities.

.7 Sale of salvaged items by Contractor to other parties not permitted on site.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

.1 Types of items described in this Section:
  .1 Administrative and procedural requirements for contract closeout, including, but not limited to, the following:
    .1 Substantial Completion procedures.
    .2 Final completion procedures.
    .3 Warranties.
    .4 Final cleaning.

.2 Types of items you will not find described in this Section:
  .1 Submitting final completion construction photographic documentation.
  .2 Progress cleaning of project site.
  .3 Operation and maintenance manual requirements.
  .4 Submitting record drawings, record specifications, and record product data.
  .5 Requirements for instructing owner's personnel.
  .6 Divisions 02 through 49 sections for specific closeout and special cleaning requirements for the work in those Sections.

1.3 SUBSTANTIAL COMPLETION

.1 Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete with request.
  .1 Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
  .2 Advise Owner of pending insurance changeover requirements.
  .3 Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
  .4 Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
  .5 Prepare and submit Project Record Documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
  .6 Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
  .7 Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
  .8 Complete startup testing of systems.
  .9 Submit test/adjust/balance records.
  .10 Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
  .11 Advise Owner of changeover in heat and other utilities.
  .12 Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
  .13 Complete final cleaning requirements, including touchup painting.
  .14 Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
  .15 Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.

.2 Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Owner's Representative will either proceed with inspection or notify Contractor of unfulfilled requirements. Owner's Representative will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Owner's Representative, that must be completed or corrected before certificate will be issued.
- .1 Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
- .2 Results of completed inspection will form the basis of requirements for final completion.

1.4 FINAL COMPLETION

.1 Preliminary Procedures: Before requesting final inspection for determining final completion, complete the following:
- .1 Submit a final Application for Payment according to Division 01 Section *Payment Procedures*.
- .2 Submit certified copy of Owner's Representative's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Owner's Representative. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.

.2 Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Owner's Representative will either proceed with inspection or notify Contractor of unfulfilled requirements. Owner's Representative will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
- .1 Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

.1 Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
- .1 Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
- .2 Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
- .3 Include the following information at the top of each page:
  - .1 Project name.
  - .2 Date.
  - .3 Name of Owner's Representative.
  - .4 Name of Contractor.
  - .5 Page number.
- .4 Submit list of incomplete items in the following format:
  - .1 Three paper copies of product schedule or list, unless otherwise indicated.

1.6 WARRANTIES

.1 Submittal Time: Submit written warranties on request of Owner's Representative for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.

.2 Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
- .1 Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 215-by-280-mm paper.

.2 Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.

.3 Identify each binder on the front and spine with the typed or printed title *WARRANTIES*, Project name, and name of Contractor.

.3 Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

.1 Use cleaning products that meet Green Seal GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 FINAL CLEANING

.1 General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

.2 Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

.1 Complete the following cleaning operations, as applicable to the project, before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:

.1 Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.

.2 Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.

.3 Rake grounds that are neither planted nor paved to a smooth, even-textured surface.

.4 Remove tools, construction equipment, machinery, and surplus material from Project site.

.5 Remove snow and ice to provide safe access to building.

.6 Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.

.7 Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.

.8 Sweep concrete floors broom clean in unoccupied spaces.

.9 Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.

.10 Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.

.11 Remove labels that are not permanent.

.12 Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.

.1 Do not paint over *ULC* and other required labels and identification, including mechanical and electrical nameplates.

.13 Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.

.14 Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.

.15 Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.

.16 Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.

.17 Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter upon inspection.

.1 Clean HVAC system in compliance with NADCA Standard 1992-01. Provide written report upon completion of cleaning upon request.

.18 Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

.19 Leave Project clean and ready for occupancy.

.20 If final cleaning is not to a standard acceptable to the owner, the owner, with prior notice to the contractor, may opt to have owners cleaning staff perform final cleaning at a cost to the contractor. Full owner burden rates will apply.

.3 Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid Project of rodents, insects, and other pests if pest problems are suspected by the Owner's Representative. Prepare a report.

.4 Construction Waste Disposal: Comply with waste disposal requirements in Division 01 Section *Construction Waste Management and Disposal*.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

.1 Types of items described in this Section:
  .1 Administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
    .1 Operation and maintenance documentation directory.
    .2 Operation manuals for systems, subsystems, and equipment.
    .3 Product maintenance manuals.
    .4 Systems and equipment maintenance manuals.

.2 Types of items you will not find described in this Section:
  .1 Emergency manuals.
  .2 Procedures for submitting copies of submittals for operation and maintenance manuals.
  .3 Requirements for verification and compilation of data into operation and maintenance manuals.

1.3 DEFINITIONS

.1 System: An organized collection of parts, equipment, or subsystems united by regular interaction.

.2 Subsystem: A portion of a system with characteristics similar to a system.

1.4 CLOSEOUT SUBMITTALS

.1 Manual Content: Operations and maintenance manual content is specified in individual specification sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
  .1 Where applicable, clarify and update reviewed manual content to correspond to modifications and field conditions.

.2 Format: Submit operations and maintenance manuals in the following format:
  .1 PDF electronic file. Assemble each manual into a composite electronically-indexed file. Submit on digital media acceptable to Owner's Representative.
    .1 Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically-linked operation and maintenance directory.
    .2 Enable inserted reviewer comments on draft submittals.
  .2 One paper copy. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. Owner's Representative will return one copy.

.3 Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Owner's Representative will comment on whether general scope and content of manual are acceptable.

.4 Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Owner's Representative will return copy with comments.

.1 Correct or modify each manual to comply with Owner's Representative's comments. Submit copies of each corrected manual within 15 days of receipt of Owner's Representative's comments and prior to commencing demonstration and training.

.5 Close-out submittal procedures are to be in conjunction with Memorial University's Stipulated Price Contract General Conditions.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

.1 Organization: Include a section in the directory for each of the following:
- .1 List of documents.
- .2 List of systems.
- .3 List of equipment.
- .4 Table of contents.

.2 List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

.3 List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

.4 Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

.5 Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, *Preparation of Operating and Maintenance Documentation for Building Systems*.

2.2 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

.1 Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
- .1 Title page.
- .2 Table of contents.
- .3 Manual contents.

.2 Title Page: Include the following information:
- .1 Subject matter included in manual.
- .2 Name and address of Project.
- .3 Name and address of Owner.
- .4 Date of submittal.
- .5 Name and contact information for Contractor.
- .6 Name and contact information for Owner's Representative.
- .7 Name and contact information for Commissioning Agent.
- .8 Names and contact information for major consultants to the Owner's Representative that designed the systems contained in the manuals.
- .9 Cross-reference to related systems in other operation and maintenance manuals.

.3 Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
.1 If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

.4 Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

.5 Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
.1 Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
.2 File Names and Bookmarks: Enable bookmarking of individual documents based upon file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel upon opening file.

.6 Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.
.1 Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 215-by-280 mm paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
.1 If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
.2 Identify each binder on front and spine, with printed title *OPERATION AND MAINTENANCE MANUAL*, Project title or name, subject matter of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.
.2 Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
.3 Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
.4 Supplementary Text: Prepared on 215-by-280 mm white bond paper.
.5 Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
.1 If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
.2 If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.3 OPERATION MANUALS

.1 Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
.1 System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
.2 Performance and design criteria if Contractor is delegated design responsibility.
.3 Operating standards.
.4 Operating procedures.

.5 Operating logs.
.6 Wiring diagrams.
.7 Control diagrams.
.8 Piped system diagrams.
.9 Precautions against improper use.
.10 License requirements including inspection and renewal dates.

.2 Descriptions: Include the following:
.1 Product name and model number. Use designations for products indicated on Contract Documents.
.2 Manufacturer's name.
.3 Equipment identification with serial number of each component.
.4 Equipment function.
.5 Operating characteristics.
.6 Limiting conditions.
.7 Performance curves.
.8 Engineering data and tests.
.9 Complete nomenclature and number of replacement parts.

.3 Operating Procedures: Include the following, as applicable:
.1 Startup procedures.
.2 Equipment or system break-in procedures.
.3 Routine and normal operating instructions.
.4 Regulation and control procedures.
.5 Instructions on stopping.
.6 Normal shutdown instructions.
.7 Seasonal and weekend operating instructions.
.8 Required sequences for electric or electronic systems.
.9 Special operating instructions and procedures.

.4 Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

.5 Piped Systems: Diagram piping as installed, and identify colour-coding where required for identification.

2.4 PRODUCT MAINTENANCE MANUALS

.1 Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

.2 Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

.3 Product Information: Include the following, as applicable:
.1 Product name and model number.
.2 Manufacturer's name.
.3 Colour, pattern, and texture.
.4 Material and chemical composition.
.5 Reordering information for specially manufactured products.

.4 Maintenance Procedures: Include manufacturer's written recommendations and the following:

.1 Inspection procedures.
.2 Types of cleaning agents to be used and methods of cleaning.
.3 List of cleaning agents and methods of cleaning detrimental to product.
.4 Schedule for routine cleaning and maintenance.
.5 Repair instructions.

.5 Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

.6 Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
.1 Include procedures to follow and required notifications for warranty claims.

2.5 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

.1 Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

.2 Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

.3 Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
.1 Standard maintenance instructions and bulletins.
.2 Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
.3 Identification and nomenclature of parts and components.
.4 List of items recommended to be stocked as spare parts.

.4 Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
.1 Test and inspection instructions.
.2 Troubleshooting guide.
.3 Precautions against improper maintenance.
.4 Disassembly; component removal, repair, and replacement; and reassembly instructions.
.5 Aligning, adjusting, and checking instructions.
.6 Demonstration and training video recording, if available.

.5 Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
.1 Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
.2 Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

.6 Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

.7 Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

.8 Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
.1 Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

.1 Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

.2 Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
.1 Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
.2 Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

.3 Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
.1 Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

.4 Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
.1 Do not use original project record documents as part of operation and maintenance manuals.
.2 Comply with requirements of newly prepared record Drawings in Division 01 Section *Project Record Documents*.

.5 Comply with Division 01 Section *Closeout Procedures* for schedule for submitting operation and maintenance documentation.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

.1 Types of items described in this Section:
  .1 Administrative and procedural requirements for project record documents, including the following:
    .1 Record Drawings.

.2 Types of items you will not find described in this Section:
  .1 Record specifications.
  .2 Record product data.
  .3 Miscellaneous record submittals.
  .4 Final property survey.
  .5 General closeout procedures.
  .6 Operation and maintenance manual requirements.

1.3 CLOSEOUT SUBMITTALS

.1 Record Drawings: Comply with the following:
  .1 Number of Copies: Submit two set(s) of marked-up record prints.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

.1 Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings.
  .1 Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
    .1 Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
    .2 Accurately record information in an acceptable drawing technique.
    .3 Record data as soon as possible after obtaining it.
    .4 Record and check the markup before enclosing concealed installations.
    .5 Cross-reference record prints to corresponding archive photographic documentation.
  .2 Content: Types of items requiring marking include, but are not limited to, the following:
    .1 Dimensional changes to Drawings.
    .2 Revisions to details shown on Drawings.
    .3 Depths of foundations below first floor.
    .4 Locations and depths of underground utilities.
    .5 Revisions to routing of piping and conduits.
    .6 Revisions to electrical circuitry.
    .7 Actual equipment locations.
    .8 Duct size and routing.
    .9 Locations of concealed internal utilities.
    .10 Changes made by Change Order or Construction Change Directive.

.11 Changes made following Owner's Representative's written orders.
.12 Details not on the original Contract Drawings.
.13 Field records for variable and concealed conditions.
.14 Record information on the Work that is shown only schematically.

.3 Mark the Contract Drawings and Shop Drawings completely and accurately. Utilize personnel proficient at recording graphic information in production of marked-up record prints.

.4 Mark record sets with erasable, red-coloured pencil. Use other colors to distinguish between changes for different categories of the Work at same location.

.5 Mark important additional information that was either shown schematically or omitted from original Drawings.

.6 Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

.2 Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

.1 Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Owner's Representative's reference during normal working hours.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

.1 Types of items described in this Section:
  .1 Administrative and procedural requirements for instructing Owner's personnel, including the following:
    .1 Demonstration of operation of systems, subsystems, and equipment.
    .2 Training in operation and maintenance of systems, subsystems, and equipment.

.2 Types of items you will not find described in this Section:
  .1 Demonstration and training video recordings.
  .2 Divisions 02 through 49 Sections for specific requirements for demonstration and training for products in those Sections.

1.3 SUBMITTALS

.1 Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

.2 Attendance Record: For each training module, submit list of participants and length of instruction time.

1.4 QUALITY ASSURANCE

.1 Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 01 Section *Quality Requirements*, experienced in operation and maintenance procedures and training.

.2 Pre-instruction Conference: Conduct conference at Project site to comply with requirements in Division 01 Section *Project Management and Coordination*. Review methods and procedures related to demonstration and training including, but not limited to, the following:
  .1 Inspect and discuss locations and other facilities required for instruction.
  .2 Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
  .3 Review required content of instruction.
  .4 For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.5 COORDINATION

.1 Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations.

.2 Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

.3 Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Owner's Representative.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

.1 Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

.2 Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:

.1 Basis of System Design, Operational Requirements, and Criteria: Include the following:

.1 System, subsystem, and equipment descriptions.
.2 Operating standards.
.3 Regulatory requirements.
.4 Equipment function.
.5 Operating characteristics.
.6 Limiting conditions.
.7 Performance curves.

.2 Documentation: Review the following items in detail:

.1 Emergency manuals.
.2 Operations manuals.
.3 Maintenance manuals.
.4 Project record documents.
.5 Identification systems.
.6 Warranties and bonds.
.7 Maintenance service agreements and similar continuing commitments.

.3 Emergencies: Include the following, as applicable:

.1 Instructions on meaning of warnings, trouble indications, and error messages.
.2 Instructions on stopping.
.3 Shutdown instructions for each type of emergency.
.4 Operating instructions for conditions outside of normal operating limits.
.5 Sequences for electric or electronic systems.
.6 Special operating instructions and procedures.

.4 Operations: Include the following, as applicable:

.1 Startup procedures.
.2 Equipment or system break-in procedures.
.3 Routine and normal operating instructions.
.4 Regulation and control procedures.
.5 Control sequences.
.6 Safety procedures.
.7 Instructions on stopping.
.8 Normal shutdown instructions.
.9 Operating procedures for emergencies.
.10 Operating procedures for system, subsystem, or equipment failure.
.11 Seasonal and weekend operating instructions.
.12 Required sequences for electric or electronic systems.
.13 Special operating instructions and procedures.

.5 Adjustments: Include the following:

.1 Checking adjustments.

.6 Troubleshooting: Include the following:

.1 Diagnostic instructions.
.2 Test and inspection procedures.

.7 Maintenance: Include the following:
- .1 Inspection procedures.
- .2 Procedures for preventive maintenance.
- .3 Procedures for routine maintenance.
- .4 Instruction on use of special tools.

.8 Repairs: Include the following:
- .1 Diagnosis instructions.
- .2 Repair instructions.
- .3 Disassembly; component removal, repair, and replacement; and reassembly instructions.
- .4 Instructions for identifying parts and components.
- .5 Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION

.1 Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Division 01 Section *Operations and Maintenance Data*.

.2 Set up instructional equipment at instruction location.

3.2 INSTRUCTION

.1 Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
- .1 Owner will furnish Contractor with names and positions of participants.

.2 Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
- .1 Schedule training with Owner, through Owner's Representative, with at least seven days' advance notice.

.3 Cleanup: Collect used and leftover educational materials and remove from Project site. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

.1 Types of items described in this Section:
- .1 Demolition and removal of selected portions of building or structure.
- .2 Demolition and removal of selected site elements.
- .3 Salvage of existing items to be reused or recycled.

.2 Types of items you will not find described in this Section:
- .1 Use of premises, and phasing, and Owner-occupancy requirements.
- .2 Photographic Documentation for preconstruction photographs taken before selective demolition operations.
- .3 Temporary Facilities and Controls for temporary construction and environmental-protection measures for selective demolition operations.
- .4 Cutting and Patching for cutting and patching procedures.
- .5 Construction Waste Management and Disposal for disposal of demolished materials.

1.2 DEFINITIONS

.1 Remove: 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 to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.3 MATERIALS OWNERSHIP

.1 Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to Owner that may be encountered during selective demolition remain Owner's property. Carefully remove and salvage each item or object in a manner to prevent damage and deliver promptly to Owner.
- .1 Coordinate with Owner's archaeologist, who will establish special procedures for removal and salvage.

1.4 SUBMITTALS

.1 Schedule of Selective Demolition Activities: Indicate the following:
- .1 Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's building managers and other tenants' on-site operations are uninterrupted.
- .2 Interruption of utility services. Indicate how long utility services will be interrupted.
- .3 Coordination for shutoff, capping, and continuation of utility services.
- .4 Use of elevator and stairs.
- .5 Locations of proposed dust- and noise-control temporary partitions and means of egress, including for other tenants affected by selective demolition operations.
- .6 Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
- .7 Means of protection for items to remain and items in path of waste removal from building.

.2 Inventory: After selective demolition is complete, submit a list of items that have been removed and salvaged.

.3 Predemolition Photographs or Videotapes: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by selective demolition operations. Comply with Division 01 Section *Photographic Documentation*. Submit before Work begins.

.4 Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.
.1 Comply with submittal requirements in Division 01 Section "*Construction Waste Management and Disposal*."

1.5 QUALITY ASSURANCE

.1 Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.

.2 Standards: Comply with ANSI A10.6, NFPA 241, NBCC, and NFCC.

.3 Predemolition Conference: Conduct conference at Project site to comply with requirements in Division 01 Section *Project Management and Coordination*. Review methods and procedures related to selective demolition including, but not limited to, the following:
.1 Inspect and discuss condition of construction to be selectively demolished.
.2 Review structural load limitations of existing structure.
.3 Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
.4 Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
.5 Review areas where existing construction is to remain and requires protection.

1.6 PROJECT CONDITIONS

.1 Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
.1 Comply with requirements specified in Division 01 Section *Summary*.

.2 Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

.3 Notify Owner's Representative of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

.4 Hazardous Materials: It may be possible hazardous materials could be present in construction to be selectively demolished. A report on the presence of hazardous materials is attached for review and use (If no report is attached, request clarification from Owner's Representative. Examine report to become aware of locations where hazardous materials are present.
.1 Hazardous material remediation is specified elsewhere in the Contract Documents.
.2 Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.

.5 Storage or sale of removed items or materials on-site is not permitted.

.6 Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
.1 Maintain fire-protection facilities in service during selective demolition operations.

1.7 WARRANTY

.1 Existing Warranties: 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.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verify that utilities have been disconnected and capped.

.2 Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

.3 Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.

.4 When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Owner's Representative.

.5 Engage a experienced trades to survey condition of items to be demolished to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of system or structure or adjacent structures during selective demolition operations. Provide temporary supports.

.6 Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs.
.1 Comply with requirements specified in Division 01 Section "*Photographic Documentation*."
.2 Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

.7 Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

.1 Existing Services/Systems: Maintain services/systems indicated to remain and protect them against damage during selective demolition operations.
.1 Comply with requirements for existing services/systems interruptions specified in Division 01 Section *Summary*.

.2 Service/System Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
.1 Arrange to shut off indicated utilities with Annex.
.2 If services/systems are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
.3 Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.
.1 Where entire wall is to be removed, existing services/systems may be removed with removal of the wall.

3.3 PREPARATION

.1 Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with walkways, and other adjacent occupied and used facilities.
  .1 Comply with requirements for access and protection specified in Division 01 Section *Temporary Facilities and Controls*.

.2 Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
  .1 Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
  .2 Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
  .3 Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
  .4 Cover and protect furniture, furnishings, and equipment that have not been removed.
  .5 Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Division 01 Section *Temporary Facilities and Controls*.

.3 Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
  .1 Strengthen or add new supports when required during progress of selective demolition.

3.4 SELECTIVE DEMOLITION, GENERAL

.1 General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
  .1 Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
  .2 Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
  .3 Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
  .4 Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
  .5 Maintain adequate ventilation when using cutting torches.
  .6 Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
  .7 Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
  .8 Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
  .9 Dispose of demolished items and materials promptly. Comply with requirements in Division 01 Section *Construction Waste Management and Disposal*.

.2 Reuse of Building Elements: Project has been designed to result in end-of-Project rates for reuse of building elements as follows. Do not demolish building elements beyond what is indicated on Drawings without Owner's Representative's approval.

.3 Removed and Salvaged Items:
- .1 Clean salvaged items.
- .2 Pack or crate items after cleaning. Identify contents of containers.
- .3 Store items in a secure area until delivery to Owner.
- .4 Transport items to Owner's storage area designated by Owner.
- .5 Protect items from damage during transport and storage.

.4 Removed and Reinstalled Items:
- .1 Clean and repair items to functional condition adequate for intended reuse. Paint equipment to match new equipment.
- .2 Pack or crate items after cleaning and repairing. Identify contents of containers.
- .3 Protect items from damage during transport and storage.
- .4 Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

.5 Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Owner's Representative, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

.1 Concrete: Demolish in small sections. Cut concrete to a depth of at least 19 mm at junctures with construction to remain, using power-driven saw. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete indicated for selective demolition. Neatly trim openings to dimensions indicated.

.2 Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals, using power-driven saw, then remove concrete between saw cuts.

.3 Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.

.4 Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.

.5 Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI-WP and its Addendum.
- .1 Remove residual adhesive and prepare substrate for new floor coverings by one of the methods recommended by RFCI.

.6 Roofing: Remove no more existing roofing than can be covered in one day by new roofing and so that building interior remains watertight and weather tight. Refer to Division 07 for new roofing requirements.
- .1 Remove existing roof membrane, flashings, copings, and roof accessories.
- .2 Remove existing roofing system down to substrate.

.7 Air-Conditioning Equipment: Remove equipment without releasing refrigerants.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

.1 General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an approved landfill.
  .1 Do not allow demolished materials to accumulate on-site.
  .2 Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
  .3 Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
  .4 Comply with requirements specified in Division 01 Section *Construction Waste Management and Disposal*.

.2 Burning: Do not burn demolished materials.

.3 Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.7 CLEANING

.1 Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

.1 This Section includes:

- .1 Demolition and removal of selected portions of interior building components and finishes.
- .2 Repair procedures for selective demolition operations.

.2 This section does not include:

- .1 Removal of hazardous materials or asbestos abatement.
- .2 Demolition of exterior building components or structural elements.
- .3 Mechanical or electrical equipment, except as required to make minor modifications to allow the work to be completed.

1.2 RELATED SECTIONS

.1 Section 01 11 00 – Summary of Work

.2 Section 01 35 29.06 - Health and Safety Requirements

.3 Section 01 35 43 - Environmental Procedures

.4 Section 01 52 00 – Construction Facilities

.5 Section 01 56 00 - Temporary Barriers and Enclosures

.6 Section 01 74 21 – Construction/Demolition Waste Management and Disposal

.7 Section 02 41 13- Selective Site Demolition.

1.3 REFERENCES

.1 American National Standards Institute (ANSI)

- .1 ANSI A10.8, Safety Requirements for Scaffolding.

.2 CSA Group (CSA)

- .1 CSA S350, Code of Practice for Safety in Demolition of Structures.

.3 National Fire Protection Association (NFPA)

- .1 NFPA 241 13, Standard for Safeguarding Construction, Alteration, and Demolition Operations

1.4 DEFINATIONS

.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.

.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 Substances: Dangerous substances, dangerous goods, hazardous commodities and hazardous products may include asbestos, mercury and lead, PCB s, poisons, corrosive agents, flammable substances, radioactive substances, or other material that can endanger human health or wellbeing or environment if handled improperly as defined by the Federal Hazardous Products Act (RSC 1985) including latest amendments.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property. Demolished materials shall become Contractor's property and shall be removed from Project site.

.2 Coordinate selective demolition work so that work of this Section adheres to aesthetic criteria established by the Drawings and specified dimensions with all elements in planes as drawn, maintaining their relationships with all other building elements.

.3 Pre Demolition Meeting: Convene pre-installation meeting one (1) week prior to beginning work of this Section, with Owner to:

.1 Confirm extent of salvaged and demolished materials.

.2 Review Contractor's demolition plan:

.1 Verify existing site conditions adjacent to demolition work.

.2 Coordination with other construction sub trades.

1.6 ACTION AND INFORMATION SUBMITTALS

.1 Provide the following submittals before starting any work of this Section:

.1 Schedule of Selective Demolition Activities:

.1 Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity.

.2 Coordinate with Owner ongoing site operations, and limit the number of interruptions during regular business hours.

.3 Interruption of utility services.

.4 Coordination for shutoff, capping, and continuation of utility services.

.5 Use of elevator and stairs.

.6 Locations of temporary partitions and means of egress, including for others affected by selective demolition operations.

.7 Coordination with Owner continuing occupancy of portions of existing building and of partial occupancy of completed Work.

.2 Demolition Plan: Submit a plan of demolition area indicating extent of temporary facilities and supports, methods of removal and demolition prepared by a professional engineer in accordance with requirements of Authority Having Jurisdiction, and as follows:

.1 Proposed Noise Control and Dust Control Measures: Submit statement or drawing that indicates the measures proposed for use, proposed locations, and proposed time frame for their operation. Owner reserves the right to make modifications where proposed methods interfere with the Owner's ongoing operation.

.2 Inventory: Submit a list of items that have been removed and salvaged after selective demolition is complete.

1.7 SITE CONDITIONS

.1 Owner will occupy portions of building immediately adjacent to selective demolition area:

.1 Conduct selective demolition so that Owner's operations will not be disrupted.

.2 Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.

.2 Maintain access to existing means of egress, walkways, corridors, exits, and other adjacent occupied or used facilities:

.1 Do not close or obstruct means of egress, walkways, corridors, exits, or other occupied or used facilities without written acceptance from authorities having jurisdiction.

.3 Discovery of Hazardous Substances:

.1 It is not expected that Hazardous Substances will be encountered in the Work. Immediately notify Owner if materials suspected of containing hazardous substances are encountered.

.4 Hazardous Substances:

.1 Hazardous Substances are present in building to be selectively demolished. A report on the presence of Hazardous Substances is attached as an information document to this Specification for review and use. Examine report to become

aware of locations where hazardous materials are present. Coordinate removal of hazardous materials as per appropriate sections of this specification.

PART 2 PRODUCTS

2.1 TEMPORARY SUPPORT STRUCTURES

.1 Design temporary support structures required for demolition work and underpinning and other foundation supports necessary for the project using a qualified professional engineer registered or licensed in Province of Newfoundland and Labrador.

2.2 DESCRIPTION

.1 This section of the Work includes, but is not necessarily limited to, the following:

.1 Demolition, removal completely from site, and disposal of all identified components, materials, equipment and debris.

.2 Selective demolition to allow new walls, bulkheads, ceilings and other materials to meet existing construction as indicated.

.3 All material from demolition shall be removed from site immediately with no salvage, selling, sorting or burning permitted on site.

.4 Retain items indicated on drawings for re use in new construction.

2.3 DEBRIS

.1 Make all arrangements for transport and disposal of all demolished materials from the site.

2.4 EQUIPMENT

.1 Provide all equipment required for safe and proper demolition of the building interiors indicated.

2.5 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 Floor Patching and Levelling Compounds: Cement based, trowelable, self levelling compounds compatible with specified floor finishes; gypsum based products are not acceptable for work of this Section.

.3 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.

.4 Gypsum Board Patching Compounds: Joint compound to ASTM C475/C475M, bedding and finishing types thinned to provide skim coat consistency to patch and prepare existing gypsum board walls ready for new finishes in accordance with Section 09 21 16 – Gypsum Board Assemblies.

.5 Hoarding and Dust Screens: Refer to Sections 01 35 99 – Dust Control Procedures and 01 56 00 - Temporary Barriers and Enclosures for stud framing and gypsum board sheathing materials.

PART 3 EXECUTION

3.1 EXAMINATION

.1 Verify that utilities have been disconnected and capped.

.2 Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

.3 Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.

.4 Notify the Owner where existing mechanical, electrical, or structural elements conflict with intended function or design:

.1 Investigate and measure the nature and extent of conflict and submit a written report to Owner.

.2 Owner will issue additional instructions or revise drawings as required to correct conflict.

.5 Perform surveys as the work progresses to detect hazards resulting from selective demolition activities.

3.2 UTILITY SERVICES

.1 Coordinate existing services indicated to remain and protect them against damage during selective demolition operations.

.2 Locate, identify, disconnect, and seal or cap off indicated utilities serving areas to be selectively demolished.

.1 Arrange to shut off affected utilities with utility companies.

.2 If utility services are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary utilities that bypass area of selective demolition and that maintain continuity of service to other parts of building.

.3 Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.

.4 Cut off pipe or conduit to a minimum of 25 mm below slab, and remove concrete mound. Patch concrete using cementitious grout.

.3 Coordinate with Mechanical and Electrical Divisions for shutting off, disconnecting, removing, and sealing or capping utilities.

.4 Do not start selective demolition work until utility disconnecting and sealing have been completed and verified in writing.

3.3 PREPARATION

.1 Identify and mark all equipment and materials identified to be retained by Owner or to be re used in subsequent construction. Separate and store items to be retained in an area away from area of demolition and protect from accidental disposal.

.2 Post warning signs on electrical lines and equipment that must remain energized to serve other areas during period of demolition.

.3 Confirm that all electrical and telephone service lines entering buildings are not disconnected.

.4 Do not disrupt active or energized utilities crossing the demolition site.

.5 Provide and maintain barricades, warning signs, protection for workmen and the public during the full extent of the Work. Read drawings carefully to ascertain extent of protection required.

.6 Mark all materials required to be re used, store in a safe place until ready for re installation.

.7 Adjust all junction boxes, receptacles and switch boxes flush with new wall construction where additional layers to existing construction are indicated.

.8 Remove permanent marker lines used or found on exposed surfaces and at surfaces indicated for subsequent finish materials. Mechanically remove permanent marker lines and associated substrates where permanent marker lines occur and patch surface. Sealing or priming over permanent marker lines is not acceptable.

3.4 CONCRETE SLAB REINFORCING

.1 Locate location of reinforcing steel in concrete slabs prior to cutting or coring using non destructive, non ionizing radio frequency locators.

.2 Core concrete slabs to avoid reinforcing steel, electrical conduit or water pipes; adjust core location and coordinate with Engineer where slab features interfere with core drilling.

.3 Notify the Owner immediately for further instructions where coring or cutting will damage existing slab features.

3.5 SELECTIVE DEMOLITION

.1 Demolish and dismantle work in a neat and orderly manner and in strict accordance with all regulations.

.2 At end of each day s work, leave Work in safe condition so that no part is in danger of toppling or falling.

.3 Demolish in a manner to minimize dusting and to prevent migration of dust.

.4 Selling or burning of materials on the site is not permitted.

.5 Remove concrete bases by cutting and chipping, take precautions against slab cracking and degradation. Grind edges smooth, fill and make level with self levelling grout.

.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 Demolish existing carpet, resilient flooring and adhesive remnants as follows:

.1 Vacuum existing carpet thoroughly, prior to removal, using vacuum equipped with power head/sweeper.

.2 Apply fine mist water spray to carpet as required to minimize dust generation during removal. Avoid spraying near electrical outlets.

.3 Demolish existing carpet and resilient floor finishes, remove and dispose of off site.

.4 Remove adhesive to the greatest extent possible using scrapping tools and as follows:

.1 Do not use solvent based cleaners to remove adhesive remnants.

.2 Lightly shot blast or grind floor using machine designed for purpose to remove adhesive remnants.

.3 Vacuum floor ready for application of skim coating.

.4 Repair all slab depressions and damage with cementitious patching compound.

.5 Skim coat floor with minimum 1 mm thick cementitious floor underlayment compatible with new flooring materials.

.5 Floor substrate shall be smooth, free from ridges and depressions, and adhesive remnants that could telegraph through resilient flooring materials and carpets.

.9 Demolish existing ceramic tile finishes. Remove setting bed or adhesive to the greatest extent possible using mechanical scrapping tools and as follows:

.1 Saw cut edge of tile for clean and even transition joint between existing tile to remain and new flooring materials

.2 Lightly shot blast or grind floor to remove remnants of setting materials

.3 Vacuum floor ready for application of skim coating

.4 Repair all slab depressions and damage with cementitious patching compound. Skim coat floor with minimum 1 mm thick cementitious floor underlayment compatible with new flooring materials

.10 Demolish completely all ceiling panels and grid as indicated.

.11 Remove all wall coverings scheduled for demolition. Patch and repair wall surfaces with skim coat of gypsum board joint compound leaving wall surfaces smooth and even ready for new wall finishes.

.12 Patch and repair all walls, floor and ceilings damaged during demolition with material matching adjacent walls, prepare ready for new finishes.

.13 Patch and repair all radiation cabinets, mechanical equipment and electrical fixtures damaged or exposed during demolition to match adjacent finished surfaces.

3.6 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 a 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 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.

.7 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.

3.7 PROTECTION

.1 Prevent debris from blocking drainage inlets and systems and ground draining, and protect material and electrical systems and services that must remain in operation.

.2 Arrange demolition and shoring work so that interference with the use of adjoining areas by the Owner and users is minimized.

.3 Maintain safe access to and egress from occupied areas adjoining.

.4 Provide and maintain fire prevention equipment and alarms accessible during demolition.

3.8 CLEANING

.1 Promptly as the Work progresses, and on completion, clean up and remove from the site all rubbish and surplus material. Remove rubbish resulting from demolition work daily.

.2 Maintain access to exits clean and free of obstruction during removal of debris.

.3 Keep surrounding and adjoining roads, lanes, sidewalks, municipal rights of way clean and free of dirt, soil or debris that may be a hazard to vehicles or persons.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

.1 Types of items described in this Section:
- .1 Removal as specified of spray or trowel applied asbestos containing material located at site except where removal is considered impracticable by Owner's Representative.
- .2 Encapsulation as specified of spray or trowel applied asbestos containing material located at site where removal is considered by Owner's Representative to be impracticable.
- .3 Encapsulation of areas where asphaltic adhesive coating under spray or trowel applied asbestos containing material prevents complete removal of spray or trowel applied asbestos containing material.
- .4 Enclosure as specified of spray or trowel applied asbestos containing material located at site.
- .5 Removal (other than defined minor amounts) of friable materials containing asbestos.
- .6 Removal of amosite or crocidolite asbestos containing materials.
- .7 Use of power tools that are fitted with dust collectors equipped with HEPA filter to cut, shape, grind, drill, scrape, or abrade manufactured products containing asbestos.
- .8 Cleaning, maintaining, or removal of air handling equipment in buildings where sprayed fireproofing materials containing asbestos have been applied.

.2 Types of items you will not find described in this Section:
- .1 Submittal Procedures.
- .2 Health and Safety Requirements.
- .3 Construction/Demolition Waste Management and Disposal.
- .4 Applied Fireproofing.

.3 References
- .1 Canadian General Standards Board (CGSB).
  - .1 CAN/CGSB-1.205-94, Sealer for Application to Asbestos Fibre Releasing Materials.
- .2 Canadian Standards Association (CSA International).
- .3 Department of Justice Canada.
  - .1 Canadian Environmental Protection Act (CEPA), 1999.
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
  - .1 Material Safety Data Sheets (MSDS).
- .5 Transport Canada (TC).
  - .1 Transportation of Dangerous Goods Act, 1992 (TDGA).
- .6 Underwriters' Laboratories of Canada (ULC).
- .7 U.S. Department of Health and Human Services/Centers for Disease Control and Prevention (CDC)/National Institute for Occupational Safety and Health (NIOSH).
  - .1 NIOSH 94-113-August 1994, NIOSH Manual of Analytical Methods (NMAM), 4th Edition.
- .8 U.S. Department of Labour - Occupational Safety and Health Administration - Toxic and Hazardous Substances.
  - .1 29 CFR 1910.1001-2001, Asbestos Regulations.

1.2 DEFINITIONS

.1 HEPA vacuum: High Efficiency Particulate Air filtered vacuum equipment with a filter system capable of collecting and retaining fibres greater than 0.3 microns in any direction at 99.97% efficiency.

.2 Amended Water: water with a non-ionic surfactant wetting agent added to reduce water tension to allow wetting of fibres.

.3 Asbestos Containing Materials (ACMs): materials identified under Existing Conditions Article, including fallen materials and settled dust.

.4 Asbestos Work Area: Area where actual removal and sealing and enclosure of spray or trowel applied asbestos containing materials takes place.

.5 Authorized Visitors: Owner's Representative, or designated representative, and representatives of regulatory agencies.

.6 Friable Material: material that when dry can be crumbled, pulverized or powdered by hand pressure and includes such material that is crumbled, pulverized or powdered.

.7 Occupied Area: any area of building or work site that is outside Asbestos Work Area.

.8 Polyethylene sheeting sealed with tape: Polyethylene sheeting of type and thickness specified sealed with tape along edges, around penetrating objects, over cuts and tears, and elsewhere as required to provide continuous polyethylene membrane to protect underlying surfaces from water damage or damage by sealants, and to prevent escape of asbestos fibres through sheeting into clean area.

.9 Glove Bag: prefabricated glove bag as follows:
- .1 Minimum thickness 0.25 mm polyvinyl-chloride bag.
- .2 Integral 0.25 mm thick polyvinyl-chloride gloves and elastic ports.
- .3 Equipped with reversible double pull double throw zipper on top.
- .4 Straps for sealing ends around pipe.
- .5 Must incorporate internal closure strip if it is to be moved or used in more than one specific location.

.10 DOP Test: testing method used to determine integrity of Negative Pressure unit using dioctyl phthalate (DOP) HEPA-filter leak test.

.11 Sprayer: garden reservoir type sprayer or airless spray equipment capable of producing mist or fine spray. Must be appropriate capacity for scope of work.

.12 Negative pressure: system that extracts air directly from work area, filters such extracted air through High Efficiency Particulate Air filtering system, and discharges this air directly outside work area to exterior of building.
- .1 System to maintain minimum pressure differential of 5 Pa relative to adjacent areas outside of work areas, be equipped with alarm to warn of system breakdown, and be equipped with instrument to continuously monitor and automatically record pressure differences.

.13 Airlock: system for permitting ingress or egress without permitting air movement between contaminated area and uncontaminated area, typically consisting of two curtained doorways at least 2 m apart.

.14 Curtained doorway: arrangement of closures to allow ingress and egress from one room to another while permitting minimal air movement between rooms, typically constructed as follows:
- .1 Place two overlapping sheets of polyethylene over existing or temporarily framed doorway, secure each along top of doorway, secure vertical edge of one sheet along one vertical side of doorway, and secure vertical edge of other sheet along opposite vertical side of doorway.
- .2 Reinforce free edges of polyethylene with duct tape and weight bottom edge to ensure proper closing.
- .3 Overlap each polyethylene sheet at openings not less than 1.5 m on each side.

1.3 SUBMITTALS

.1 Before beginning work:
- .1 Obtain from appropriate agency and submit to Owner's Representative necessary permits for transportation and disposal of asbestos waste. Ensure that dump operator is fully aware of hazardous nature of material

being dumped, and proper methods of disposal. Submit proof satisfactory to Owner's Representative that suitable arrangements have been made to receive and properly dispose of asbestos waste.

.2 Submit proof satisfactory to Owner's Representative that employees have had instruction on hazards of asbestos exposure, respirator use, dress, use of showers, entry and exit from work areas, and aspects of work procedures and protective measures. Ensure supervisory personnel have attended asbestos abatement course, of not less than two days duration, approved by Owner's Representative. Submit proof of attendance in form of certificate. Minimum of one Supervisor for every ten workers.

.3 Submit layout of proposed enclosures and decontamination facilities to Owner's Representative for review.

.4 Submit documentation including test results for sealer proposed for use.

.5 Submit Provincial/Territorial and/or local requirements for Notice of Project Form.

.6 Submit proof of Contractor's Asbestos Liability Insurance.

.7 Submit proof satisfactory to Owner's Representative that employees have respirator fitting and testing. Workers must be fit tested (irritant smoke test) with respirator that is personally issued.

.8 Submit Worker's Compensation Board status and transcription of insurance.

.9 Submit documentation including test results, fire and flammability data, and Material Safety Data Sheets (MSDS) for chemicals or materials including but not limited to following:

.1 encapsulants;

.2 amended water;

.3 slow-drying sealer.

1.4 QUALITY ASSURANCE

.1 Regulatory Requirements: comply with Federal, Provincial/Territorial and local requirements pertaining to asbestos, provided that in case of conflict among those requirements or with these specifications more stringent requirement applies. Comply with regulations in effect at time work is performed.

.2 Health and Safety:

.1 Safety Requirements: worker and visitor protection.

.1 Protective equipment and clothing to be worn by workers while in Asbestos Work Area includes:

.1 Respirator equipped with HEPA filter cartridges or supplied air type, personally issued to worker and marked as to efficiency and purpose, and acceptable to Authority having jurisdiction as suitable for type of asbestos and level of asbestos exposure in Asbestos Work Area. If disposable type filters are used, provide sufficient filters so that workers can install new filters following disposal of used filters and before re-entering contaminated areas.

.2 Disposable type protective clothing that does not readily retain or permit penetration of asbestos fibres, consisting of full body covering including head covering with snug fitting cuffs at wrists, ankles, and neck.

.2 Requirements for each worker:

.1 Remove street clothes in clean change room and put on respirator with new filters or reusable filters that have been tested as satisfactory, clean coveralls and head covers before entering Equipment and Access Rooms or Asbestos Work Area. Store street clothes, uncontaminated footwear, towels, and similar uncontaminated articles in clean change room.

.2 Remove gross contamination from clothing before leaving work area then proceed to Equipment and Access Room and remove clothing except respirators. Place contaminated work suits in receptacles for disposal with other asbestos - contaminated materials. Leave reusable items except respirator in Equipment and Access Room. Still wearing the respirator proceed naked to showers. Using soap and water wash body and hair thoroughly. Clean outside of respirator with soap and water while showering; remove respirator; remove filters and wet them and dispose of filters in container provided for purpose; and wash and rinse inside of respirator. When not in use in work area, store work footwear in Equipment and Access Room. Upon completion of asbestos abatement, dispose of footwear as contaminated waste or clean thoroughly inside and out using soap and water before removing from work area or from Equipment and Access Room.

.3 After showering and drying off, proceed to clean change room and dress in street clothes at end of each day's work, or in clean coveralls before eating, smoking, or drinking. If re-entering work area, follow procedures outlined in paragraphs above.

.4 Enter unloading room from outside dressed in clean coveralls to remove waste containers and equipment from Holding Room of Container and Equipment Decontamination Enclosure system. Workers must not use this system as means to leave or enter work area.

.3 Eating, drinking, chewing, and smoking are not permitted in Asbestos Work Area.

.4 Ensure workers are fully protected with respirators and protective clothing during preparation of system of enclosures prior to commencing actual asbestos abatement.

.5 Provide and post in Clean Change Room and in Equipment and Access Room the procedures described in this Section, in both official languages.

.6 Ensure that no person required to enter an Asbestos Work Area has facial hair that affects seal between respirator and face.

.7 Visitor Protection:

.1 Provide protective clothing and approved respirators to Authorized Visitors to work areas.

.2 Instruct Authorized Visitors in the use of protective clothing, respirators and procedures.

.3 Instruct Authorized Visitors in proper procedures to be followed in entering into and exiting from Asbestos Work Area.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Place materials defined as hazardous or toxic in designated containers.

.2 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.

.3 Fold up metal banding, flatten and place in designated area for recycling.

.4 Disposal of asbestos waste generated by removal activities must comply with Federal, Provincial, Territorial and Municipal regulations. Dispose of asbestos waste in sealed double thickness 6 ml bags or leak proof drums. Label containers with appropriate warning labels.

.5 Provide manifests describing and listing waste created. Transport containers by approved means to licensed landfill for burial.

1.6 EXISTING CONDITIONS

.1 Results of tests of asbestos containing materials to be handled, removed, or otherwise disturbed and disposed of during this Project are bound into this specification manual. These are for general information only and are not necessarily representative of asbestos containing materials covered within scope of this Project.

1.7 SCHEDULING

.1 Not later than ten (10) days before beginning Work on this Project notify following in writing:

.1 Appropriate Regional or Zone Director of Medical Services Branch, Health Canada.

.2 Regional Office of Labour Canada.

.3 Provincial/Territorial, Department of Labour.

.4 Disposal Authority.

.2 Inform sub trades of presence of friable asbestos containing materials identified in Existing Conditions.

.3 Submit to Owner's Representative copy of notifications prior to start of Work.

1.8 OWNER'S INSTRUCTIONS

.1 Before beginning Work, provide to Owner's Representative satisfactory proof that every worker has had instruction and training in hazards of asbestos exposure, in personal hygiene including dress and showers, in entry and exit from Asbestos Work Area, in aspects of work procedures including glove bag procedures, and in use, cleaning, and disposal of respirators and protective clothing.

.2 Instruction and training related to respirators includes, at minimum:
- .1 Proper fitting of equipment.
- .2 Inspection and maintenance of equipment.
- .3 Disinfecting of equipment.
- .4 Limitations of equipment.

.3 Instruction and training must be provided by competent, qualified person.

.4 Supervisory personnel to complete required training.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Polyethylene: minimum 0.15 mm thick unless otherwise specified; in sheet size to minimize joints.

.2 FR polyethylene: minimum 0.15 mm thick, woven fibre reinforced fabric bonded both sides with polyethylene.

.3 Tape: fibreglass - reinforced duct tape suitable for sealing polyethylene under both dry conditions and wet conditions using amended water.

.4 Wetting agent: 50% polyoxyethylene ester and 50% polyoxyethylene ether, or other material approved by Owner's Representative, mixed with water in concentration to provide adequate penetration and wetting of asbestos containing material.

.5 Asbestos waste containers: Metal or fibre - type acceptable to dump operator with tightly fitting covers and 0.15 mm minimum thickness sealable polyethylene liners.
- .1 Label containers in accordance with Asbestos Regulations 29 CFR 1910.1001. Label in both official languages.

.6 Encapsulants: Type 2 surface film forming or Type 1 penetrating type Class A water based conforming to CAN/CGSB-1.205 and approved by the Fire Commissioner of Canada.

.7 Glove bag: acceptable materials include safe-T-strip products in configuration suitable for Work, or alternative material approved by addendum during tendering period in accordance with Instructions to Tenderers.
- .1 Equip glove bags intended for use in more than one location with reversible, double pull, double throw zipper on top and at approximately mid-section of bag.

.8 Sprayed fireproofing: ULC labelled and listed asbestos free cementitious or mineral fibre to provide degree of fire or thermal protection required.

.9 Slow - drying sealer: non-staining, clear, water - dispersible type that remains tacky on surface for at least 8 hours and designed for purpose of trapping residual asbestos fibres.
- .1 Sealer: flame spread and smoke developed rating less than 50.

PART 3 - EXECUTION

3.1 PREPARATION

.1 Do construction occupational health and safety in accordance with *Health and Safety Requirements*.

.2 Work Areas:

.1 Shut off and isolate air handling and ventilation systems to prevent fibre dispersal to other building areas during work phase. Conduct smoke tests to ensure that duct work is airtight. Seal and caulk joints and seams of active return air ducts within Asbestos Work Area.

.2 Preclean moveable furniture and carpeting within proposed work areas using HEPA vacuum and remove from work areas to temporary location.

.3 Preclean fixed casework, plant, and equipment within proposed work areas, using HEPA vacuum and cover with polyethylene sheeting sealed with tape.

.4 Clean proposed work areas using, where practicable, HEPA vacuum cleaning equipment. If not practicable, use wet cleaning method. Do not use methods that raise dust, such as dry sweeping, or vacuuming using other than HEPA vacuum equipment.

.5 Put negative pressure system in operation and operate continuously from time first polyethylene is installed to seal openings until final completion of work including final cleanup. Provide continuous monitoring of pressure difference using automatic recording instrument.

.6 Seal off openings such as corridors, doorways, windows, skylights, ducts, grilles, and diffusers, with polyethylene sheeting sealed with tape.

.7 Cover floor and wall surfaces with polyethylene sheeting sealed with tape. Use two layers of FR polyethylene on floors. Cover floors first so that polyethylene extends at least 300 mm up walls then cover walls to overlap floor sheeting.

.8 Build airlocks at entrances to and exits from work areas so that work areas are always closed off by one curtained doorway when workers enter or exit.

.9 At each access to work areas install warning signs in both official languages in upper case "*Helvetica Medium*" letters reading as follows where number in parentheses indicates font size to be used : "*CAUTION ASBESTOS HAZARD AREA (25 mm) NO UNAUTHORIZED ENTRY (19 mm) WEAR ASSIGNED PROTECTIVE EQUIPMENT (19 mm) BREATHING ASBESTOS DUST MAY CAUSE SERIOUS BODILY HARM (7 mm)*".

.10 After work area isolation, remove heating, ventilating, and air conditioning filters, pack in sealed plastic bags 0.15 mm minimum thick and treat as contaminated asbestos waste. Remove ceiling - mounted objects such as lights, partitions, other fixtures not previously sealed off, and other objects that interfere with asbestos removal, as directed by Owner's Representative. Use localized water spraying during fixture removal to reduce fibre dispersal.

.11 Maintain emergency and fire exits from work areas, or establish alternative exits satisfactory to Fire Commissioner and Authority having jurisdiction.

.12 Where application of water is required for wetting asbestos containing materials, shut off electrical power, provide 24 volt safety lighting and ground fault interrupter circuits on power source for electrical tools, in accordance with applicable CSA Standard. Ensure safe installation of electrical lines and equipment.

.13 After preparation of work areas and Decontamination Enclosure Systems, remove ceiling panels and tiles within work areas progressively and carefully, clean using HEPA vacuum and damp sponge, wrap clean panels in 0.10 mm minimum thick polyethylene, and store in building as directed by Owner's Representative and dispose of as contaminated waste. Clean "*T*" grid suspension system within work areas using wet sponge, disconnect grid from hangers, wrap grid members in 0.10 mm minimum thick polyethylene and store in building as directed by Owner's Representative.

.14 After preparation of work areas and Decontamination Enclosure Systems remove plaster ceilings, including lath, furring, channels, hangers, wires, clips, and dispose of as contaminated waste in specified containers. Spray ceiling debris and immediate work area with amended water to reduce dust, as work progresses.

.3 Worker Decontamination Enclosure System:

.1 Worker Decontamination Enclosure System includes Equipment and Access Room, Shower Room, and Clean Room, as follows:

.1 Equipment and Access Room: build Equipment and Access Room between Shower Room and work areas, with two curtained doorways, one to Shower Room and one to work areas. Install portable toilet, waste receptor, and storage facilities for workers' shoes and protective clothing to be reworn in work areas. Build Equipment and Access Room large enough to accommodate specified facilities, other equipment needed, and at least one worker allowing him /her sufficient space to undress comfortably.

.2 Shower Room: build Shower Room between Clean Room and Equipment and Access Room, with two curtained doorways, one to Clean Room and one to Equipment and Access Room. Provide one shower for every five workers. Provide constant supply of hot and cold or warm water. Provide piping and connect to water sources and drains. Pump waste water through 5 micrometre filter system acceptable to Owner's Representative before directing into drains. Provide soap, clean towels, and appropriate containers for disposal of used respirator filters.

.3 Clean Room: build Clean Room between Shower Room and clean areas outside of enclosures, with two curtained doorways, one to outside of enclosures and one to Shower Room. Provide lockers or hangers and hooks for workers' street clothes and personal belongings. Provide storage for clean protective clothing and respiratory equipment. Install mirror to permit workers to fit respiratory equipment properly.

.4 Container and Equipment Decontamination Enclosure System:

.1 Container and Equipment Decontamination Enclosure System consists of Staging Area within work area, Washroom, Holding Room, and Unloading Room. Purpose of system is to provide means to decontaminate waste containers, scaffolding, waste and material containers, vacuum and spray equipment, and other tools and equipment for which Worker Decontamination Enclosure System is not suitable.

.1 Staging Area: designate Staging Area in work area for gross removal of dust and debris from waste containers and equipment, labelling and sealing of waste containers, and temporary storage pending removal to Washroom. Equip Staging Area with curtained doorway to Washroom.

.2 Washroom: build Washroom between Staging Area and Holding Room with two curtained doorways, one to Staging Area and one to Holding Room. Provide high - pressure low - volume sprays for washing of waste containers and equipment. Pump waste water through 5 micrometre filter system before directing into drains. Provide piping and connect to water sources and drains.

.3 Holding Room: build Holding Room between Washroom and Unloading Room, with two curtained doorways, one to Washroom and one to Unloading Room. Build Holding Room sized to accommodate at least two waste containers and largest item of equipment used.

.4 Unloading Room: build Unloading Room between Holding Room and outside, with two curtained doorways, one to Holding Room and one to outside.

.5 Construction of Decontamination Enclosures:

.1 Build suitable framing for enclosures or use existing rooms where convenient, and line with polyethylene sheeting sealed with tape. Use two layers of FR polyethylene on floors.

.2 Build curtained doorways between enclosures so that when people move through or when waste containers and equipment are moved through doorway, one of two closures comprising doorway always remains closed.

.6 Separation of Work Areas from Occupied Areas:

.1 Separate parts of building required to remain in use from parts of building used for asbestos abatement by means of airtight barrier system constructed as follows:

.1 Build suitable floor to ceiling lumber or metal stud framing, cover with polyethylene sheeting sealed with tape, and apply 9 mm minimum thick plywood. Seal joints between plywood sheets and between plywood and adjacent materials with surface film forming type sealer, to create airtight barrier.

.2 Cover plywood barrier with polyethylene sealed with tape, as specified for work areas.

.7 Maintenance of Enclosures:
- .1 Maintain enclosures in tidy condition.
- .2 Ensure that barriers and polyethylene linings are effectively sealed and taped. Repair damaged barriers and remedy defects immediately upon discovery.
- .3 Visually inspect enclosures at beginning of each working period.
- .4 Use smoke methods to test effectiveness of barriers when directed by Owner's Representative.

.8 Do not begin Asbestos Abatement work until:
- .1 Arrangements have been made for disposal of waste.
- .2 For wet stripping techniques, arrangements have been made for containing, filtering, and disposal of waste water.
- .3 Work areas and decontamination enclosures and parts of building required to remain in use are effectively segregated.
- .4 Tools, equipment, and materials waste containers are on hand.
- .5 Arrangements have been made for building security.
- .6 Warning signs are displayed where access to contaminated areas is possible.
- .7 Notifications have been completed and other preparatory steps have been taken.

3.2 SUPERVISION

.1 Minimum of one Supervisor for every ten workers is required.

.2 Approved Supervisor must remain within Asbestos Work Area during disturbance, removal, or other handling of asbestos containing materials.

3.3 ASBESTOS REMOVAL

.1 Before removing asbestos:
- .1 Prepare site.
- .2 Spray asbestos material with water containing specified wetting agent, using airless spray equipment capable of providing "*mist*" application to prevent release of fibres. Saturate asbestos material sufficiently to wet it to substrate without causing excess dripping. Spray asbestos material repeatedly during work process to maintain saturation and to minimize asbestos fibre dispersion.

.2 Remove saturated asbestos material in small sections. Do not allow saturated asbestos to dry out. As it is being removed pack material in sealable plastic bags 0.15 mm minimum thick and place in labelled containers for transport.

.3 Seal filled containers. Clean external surfaces thoroughly by wet sponging. Remove from immediate working area to Staging Area. Clean external surfaces thoroughly again by wet sponging before moving containers to decontamination Washroom. Wash containers thoroughly in decontamination Washroom, and store in Holding Room pending removal to Unloading Room and outside. Ensure that containers are removed from Holding Room by workers who have entered from uncontaminated areas dressed in clean coveralls.

.4 After completion of stripping work, wire brushed and wet sponged surfaces from which asbestos has been removed to remove visible material. During this work keep surfaces wet.

.5 Where Owner's Representative decides complete removal of asbestos containing material is impossible due to obstructions such as structural members or major service elements, or because asbestos containing material was originally applied to asphaltic coating, and provides written direction, encapsulate material as follows:

.1 Apply surface film forming type sealer to provide 0.635 mm minimum dry film thickness over sprayed asbestos surfaces. Apply using airless spray equipment to avoid blowing off fibres. Use different colour for each coat. Use colour for final coat. Or Apply penetrating type sealer to penetrate existing sprayed asbestos surfaces to uniform depth of 25 mm minimum. Apply penetrating type sealer to penetrate existing sprayed asbestos surfaces uniformly to substrate.

.6 After wire brushing and wet sponging to remove visible asbestos, and after encapsulating asbestos containing material impossible to remove, wet clean entire work area including Equipment and Access Room, and equipment used in process. After 24 hour period to allow for dust settling, wet clean these areas and objects again. During this settling period no entry, activity, or ventilation will be permitted. After second 24 hour period under same conditions, clean these areas and objects again using HEPA vacuum followed by wet cleaning. After inspection by Owner's Representative apply continuous coat of slow drying sealer to surfaces of work area . Allow at least 16 hours with no entry, activity, ventilation, or disturbance other than operation of negative pressure units during this period.

3.4 ASBESTOS ENCAPSULATION

.1 Before encapsulating asbestos:
- .1 Prepare site.
- .2 Vacuum surfaces in work areas except those to be sealed, using HEPA vacuum to remove loose debris and dust particles.
- .3 Repair damaged and missing areas of existing sprayed asbestos to obtain suitable base for sealing and to restore continuity of fireproofing. Use specified asbestos free fireproofing material. Prepare surfaces and apply fireproofing in accordance with manufacturer's printed instructions.
- .4 Remove loose asbestos and pack in sealable plastic bags 0.15 mm minimum thick and place in labelled waste containers for transport.
- .5 Seal filled waste containers. Remove from immediate working area to Staging Area. Clean external surfaces thoroughly again by wet sponging before moving containers to decontamination washroom. Wash waste containers thoroughly in decontamination Washroom, and store in Holding Room pending removal to Unloading Room and outside. Ensure that waste containers are removed from holding areas by workers who have entered from uncontaminated areas dressed in clean coveralls.

.2 Apply surface film forming type sealer to provide 0.635 mm minimum dry film thickness over sprayed asbestos surfaces. Apply using airless spray equipment to avoid blowing off fibres. Use different colour for each coat. Use colour for final coat. Or Apply penetrating type sealer to penetrate existing sprayed asbestos surfaces to uniform depth of 25 mm minimum. Apply penetrating type sealer to penetrate existing sprayed asbestos surfaces uniformly to substrate.

.3 After sealing asbestos surfaces wet clean the entire work area including Equipment and Access Room, and equipment used in the process. After 24 hour period to allow for dust settling, wet clean these areas and objects again. During this settling period no entry, activity, or ventilation will be permitted. After second 24 hour period under same conditions, clean these areas and objects again using HEPA vacuum followed by wet cleaning.

.4 Install warning signs in both official languages in 25 mm sans serif letters worded as follows: WARNING - SEALED ASBESTOS/ATTENTION AMIANTE ENCAPSULÉ. Install signs at locations indicated. Total of 20 signs will be required.

3.5 ASBESTOS ENCLOSURE

.1 Before enclosing asbestos:
- .1 Prepare site.
- .2 Vacuum surfaces in work areas, except asbestos surfaces, using HEPA vacuum equipment to remove loose debris and dust particles.

.3 Spray areas to be disturbed while securing hangers and other fixing devices. Use water containing specified wetting agent. Keep asbestos material damp to prevent release of airborne fibres.

.4 Remove loose asbestos and pack in sealable plastic bags 0.15 mm minimum thickness and place in labelled containers for transport.

.5 Seal filled waste containers. Remove from immediate working area to Staging Area. Clean external surfaces thoroughly again by wet sponging before moving containers to decontamination washroom. Wash waste containers thoroughly in decontamination Washroom, and store in Holding Room pending removal to Unloading Room and outside. Ensure that waste containers are removed from holding areas by workers who have entered from uncontaminated areas dressed in clean coveralls.

.2 After installation of hangers and other fixing devices and before enclosing asbestos, repair damaged and missing areas of existing sprayed on material using specified asbestos free fireproofing material. Prepare surfaces and apply fireproofing or thermal insulation in accordance with manufacturer's printed instructions.

.3 After enclosing asbestos surfaces, wet clean entire work area including Equipment and Access Room, and equipment used in process. After 24 hour period to allow for dust settling, wet clean these areas and objects again. During this settling period no entry, activity, or ventilation will be permitted. After second 24 hour period under same conditions, clean these areas and objects again using HEPA vacuum followed by wet cleaning.

.4 Install warning signs at each access in both official languages in 25 mm sans serif letters worded as follows: WARNING: ENCLOSED ASBESTOS/ATTENTION: AMIANTE ENCOFFRÉ.

3.6 PIPE INSULATION REMOVAL USING GLOVE BAG

.1 Place tools necessary to remove insulation in tool pouch. Wrap bag around pipe and close zippers. Seal bag to pipe with cloth straps.

.2 Place hands in gloves and use necessary tools to remove insulation. Arrange insulation in bag to obtain full capacity of bag.

.3 Insert nozzle of garden reservoir type sprayer into bag through valve and wash down pipe and interior of bag thoroughly. Wet surface of insulation in lower section of bag.

.4 When glove bags are intended for use at more than one location: after wash down and application of sealer, seal off waste in lower section of bag using zipper at mid-section of bag. Remove air from top section of bag through elasticized valve using HEPA vacuum. Remove bag from pipe, reinstall in new location, and reseal to pipe prior to opening lower section of bag. Repeat stripping operation.

.5 If bag is to be moved along pipe, first remove air from top section through elasticized valve using HEPA vacuum. Next loosen straps, move bag, re-seal to pipe using double pull zipper to pass hangers. Repeat stripping operation.

.6 To remove bag after completion of stripping, wash top section and tools thoroughly. Remove air from top section through elasticized valve using HEPA vacuum. Pull polyethylene waste container over glove bag before removing from pipe. Release one strap and remove freshly washed tools. Place tools in water. Remove second strap and zipper. Fold over into waste container and seal.

.7 After removal of bag ensure that pipe is free of residue. Remove residue using HEPA vacuum or wet cloths. Ensure that surfaces are free of sludge which after drying could release asbestos dust into atmosphere. Seal exposed surfaces of pipe and ends of insulation with slow drying sealer to seal in any residual fibres.

.8 Upon completion of work shift, cover exposed ends of remaining pipe insulation with polyethylene taped in place.

3.7 FINAL CLEANUP

.1 Following cleaning specified above, and when air sampling shows that asbestos levels on both sides of seals do not exceed 0.01 fibres/cc as determined by membrane filter method at 400-500X magnification phase contrast illumination, as described in NIOSH 94-113 or equivalent, proceed with final cleanup.

.2 Remove polyethylene sheet by rolling it away from walls to centre of work area. Vacuum visible asbestos containing particles observed during cleanup, immediately, using HEPA vacuum equipment.

.3 Place polyethylene seals, tape, cleaning material, clothing, and other contaminated waste in plastic bags and sealed labelled waste containers for transport.

.4 Include in clean-up Work areas, Equipment and Access Room, Washroom, Shower Room, and other contaminated enclosures.

.5 Include in clean-up sealed waste containers and equipment used in Work and remove from work areas, via Container and Equipment Decontamination Enclosure System, at appropriate time in cleaning sequence.

.6 Conduct final check to ensure that no dust or debris remains on surfaces as result of dismantling operations and carry out air monitoring again to ensure that asbestos levels in building do not exceed 0.01 fibres/cc. Repeat cleaning using HEPA vacuum equipment, or wet cleaning methods where feasible, in conjunction with sampling until levels meet this criteria.

.7 As work progresses, and to prevent exceeding available storage capacity on site, remove sealed and labelled containers containing asbestos waste and dispose of to authorized disposal area in accordance with requirements of disposal authority. Ensure that each shipment of containers transported to dump is accompanied by Contractor's representative to ensure that dumping is done in accordance with governing regulations.

3.8 RE-ESTABLISHMENT OF OBJECTS AND SYSTEMS

.1 When cleanup is complete:
- .1 Re-establish objects and furniture moved to temporary locations in course of Work, in their proper positions.
- .2 Re-secure mounted objects removed in course of Work in their former positions.
- .3 Re-establish mechanical and electrical systems in proper working order. Install new filters.
- .4 Repair or replace objects damaged in the course of Work, as directed by Owner's Representative.

3.9 AIR MONITORING

.1 From beginning of Work until completion of cleaning operations, Owner's Representative to take air samples on daily basis outside of work area enclosure in accordance with Health Canada recommendations.
- .1 Contractor will be responsible for monitoring inside enclosure in accordance with applicable Provincial/Territorial Occupational Health and Safety Regulations.

.2 Use results of air monitoring inside work area to establish type of respirators to be used. Workers may be required to wear sample pumps for up to full shift periods.
- .1 If fibre levels are above safety factor of respirators in use, stop abatement, apply means of dust suppression, and use higher safety factor in respiratory protection for persons inside enclosure.
- .2 If air monitoring shows that areas outside work area enclosures are contaminated, enclose, maintain and clean these areas, in same manner as that applicable to work areas.

.3 During course of Work, Owner's Representative to measure fibre content of air outside work areas by means of fibrous aerosol monitors (FAM).
- .1 When FAM readings exceed 0.25 f/cc adopt more stringent work procedures immediately and carry out PCM test.

.2 Stop Work when PCM measurements exceed 0.01 f/cc and correct procedures.

.4 Final air monitoring to be conducted as follows: After Asbestos Work Area has passed visual inspection and acceptable coat of lock-down agent has been applied to surfaces within enclosure, and appropriate setting period has passed, Owner's Representative will perform air monitoring within Asbestos Work Area.
.1 Final air monitoring results must show fibre levels of less than 0.01 f/cc.
.2 If air monitoring results show fibre levels in excess of 0.01 f/cc, re-clean work area and apply another acceptable coat of lock-down agent to surfaces.
.3 Repeat as necessary until fibre levels are less than 0.01 f/cc.

3.10 INSPECTION

.1 Perform inspection of Asbestos Work Area to confirm compliance with specification and governing authority requirements. Deviations from these requirements that have not been approved in writing by Owner's Representative may result in Work stoppage, at no cost to Owner.

.2 Owner's Representative will inspect Work for:
.1 Adherence to specific procedures and materials.
.2 Final cleanliness and completion.
.3 No additional costs will be allowed by Contractor for additional labour or materials required to provide specified performance level.

.3 When asbestos leakage from Asbestos Work Area has occurred or is likely to occur Owner's Representative may order Work shutdown.

.4 No additional costs will be allowed by Contractor for additional labour or materials required to provide specified performance level.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

.1 Comply with requirements of this Section when performing following Work:

.1 Removal of lead containing paint using power tools with an effective dust collection system equipped with HEPA filter.

.2 Welding, torching, or high temperature cutting of lead-containing surface coatings or materials indoors, with use of an effective fume collector or smoke eater.

.3 Welding, torching, or high temperature cutting of lead-containing surface coatings materials outdoors.

.4 Removal of lead-containing surface coatings or materials by scraping or sanding (including wet sanding) using non-powered hand tools.

.5 Demolition of plaster or other building components that crumble, pulverize or powder and are covered with lead-containing surface coating.

1.2 RELATED REQUIREMENTS

.1 Section 02 56 13 Waste Containment.

.2 Section 02 80 00 Hazardous Materials - Scope and Details

.3 Section 02 81 00 Hazardous Material.

.4 Section 02 82 00.01 Asbestos Abatement - Minimum Precautions.

.5 Section 02 82 00.02 Asbestos Abatement - Intermediate Precautions.

.6 Section 02 82 00.03 Asbestos Abatement - Maximum Precautions.

.7 Section 02 83 10 Lead-Containing Paint Abatement - Minimum Precautions.

.8 Section 02 84 00 Polychlorinated Biphenyl Remediation.

.9 Section 02 85 11 Silica - Intermediate Precautions.

.10 Section 02 87 00 Mercury Abatement.

1.3 DEFINITIONS

.1 Action level: employee exposure, without regard to usage of respirators, to an airborne concentration of lead:

.1 50 micrograms per cubic meter of air calculated as 8-hour time-weighted average (TWA). Intermediate precautions for lead abatement are based on airborne lead concentrations greater than 0.05 milligrams per cubic meter of air within Work Area.

.2 Authorized Visitors: Consultant and/or Owner, Consultant and representatives of regulatory agencies.

.3 Competent person: individuals capable of identifying existing lead hazards in workplace and taking corrective measures to eliminate them.

.4 HEPA: High Efficiency Particulate Air.

.5 HEPA vacuum: HEPA filtered vacuum equipment with a filter system capable of collecting and retaining fibres greater than 0.3 microns in any dimension at 99.97% efficiency.

.6 Sprayer: garden reservoir type sprayer or airless spray equipment capable of producing mist or fine spray. Must be appropriate capacity for scope of work.

1.4 INSTRUCTION AND TRAINING

.1 Provide instruction and training to all workers including the following:

.1 Hazards of lead.

.2 Use, care and disposal of protective equipment (including but not limited to respirators and filters) and clothing that would be used and worn during abatement work, including:

.1 Limitations of equipment.

.2 Inspection and maintenance of equipment.

.3 Proper fitting of equipment.

.4 Disinfecting and cleaning of equipment.

.3 Personal hygiene to be observed when performing the work.

.4 The measures and procedures prescribed by this section including decontamination of the worker.

.5 Instruction and training must be provided by a competent person.

1.5 PERSONAL PROTECTION

.1 Provide the following respiratory protection to all personnel, at minimum:

.1 Non-powered half-face respirators with P100 high efficiency cartridge filters.

.2 Non-powered full-face respirators with P100 high efficiency cartridge filters for spray application of lead-containing surface coatings.

.2 Provide protective clothing, to all personnel entering the Abatement Work Area, including:

.1 Dust impermeable gloves appropriate for the work being completed.

.2 Disposable protective clothing that does not readily retain or permit skin contamination, consisting of full body covering including head covering with snug fitting cuffs at wrists, ankles, and neck.

.3 Provide protective clothing, to all personnel entering the Abatement Work Area.

.4 Wear hard hats, safety shoes and other personal protective equipment required by applicable construction safety regulations.

.5 Lead-specific soaps and hygiene indicators are recommended to be provided for shower and hand-wash stations.

1.6 Inspections

.1 The following Milestone Inspections are to be scheduled:

.1 Milestone Inspection - Clean Site Preparation

.2 Milestone Inspection – Bulk Removal Inspection

.3 Milestone Inspection - Visual Clearance

PART 2 – PRODUCTS AND FACILITIES

2.1 MATERIALS

.1 FR polyethylene: 0.15 mm (6 mils) woven fibre reinforced fabric bonded both sides with polyethylene.

.2 Polyethylene: 0.15 mm (6 mils) unless otherwise specified; in sheet size to minimize joints.

.3 Slow - drying sealer: non-staining, clear, water - dispersible type that remains tacky on surface for at least 8 hours and designed for trapping residual lead-containing paint residue.

.4 Tape: fibreglass - reinforced duct tape suitable for sealing polyethylene under dry conditions and wet conditions using amended water.

.5 Regular Waste Container: an impermeable 0.15 mm thick sealable polyethylene waste bag.

2.2 Curtained Doorways

.1 Construct as follows:

.1 Install two flap doors, full width and height of door opening at all doors to Abatement Work Area and both ends of Transfer Room.

.2 Construct each flap door of two layers of polyethylene sheeting with all edges reinforced with tape. Use wood strapping to securely fasten flap doors to head and alternate jambs.

.3 Install weights attached to bottom edge of each door flap.

.4 Provide direction arrows on flaps to indicate opening.

PART 3 - EXECUTION

3.1 Site Preparation - General

.1 Approved Supervisor must remain within Work Area during disturbance, removal, or other handling of lead-containing paints.

.2 Provide washing facilities consisting of a wash basin, clean water, soap and towels.

.1 Workers are to use washing facilities each time leaving the Abatement Work Area.

.3 Stored or non-fixed items, including but not limited to equipment, furniture, waste etc., shall be removed from the Abatement Work Area prior to abatement work.

.4 Isolate, at panel, and disconnect existing power supply to Abatement Work Area. Power supply to remaining areas of building must not be disrupted during work of this section.

.1 Lock-out/tag-out power at electrical panels.

.2 Mark/tag any items within or passing through the Abatement Work Area that are to remain live including but not limited to cable, conduit, wire, fixtures, equipment panels, etc.

.5 Shut down HVAC systems serving the Abatement Work Area.

.1 Install polyethylene sheeting over openings in ducts and diffusers and seal.

.2 HVAC to remaining areas of building must not be disrupted during work of this section.

.3 System shall remain inoperative until completion of work, unless ducts can be effectively capped.

.4 Perform work at scheduled times after shutting down HVAC systems affecting the Abatement Work Area.

.6 Remove visible dust from all surfaces in the work area including those to be worked on, using HEPA Vacuums or wet wiping.

.7 Provide amended water for wetting materials, and adequate method of wetting (garden sprayers, airless sprayers, etc.).

.8 Provide electrical power and shut off for operation of powered tools and equipment. Provide ground fault interrupter circuits on power source for electrical tools, in accordance with applicable CSA Standard.

.1 Ensure safe installation of electrical lines and equipment.

.9 Do not use compressed air to clean or remove dust or debris.

.10 Frequently and at regular intervals during the work, clean up dust and waste using HEPA vacuums and/or wet sweeping or mopping.

.11 Frequently and at regular intervals, place all waste in waste containers.

.12 Immediately upon completion of work, clean area with HEPA vacuum and/or wet sweeping or mopping.

3.2 Site Preparation –Enclosure Required

.1 Install Curtained Doorways.

.2 Install polyethylene sheeting at openings in walls (as required) and seal.

.3 Seal openings in floor using tape, caulking, polyethylene, etc. Floor openings are to be sealed independently prior to installation of floor polyethylene.

.4 Install polyethylene sheeting on floors of Abatement Work Area. Use sufficient layers to provide adequate protection for carpeting and equipment.

.1 Cover floors first so that polyethylene on walls is overlapped by at least 305 mm.

.5 Install 6 mil polyethylene sheeting on walls to remain, within the Abatement Work Area., including existing walls that make up, or are within, the Abatement Work Area.

.6 Install one layer of 6 mil polyethylene sheeting so as to protect all equipment and finishes in the Abatement Work Area that may be damaged.

.7 Place required tools to complete the abatement with the Abatement Work Area.

.8 Install temporary lighting in enclosure to a level that will provide for safe and efficient use of work area - minimum 550 LUX.

.9 Establish negative pressure in Abatement Work Areas as follows:

.1 Provide sufficient HEPA filtered negative pressure machines to exchange a volume of air equivalent to that of the Abatement Work Area a minimum of every 20 minutes.

.2 Provide additional HEPA filtered negative pressure machines as required to ensure air flow from Occupied Area into Abatement Work Area.

.3 Operate HEPA filtered negative pressure machines continuously from first disturbance of ACM until completion of dismantling.

.4 Replace prefilters to maintain specified flow rate.

.5 Replace HEPA filter as required to maintain flow rate and integrity of unit.

.6 Discharge HEPA filtered negative air machines to building exterior, where possible.

.1 Direct discharge away from building access points.

.10 Install Signage in clearly visible locations and in sufficient numbers to adequately warn of lead hazard, and lead hazard where appropriate.

3.3 Maintenance of Abatement Work Area

.1 Inspect polyethylene sheeting and ensure it is effectively sealed and taped. Repair damage and remedy defects immediately.

.2 Inspect electrical panels and ensure locks and tags are on panels prior to entering the Abatement Work Area.

.3 Inspect HEPA filtered negative pressure machines including discharge ducting at the beginning and end of each working period. Inspection must be performed by competent person.

.4 Maintain Abatement Work Area in tidy condition.

.5 Remove standing water on polyethylene/floor at the end of every shift.

.6 Turn off water supply to any hoses and reduce pressure in hose, prior to leaving the Abatement Work Area at end of shift.

3.4 Lead Abatement

.1 Use the procedures described above under *Site Preparation – Enclosure Required*.

.1 Removal of lead-containing surface coatings or materials by scraping or sanding (including wet sanding) using non-powered hand tools.

.2 Demolition of plaster or other building components that crumble, pulverize or powder and are covered with lead-containing surface coating.

.3 Wet cleaning or HEPA vacuuming of significant amounts of lead-containing dust and debris that can be made easily airborne.

.2 Use the procedures described above under *Site Preparation – No Enclosure Required*.

.1 Removal of lead containing paint using power tools with an effective dust collection system equipped with HEPA filter.

.2 Welding, torching or high temperature cutting of lead-containing surface coatings or materials indoors, with use of an effective fume collector or smoke eater.

.3 Welding, torching or high temperature cutting of lead-containing surface coatings materials outdoors.

.3 Provide washing facilities consisting of a wash basin, clean water, soap and towels.

.1 Workers are to use washing facilities each time leaving the Abatement Work Area.

.4 Removal methods minimizing dust generation should be used wherever possible.

.1 Wet methods are to be used to reduce dust generation.

.1 Wetting agents should be used where possible.

.2 Wet method may not be used if it creates a hazard or cause damage to equipment or to project.

.5 Provide drop sheets below all lead operations that may produce dust, chips or debris containing lead.

.6 Wastewater from cleaning or removal operations must be contained, for treatment or disposal.

.7 Remove lead containing paint in small sections and pack as it is being removed in sealable waste containers.

.8 Waste generated should be maintained wet until cleaned and packaged.

.9 After completion of stripping work, wire brush and wet sponge surface from which lead based paint has been removed to remove visible material. During this work keep surfaces wet.

.10 After wire brushing and wet sponging to remove visible lead containing paint, wet clean entire work area, and equipment used in process.

.1 Compressed air or dry sweeping may not be used to clean up lead-containing dust or waste.

.2 Ensure all waste is cleaned and packaged.

.11 Seal filled containers. Clean external surfaces thoroughly by wet sponging. Remove from immediate working area to staging area. Clean external surfaces thoroughly again by wet sponging. Wash containers thoroughly pending removal to outside. Ensure containers are removed by workers who have entered from uncontaminated areas dressed in clean coveralls.

.12 The Abatement Work Area is not to be dismantled until acceptable lead wipe sample results are achieved.

.1 If lead wipe sampling exceeds the clearance criteria the Abatement Work Area will require re-cleaning and re-sampling.

.2 Obtain Abatement Consultant's written permission to proceed.

3.5 Final Cleaning

.1 Following specified cleaning procedures, and when lead wipe sampling is below acceptable concentrations proceed with final cleanup.

.2 Remove polyethylene sheet by rolling it away from walls to centre of work area. Clean visible lead containing particles observed during cleanup, immediately, using HEPA vacuum.

.3 Place polyethylene sheets, tape, cleaning material, clothing, and contaminated waste in plastic bags and seal. Dispose of in accordance with waste materials generated.

.4 Clean Work areas and Transfer Room, where present.

.5 Remove sealed waste containers and equipment used in Work and remove from work areas at appropriate time in cleaning sequence.

.6 Conduct final check to ensure no dust or debris remain on surfaces as result of dismantling operations.

END OF SECTION

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 21 - Construction / Demolition Waste Management and Disposal.

.3 Section 01 78 00 - Closeout Submittals.

.4 Section 21 05 01 – Common Work Results - Mechanical

1.2 SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00 – Submittal Procedures. All mechanical submissions shall be electronic searchable and editable (non locked) PDF's.

.2 Shop drawings; submit drawings stamped and signed for approval by Owner's Representative.

.3 Shop drawings to show:

- .1 Mounting arrangements.
- .2 Operating and maintenance clearances.

.4 Shop drawings and product data accompanied by:

- .1 Detailed drawings of bases, supports, and anchor bolts.
- .2 Acoustical sound power data, where applicable.
- .3 Points of operation on performance curves.
- .4 Manufacturer to certify current model production.
- .5 Certification of compliance to applicable codes.

.5 In addition to transmittal letter referred to in Section 01 33 00 - Submittal Procedures: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.

.6 Closeout Submittals:

- .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
- .2 Operation and maintenance manual approved by, and final copies deposited with, Owner's Representative before final inspection.
- .3 Operation data to include:
  - .1 Control schematics for systems including environmental controls.
  - .2 Description of systems and their controls.
  - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
  - .4 Operation instruction for systems and component.
  - .5 Description of actions to be taken in event of equipment failure.

.6 Valves schedule and flow diagram.

.7 Colour coding chart.

.4 Maintenance data to include:

.1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.

.2 Data to include schedules of tasks, frequency, tools required and task time.

.5 Performance data to include:

.1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.

.2 Equipment performance verification test results.

.3 Special performance data as specified.

.4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

.6 Approvals:

.1 Submit 2 copies of draft Operation and Maintenance Manual to Owner’s Representative for approval. Submission of individual data will not be accepted unless directed by Owner’s Representative.

.2 Make changes as required and re-submit as directed by Owner’s Representative.

.7 Additional data:

.1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.

.2 Provide a detailed trouble shooting and fault location guide to facilitate quick return of malfunctioning equipment to operation.

.3 In addition to manufacturers data sheets provide typed text descriptions and diagrams as required to supplement product data. Provide logical sequence fo instructions for each procedure, incorporating manufacturers instructions as required. This shall address proper start up and shut down of each piece of equipment to facilitate all maintenance

.4 Provide flow diagrams for all systems.

.5 Start up reports for all systems.

.8 Site records:

.1 Owner’s Representative will provide 1 set of reproducible mechanical drawings or AutoCAD files. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.

.2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.

.3 Use different colour for each service.

.4 Make available for reference purposes and inspection.

.9 As-built drawings:

.1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.

.2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).

.3 Submit to Owner's Representative for approval and make corrections as directed.

.4 Perform testing, adjusting and balancing for HVAC using as-built drawings.

.5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.

.10 Submit copies of as-built drawings for inclusion in final TAB report.

1.3 QUALITY ASSURANCE

.1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.

.2 Refer to Section 21 05 01 – Common Work Results - Mechanical

.3 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

.4 Mock ups: Complete mock-ups of all installations for each room for approval prior to completing installation. Contractor shall not proceed with any work until installation is acceptable to owner. Quality of installation will be paramount and only the highest quality installation will be acceptable. All required re-work shall be completed at the cost of the contractor until installation is deemed acceptable.

.5 Provide all materials and equipment and perform all labor required to install complete and operable mechanical systems as indicated on the drawings, as specified, and as required by code.

.6 Contract document drawings for mechanical work (HVAC, plumbing, fire protection, and controls) are diagrammatic and are intended to convey sizing, scope and general arrangement only.

.7 Install all mechanical equipment and appurtenances in accordance with manufacturers' recommendations, contract documents, and applicable codes and regulations.

.8 Coordinate construction of all mechanical work with architectural, structural, civil, electrical work, etc., shown on other contract document drawings

.9 All tests shall be completed before any mechanical equipment or piping insulation is applied.

.10 Locate all temperature, pressure, and flow measuring devices in accessible locations with the straight section of pipe or duct up- and downstream as recommended by the manufacturer for good accuracy.

.11 Coordinate all equipment connections with manufacturers' certified drawings. Coordinate and provide all duct and piping transitions required for final equipment connections to furnished equipment. Field verify and coordinate all duct and piping dimensions before fabrication.

.12 Concrete housekeeping pads to suit mechanical equipment shall be sized and located by the mechanical contractor. Minimum concrete pad thickness shall be 150mm. Pad shall extend beyond the equipment a minimum of 150 mm on each side. Concrete housekeeping pads shall be provided by the general contractor. It shall be the responsibility of the mechanical contractor to coordinate the size and location of concrete housekeeping pads with the general contractor.

.13 When mechanical work (HVAC, plumbing, sheet metal, fire protection, controls, balancing etc.) is subcontracted, it shall be the mechanical contractor's responsibility to coordinate subcontractors and the associated contracts.

.14 The locations of all items shown on the drawings or called for in the specifications 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 project site conditions. Do not scale drawings.

.15 All miscellaneous steel required to ensure proper installation and as shown in details for piping, ductwork, and equipment (unless otherwise noted) shall be furnished and installed by the mechanical contractor.

.16 All equipment, piping, ductwork, etc., shall be supported as detailed, specified, and required to provide a vibration-free installation.

.17 All ductwork, piping, and equipment supported from structural steel shall be coordinated with the general contractor.

.18 Locations and sizes of all floor, wall, and roof openings shall be coordinated with all other trades involved.

.19 Refer to typical details for ductwork, piping, and equipment installation.

.20 Install piping so all valves, strainers, unions, traps, flanges, and other appurtenances requiring access are accessible.

.21 All valves shall be installed so that the valve remains in service when equipment or piping on the equipment side of the valve is removed.

.22 Provide chainwheel operators for all valves in equipment rooms mounted greater than 2.1 m" above floor level; chain shall extend to 2.1m above floor level.

.23 Unions and/or flanges shall be installed at each piece of equipment, in bypasses, and in long piping runs (30 m or more) to permit disassembly for alteration and repairs.

.24 All piping work shall be coordinated with all trades involved. Offsets in piping around obstructions shall be provided at no additional cost to the owner.

.25 Certain items such as rises and drops in ductwork, access doors, volume dampers, etc., are indicated on the contract document drawings for clarity for a specific location requirement and shall not be interpreted as the extent of the requirements for these items.

.26 Coordinate diffuser, register, and grille locations with architectural reflected ceiling plans, lighting, and other ceiling items and make minor duct modifications to suit.

.27 Provide flexible connections in all ductwork systems (supply, return, and exhaust) connected to air handling units, fans, and other equipment that require vibration isolation. Flexible connections shall be provided at the point of connection to the equipment unless otherwise indicated.

.28 All ductwork shall be coordinated with all trades involved. Offsets in ducts, including divided ducts and transitions around obstructions, shall be provided at no additional cost to the owner.

.29 Provide access doors in ductwork to provide access for all smoke detectors, fire dampers, smoke dampers, volume dampers, humidifiers, coils, and other items located in the ductwork that require service and/or inspection.

.30 Smoke detectors shall be furnished and wired by the electrical contractor. The mechanical contractor shall be responsible for coordinating with the electrical contractor and in accordance with the manufacturer's printed instructions to ensure proper operation of smoke detectors

.31 Louver sizes, locations, and attachment details shall be coordinated with the general contractor. Refer to specification.

.32 All equipment provided by Div 21, 22, 23, 25 and shall be started up a factory trained and experienced journeyman or approved equal. All equipment shall have start up reports provided in an organized PDF with bookmarks. (Mech Addendum 2)

1.4 MAINTENANCE

.1 Furnish spare parts in accordance with Section 01 78 00 - Closeout Submittals as follows:

.1 One set of packing for each pump.
.2 One casing joint gasket for each size pump.
.3 One head gasket set for each heat exchanger.
.4 One glass for each gauge glass.
.5 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.

.2 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Section 01 78 00 - Closeout Submittals.

.3 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Waste Management and Disposal:

.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 PRODUCTS

2.1 MATERIALS

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

.2 Access Doors

.1 Access doors for concealed equipment, valves to allow for operation, inspection adjusting, and servicing shall be provided by general contractor in accordance with requirements of architectural specifications. Mechanical to coordinate size location and quantity's.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install all work in keeping to trade and industry practice with all work completed and overseen by journeymen experienced in the relevant trade.

.2 All work to be completed to the requirement of manufacturers with direct involvement for manufacturer trained technicians to ensure the equipment is installed and commissioned properly.

.3 Plan and coordinate all work to maintain set project schedule.

.4 Coordinate all work with other trades to plan all installation prior to starting and fabrication work or installation works. Failure to do so and resulting interferences will require re-work at the contractor's expense.

.5 All ceiling mounted equipment requiring service access shall have locations planned to allow for ease of access from ceiling hatches/tiles. Any equipment not deemed easily accessible by owner/engineer will be required to be removed and reinstalled to allow proper access. This would include but not be limited to VAV boxes, reheat coils, valves, dampers, etc.

3.2 PAINTING, REPAIRS AND RESTORATION

.1 Do painting in accordance with Section 09 91 23 - Interior Painting.

.2 Prime and touch up marred finished paintwork to match original.

.3 Restore to new condition, finishes which have been damaged.

3.3 CLEANING

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

3.4 FIELD QUALITY CONTROL

.1 Site Tests: conduct following tests in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 - SUBMITTALS.

.1 Submit tests as specified in other sections of this specification.

.2 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

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

3.5 DEMONSTRATION

.1 Owner’s Representative will use equipment and systems for test purposes prior to acceptance. Contractor to supply labour, material, and instruments required for testing.

.2 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

.3 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.

.4 Instruction duration time requirements as specified in appropriate sections.

.5 Owner’s Representative may record these demonstrations on video tape for future reference.

3.6 PROTECTION

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

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

.1 Use of HVAC systems during construction.

1.2 RELATED SECTIONS

.1 Section 01 51 00 - Temporary Utilities.

1.3 USE OF SYSTEMS

.1 Use of new and/or existing permanent heating and/or ventilating systems for supplying temporary heat or ventilation is permitted only under the following conditions:

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

.2 Filters specified in this section are over and above those specified in other sections of this project.

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

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

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

1.2 RELATED SECTIONS

.1 Section 01 74 00 – Cleaning.

.2 Section 01 74 21 – Construction / Demolition Waste Management and Disposal

.3 Section 23 08 02 – Cleaning and Start-up of Mechanical Piping Systems.

1.3 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CSA S350, Code of Practice for Safety in Demolition of Structures.

1.4 DEFINITIONS

.1 Demolish: Detach items from existing construction and legally dispose of items off site, unless indicated as removed and salvaged, or removed and reinstalled.

.2 Remove: Planned deconstruction and disassembly of electrical items from existing construction including removal of conduit, junction boxes, cabling and wiring from electrical component to panel taking care not to damage adjacent assemblies designated to remain; legally dispose of items off site, unless indicated as removed and salvaged, or removed and reinstalled.

.3 Remove and Salvage: Detach items from existing construction and deliver them to Owner ready for reuse.

.4 Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.

.5 Existing to Remain: Existing items of construction that are not removed and that are not otherwise indicated as being removed and salvaged, or removed and reinstalled.

.6 Hazardous Substances: Dangerous substances, dangerous goods, hazardous commodities and hazardous products may include asbestos, mercury and lead, PCB's, poisons, corrosive agents, flammable substances, radioactive substances, or other material that can endanger human health or wellbeing or environment if handled

improperly as defined by the Federal Hazardous Products Act (RSC 1985) including latest amendments.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Coordination: Coordinate work of this Section to avoid interference with work by other Sections.

.2 Account for Owner's continued occupancy requirements during selective demolition and schedule staged occupancy and worksite activities.

1.6 SITE CONDITIONS

.1 Condition of materials identified as being salvaged or demolished are based on their observed condition on date that tender is accepted.

1.7 SALAVAGE AND DEBRIS MATERIALS

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

.2 Carefully remove materials and items designated for salvage and store in a manner to prevent damage or devaluation of materials

PART 2 PRODUCTS

2.1 MATERIALS

.1 Use only new materials required for completion or repair matching materials damaged during performance of work of this Section; new materials are required to meet assembly or system characteristics as existing systems indicated to remain and carry CSA approval labels required by the Authority Having Jurisdiction.

.2 Use listed fire stopping materials compatible with existing fire stopping systems where removal or demolition work affects rated assemblies, restore to match existing fire rated performance.

PART 3 EXECUTION

3.1 EXAMINATION

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

.2 Identify on-site removal of walls and ceiling to facilitate the work.

.3 Identify on-site testing of ductwork and equipment to facilitate the work.

3.2 PREPARATION

.1 Protect systems and components indicated to remain in place during selective demolition operations and as follows:

.1 Prevent movement and install bracing to prevent settlement or damage of adjacent services and parts of existing buildings scheduled to remain.

.2 Notify Owner and cease operations where safety of buildings being demolished, adjacent structures or services appears to be endangered and await additional instructions before resuming demolition work specified in this Section.

.3 Prevent debris from blocking drainage inlets.

.4 Protect mechanical systems that must remain in operation.

.5 Ensure hazardous materials are removed or abated prior to commencing demolition.

.6 For components intended for relocation and reuse, remove, store, protect, clean and reinstall and connect to HVAC systems, and recommission.

.2 Sequence demolition work so that interference with the use of the building by the Owner and users is minimized and as follows:

.1 Prevent debris from endangering the safe access to and egress from occupied buildings.

.2 Notify Owner and cease operations where safety of occupants appears to be endangered and await additional instructions before resuming demolition work specified in this Section.

3.3 EXECUATION

.1 Disconnect and cap gas supply and electrical services in accordance with requirements of local Authority Having Jurisdiction.

.2 Do not disrupt active or energized utilities without approval of the Owner.

.3 Erect and maintain dust proof and weather tight partitions to prevent the spread of dust and fumes to occupied building areas; remove partitions when complete.

.4 Demolish parts of existing building to accommodate new construction and remedial work as indicated.

.5 At end of each work day, leave worksite in safe condition.

.6 Perform demolition work in a neat and workmanlike manner:

.1 Remove any tools or equipment after completion of work, and leave site clean and ready for subsequent renovation work.

.2 Repair and restore damages caused as a result of work of this Section to match existing materials and finishes.

.7 Conduct demolition of HVAC systems in accordance with local Authority Having Jurisdiction (AHT) including the Department of Digital Government and Service NL, Engineering and Inspections Division.

3.4 CLOSEOUT ACTIVITIES

.1 Arrange for legal disposal and remove demolished materials to accredited provincial landfill site or alternative disposal site (recycle centre).

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Electrical motors, drives and guards for mechanical equipment and systems.

.2 Supplier and installer responsibility indicated in Motor, Control and Equipment Schedule on electrical drawings and related mechanical responsibility is indicated on Mechanical Equipment Schedule on mechanical drawings.

.3 Control wiring and conduit specified in Division 26. Control wiring 50V or less for systems specified in Division 21, 22, 23 and 25 is by Division 25.

1.2 RELATED SECTIONS:

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 21 – Construction/Demolition Waste Management and Disposal

1.3 REFERENCES

.1 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)

.1 ASHRAE 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings (IESNA cosponsored; ANSI approved; Continuous Maintenance Standard).

.2 National Energy Code for Buildings (NECB).

.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS).

.1 Safety Data Sheets (SDS).

.4 National Electrical Manufacturers Association (NEMA).

1.4 SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Safety Data Sheets (SDS) in accordance with Section 01 33 00 - Submittal Procedures.

.2 Shop Drawings: Submit drawings stamped and signed for approval by Owner.

.3 Quality Control: in accordance with Section 01 45 00 - Quality Control.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

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

.4 Closeout Submittals

.1 Provide maintenance data for motors, drives and guards for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 QUALITY ASSURANCE

.1 Regulatory Requirements: work to be performed in compliance with Canadian Environmental Protection Act (CEPA), Canadian Environmental Assessment Agency (CEAA), Transportation of Dangerous Goods Act (TDGA) and applicable Provincial regulations.

.2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.

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

.2 Waste Management and Disposal:

.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 PRODUCTS

2.1 GENERAL

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

2.2 MOTORS

.1 Provide motors for mechanical equipment as specified.

.2 Motors under 1/2 HP : speed as indicated, continuous duty, built-in overload protection, resilient mount, single phase, 120 V, unless otherwise specified or indicated.

.3 Motors 1/2 HP and larger: NEMA, Class B, 1.15 service factor, squirrel cage induction, premium efficiency, speed as indicated, continuous duty, enclosure as indicated, ball bearing, maximum temperature rise 40^{o} C, 3 phase, 575 V, unless otherwise indicated, for inverted duty for variable frequency drives.

2.3 TEMPORARY MOTORS

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

2.4 BELT DRIVES

.1 Fit reinforced belts in sheave matched to drive. Multiple belts to be matched sets.

.2 Use cast iron or steel sheaves secured to shafts with removable keys unless otherwise specified.

.3 For motors under 10 HP: standard adjustable pitch drive sheaves, having plus or minus 10% range. Use mid-position of range for specified r/min.

.4 For motors 10 HP and over: sheave with split tapered bushing and keyway having fixed pitch unless specifically required for item concerned. Provide sheave of correct size to suit balancing.

.5 Correct size of sheave to be determined during commissioning.

.6 Minimum drive rating: 1.5 times nameplate rating on motor. Keep overhung loads within manufacturer's design requirements on prime mover shafts.

.7 Motor slide rail adjustment plates to allow for centre line adjustment.

.8 Supply one set of spare belts for each set installed in accordance with Section 01 78 00 – Closeout Submittals.

2.5 DRIVE GUARDS

.1 Provide guards for unprotected drives.

.2 Guards for belt drives;

.1 Expanded metal screen welded to steel frame.
.2 Minimum 1.2 mm thick sheet metal tops and bottoms.
.3 38 mm dia holes on both shaft centres for insertion of tachometer.
.4 Removable for servicing.

.3 Provide means to permit lubrication and use of test instruments with guards in place.

.4 Install belt guards to allow movement of motors for adjusting belt tension.

.5 Guard for flexible coupling:

.1 "U" shaped, minimum 1.6 mm thick galvanized mild steel.
.2 Securely fasten in place.
.3 Removable for servicing.

.6 Unprotected fan inlets or outlets:

.1 Wire or expanded metal screen, galvanized, 19 mm mesh.
.2 Net free area of guard: not less than 80% of fan openings.
.3 Securely fasten in place.
.4 Removable for servicing.

PART 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Fasten securely in place.

.2 Make removable for servicing, easily returned into, and positively in position.

3.3 FIELD QUALITY CONTROL

.1 Site Tests: conduct following tests in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 - SUBMITTALS.

.1 As specified in other sections of this specification.

.2 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.
.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
.3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.4 CLEANING

.1 Proceed in accordance with Section 01 74 00 - Cleaning.

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

END OF SECTION

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 74 00 – Cleaning.

.2 Section 01 74 21 – Construction / Demolition Waste Management and Disposal

.3 Section 07 84 00 – Firestopping.

.4 Section 23 08 02 – Cleaning and Start-up of Mechanical Piping Systems.

1.2 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal, paper, plastic, polystyrene, corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Divert unused metal materials from landfill to metal recycling facility approved by Owner.

1.3 QUALITY ASSURANCE

.1 Installers to be certified to journeyperson.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 CONNECTIONS TO EQUIPMENT

.1 In accordance with manufacturer's instructions unless otherwise indicated.

.2 Use valves and either unions or flanges for isolation and ease of maintenance and assembly.

.1 Unions are not required in installations using grooved mechanical couplings (The couplings shall serve as unions).

.3 Use double swing joints when equipment mounted on vibration isolation and when piping subject to movement.

.4 The flexible type grooved joint couplings may be used in lieu of a flexible connector at equipment connections for vibration attenuation and stress relief. Couplings shall be placed in close proximity to the source of the vibration, as per manufacturer's recommendations.

3.2 CLEARANCES

.1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer.

.2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer or as indicated (whichever is greater) without interrupting operation of other system, equipment, components.

3.3 DRAINS

.1 Install piping with grade in direction of flow except as indicated.

.2 Install drain valve at low points in piping systems, at equipment and at section isolating valves.

.3 Pipe each drain valve discharge separately to above floor drain. Discharge to be visible.

.4 Drain valves: NPS 3/4 gate or globe valves unless indicated otherwise, with hose end male thread, cap and chain.

3.4 AIR VENTS

.1 Install automatic air vents at high points in piping systems.

.2 Install isolating valve at each automatic air valve.

.3 Install drain piping to approved location and terminate where discharge is visible.

3.5 DIELECTRIC WATERWAY FITTINGS AND COUPLINGS

.1 General: Compatible with system, to suit pressure rating of system.

.2 Locations: Where dissimilar metals are joined.

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

.1 Waterway fittings shall be complete with thermoplastic liner.

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

.1 Waterway fittings shall be complete with thermoplastic liner.

3.6 PIPEWORK INSTALLATION

.1 Installation by certified journeyperson.

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

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

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

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

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

.5 Protect openings against entry of foreign material.

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

.7 Assemble piping using fittings manufactured to ANSI standards.

.8 Saddle type branch fittings may be used on mains if branch line is no larger than half the size of main.

.1 Hole saw (or drill) and ream main to maintain full inside diameter of branch line prior to welding saddle.

.9 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.

.10 Install concealed pipework to minimize furring space, maximize headroom, conserve space.

.11 Slope piping, except where indicated, in direction of flow for positive drainage and venting.

.12 Install, except where indicated, to permit separate thermal insulation of each pipe.

.13 Group piping wherever possible and as indicated.

.14 Ream pipes, remove scale and other foreign material before assembly.

.15 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.

.16 Provide for thermal expansion as indicated.

.17 Valves:

.1 Install in accessible locations.
.2 Remove interior parts before soldering.
.3 Install with stems above horizontal position unless otherwise indicated.
.4 Valves accessible for maintenance without removing adjacent piping.
.5 Install globe valves in bypass around control valves.
.6 Use ball or butterfly valves at branch take-offs for isolating purposes except where otherwise specified.
.7 Install butterfly valves on chilled water and related condenser water systems only.
.8 Install butterfly valves between weld neck flanges to ensure full compression of liner.
.9 Install ball valves for glycol service.
.10 Use chain operators on valves NPS 2-1/2 and larger where installed more than 2400 mm above floor in Mechanical Rooms.

.18 Check Valves:

.1 Install silent check valves on discharge of pumps and in vertical pipes with downward flow and elsewhere as indicated.
.2 Install swing check valves in horizontal lines on discharge of pumps and elsewhere as indicated.

3.7 SLEEVES

.1 General: Install where pipes pass through masonry, concrete structures, fire rated assemblies, and elsewhere as indicated.

.2 Material: Schedule 40 black steel pipe.

.3 Construction: Foundation walls and where sleeves extend above finished floors to have annular fins continuously welded on at mid-point.

.4 Sizes: 6 mm minimum clearance between sleeve and uninsulated pipe or between sleeve and insulation.

.5 Installation:

.1 Concrete, masonry walls, concrete floors on grade: Terminate flush with finished surface.
.2 Other floors: Terminate 25 mm above finished floor.

.3 Before installation, paint exposed exterior surfaces with heavy application of zinc-rich paint.

.6 Sealing:

.1 Foundation walls and below grade floors: Fire retardant, waterproof non-hardening mastic.

.2 Elsewhere: Provide space for firestopping. Maintain fire rating integrity.

.3 Sleeves installed for future use: Fill with lime plaster or other easily removable filler.

.4 Ensure no contact between copper pipe or tube and sleeve.

3.8 ESCUTCHEONS

.1 Install on pipes passing through walls, partitions, floors, and ceilings in finished areas.

.2 Construction: One piece type with set screws. Chrome or nickel plated brass or type 302 stainless steel.

.3 Sizes: Outside diameter to cover opening or sleeve. Inside diameter to fit around pipe or outside of insulation if so provided.

3.9 PREPARATION FOR FIRESTOPPING

.1 Material and installation within annular space between pipes, ducts, insulation and adjacent fire separation to 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 firestopping material or installation, or install per manufacturer’s recommendation as specified within the associated approval.

.4 Insulated pipes and ducts: Ensure integrity of insulation and vapour barriers.

3.10 FLUSHING OUT OF PIPING SYSTEMS

.1 In accordance with Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.

.2 Before start-up, clean interior of piping systems in accordance with requirements of Section 01 74 00 - Cleaning supplemented as specified in relevant sections of other Divisions.

.3 Preparatory to acceptance, clean and refurbish equipment and leave in operating condition, including replacement of filters in piping systems.

3.11 PRESSURE TESTING OF EQUIPMENT AND PIPEWORK

.1 Advise Owner, 48 hours minimum prior to performance of pressure tests.

.2 Pipework: Test as specified in relevant sections of other sections or Divisions.

.3 Maintain specified test pressure without loss for four (4) hours minimum unless specified for longer period of time in relevant sections of other Divisions.

.4 Prior to tests, isolate equipment and other parts which are not designed to withstand test pressure or media.

.5 Conduct tests in presence of Owner. Work to be carried out in off hours after 5 p.m., weekends or holidays.

.6 Pay costs for repairs or replacement, retesting, and making good. Owner to determine whether repair or replacement is appropriate.

.7 Insulate or conceal work only after approval and certification of tests by Owner.

3.12 EXISTING SYSTEMS

.1 Connect into existing piping systems at times approved by Owner. Work to be carried out off hours after 5 p.m., weekends or holidays.

.2 Request written approval ten (10) working days minimum, prior to commencement of work.

.3 Be responsible for damage to existing plant by this work.

.4 Ensure daily clean-up of existing areas.

END OF SECTION

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 74 21 – Construction/Demolition Waste Management and Disposal

.2 Section 23 05 15 - Common Installation Requirements for HVAC Pipework.

.3 Section 23 21 13.02 - Hydronic Systems: Steel

1.2 REFERENCES

.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 B31.5, Refrigeration Piping and Heat Transfer Components.
- .4 ANSI/ASME B31.9 Building Services.
- .5 ANSI/ASME Boiler and Pressure Vessel Code
  - .1 Section I: Power Boilers.
  - .2 Section V: Nondestructive Examination.
  - .3 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 C1.1, Recommended Practices for Resistance Welding.
- .2 AWS Z49.1, Safety Welding, Cutting and Allied Process.
- .3 AWS W1, Welding Inspection Handbook.

.4 Canadian General Standards Board

- .1 CAN/CGSB-48.2, Spot Radiography of Welded Butt Joints in Ferrous Materials.

.5 Canadian Standards Association (CSA International)

- .1 CSA W47.2, Certification of Companies for Fusion Welding of Aluminum.
- .2 CSA W48 series, Filler Metals and Allied Materials for Metal Arc Welding.
- .3 CSA B51, Boiler, Pressure Vessel and Pressure Piping Code.
- .4 CSA B52 Mechanical Refrigeration Code.
- .5 CSA W117.2, Safety in Welding, Cutting and Allied Processes.
- .6 CSA W178.1, Certification of Welding Inspection Organizations.

.7 CSA W178.2, Certification of Welding Inspectors.

.6 Provincial regulations: Boiler, Pressure Vessel and Compressed Gas Regulations.

1.3 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 Furnish welder's qualifications to Owner.

.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.

1.4 QUALITY ASSURANCE

.1 Registration of welding procedures in accordance with CSA B51, CSA B52 and provincial regulations.

.2 Copy of welding procedures available for inspection.

.3 Safety in welding, cutting and allied processes in accordance with CSA-W117.2.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 21 – Construction / Demolition Waste Management and Disposal, and with the Waste Reduction Workplan.

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal, paper, plastic, polystyrene, corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Divert unused metal materials from landfill to metal recycling facility as approved by Owner.

PART 2 PRODUCTS

2.1 ELECTRODES

.1 Electrodes: in accordance with CSA W48 Series.

PART 3 EXECUTION

3.1 WORKMANSHIP

.1 Welding: in accordance with ANSI/ASME B31.1 B31.3, B 31.5, B31.9, ANSI/ASME Boiler and Pressure Vessel Code, Sections I and IX and ANSI/AWWA C206, using procedures conforming to AWS C1.1, and special procedures specified elsewhere in Mechanical Division and applicable requirements of provincial authority having jurisdiction.

3.2 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.

3.3 INSPECTION AND TESTS - GENERAL REQUIREMENTS

.1 Review weld quality requirements and defect limits of applicable codes and standards with Owner before work is started.

.2 Formulate "Inspection and Test Plan" in co-operation with Owner.

.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.

3.4 SPECIALIST EXAMINATIONS AND TESTS

.1 General

.1 Perform examinations and tests by specialist engaged by contractor, qualified in accordance with CSA W178.1 and CSA W178.2 and approved by Owner.

.2 To ANSI/ASME Boiler and Pressure Vessels Code, Section V, CSA B51 and requirements of authority having jurisdiction.

.3 Inspect and test welds in accordance with "Inspection and Test Plan" by non-destructive visual examination and magnetic particle (hereinafter referred to as "particle") tests and/or spot or full gamma ray radiographic (hereinafter referred to as "radiography") tests. As per applicable reference standard or as specified.

.2 Hydrostatically test welds to requirements of 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 Owner of total of up to 10 % of welds, selected at random by Owner by radiographic tests.

.2 Full radiographic tests for piping systems.

.1 Spot radiography to CAN/CGSB-48.2.

.1 Conduct spot radiographic tests of up to 10% of welds, selected at random by Owner 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 Owner. 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 fail tests.

.5 Magnetic particle tests for piping systems as indicated.

.1 All welded pipe.

3.5 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 below 1000 kPa:

.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 particle tests.

3.6 REPAIR OF WELDS WHICH FAILED TESTS

.1 Re-inspect and re-test repaired or re-worked welds at Contractor's expense.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

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

1.2 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures

.2 Section 01 74 21 – Construction/Demolition Waste Management and Disposal

.3 Section 23 05 23.01 – Valves - Bronze

.4 Section 23 05 53.01 – Mechanical Identification

1.3 REFERENCES

.1 American Society of Mechanical Engineers (ASME)

- .1 ASME B40.100, Pressure Gauges and Gauge Attachments.
- .2 ASME B40.200, Thermometers, Direct Reading and Remote Reading.

.2 Canadian General Standards Board (CGSB)

- .1 CAN/CGSB-14.4, Thermometers, Liquid-in-Glass, Self Indicating, Commercial/Industrial Type.
- .2 CAN/CGSB-14.5, Thermometers, Bimetallic, Self-Indicating, Commercial/Industrial Type.

1.4 SUBMITTALS

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

.2 Submit shop drawings and product data.

.3 Submit manufacturer's product data for following items:

- .1 Thermometers
- .2 Pressure Gauges
- .3 Ball Valves
- .4 Syphons
- .5 Wells

1.5 HEALTH AND SAFETY

.1 Do construction occupational health and safety in accordance with Section 01 35 29.06 – Health and Safety Requirements.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

.2 Collect, separate and place in designated containers for reuse and recycling, paper, plastic, polystyrene, corrugated cardboard packaging, steel, metal, in accordance with Waste Management Plan.

.3 Fold up metal banding, flatten and place in designated area for recycling.

.4 Place materials defined as hazardous or toxic waste in designated containers.

.5 Ensure emptied containers are sealed, labelled and stored safely for disposal away form children.

PART 2 PRODUCTS

2.1 GENERAL

.1 Design point to be at mid point of scale or range.

.2 Ranges: dual imperial and metric.

2.2 DIRECT READING THERMOMETERS

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

2.3 REMOTE READING THERMOMETERS

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

2.4 THERMOMETER WELLS

.1 Copper pipe: copper or bronze.

.2 Steel pipe: brass or stainless steel.

2.5 PRESSURE GAUGES

.1 Dial type: 112 mm to ASME B40.100, Grade 2A, stainless steel or phosphor bronze bourdon tube having 0.5% accuracy full scale, 1% accuracy for liquid filled.

.2 Provide:

.1 Siphon for steam service.
.2 Snubber for pulsating operation.
.3 Diaphragm assembly for corrosive service.
.4 Gasketted pressure relief back with solid front.
.5 Bronze ball valve to Section 23 05 23.01 – Valves – Bronze.
.6 Oil filled for high vibration applications, such as pumps.

PART 3 EXECUTION

3.1 GENERAL

.1 Install so they can be easily read from floor or platform. If this cannot be accomplished, install remote reading units.

.2 Install between equipment and first fitting or valve.

3.2 THERMOMETERS

.1 Install in wells on piping. Provide heat conductive material inside well.

.2 Install on inlet and outlet of:

.1 Heat exchangers.
.2 Heating and cooling coils.
.3 Boilers.
.4 Chillers.
.5 Cooling towers, closed circuit coolers and evaporative condensers.
.6 DHW tanks.
.7 In other locations as indicated.

.3 Install wells.

.4 Use extensions where thermometers are installed through insulation.

3.3 PRESSURE GAUGES

.1 Install in following locations:

.1 Suction and discharge of pumps. (Liquid filled.)
.2 Upstream and downstream of PRV's.
.3 Upstream and downstream of control valves.
.4 Inlet and outlet of coils.
.5 Inlet and outlet of heat exchangers.
.6 Outlet of boilers.
.7 In other locations as indicated.

.2 Install ball valves.

.3 Use extensions where pressure gauges are installed through insulation.

3.4 NAMEPLATES

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

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Bronze – valves.

1.2 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures

.2 Section 01 35 29.06 – Health and Safety Requirements.

.3 Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

.4 Section 01 78 00 – Closeout Submittals.

.5 Section 23 05 15 - Common Installation Requirements for HVAC Pipework.

1.3 REFERENCES

.1 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 ANSI/ASME B16.22, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

.2 American Society for Testing and Materials (ASTM)

.1 ASTM A 276, Specification for Stainless Steel Bars and Shapes.
.2 ASTM A536, Specification for Ductile Iron Castings.
.3 ASTM B 16, Specification for Free-Cutting Brass Rod Bar and Shapes for Use in Screw Machines.
.4 ASTM B 62, Specification for Composition Bronze or Ounce Metal Castings.
.5 ASTM B 283, Specification for Copper and Copper Alloy Die Forgings (Hot Pressed)
.6 ASTM B 505/B505M, Specification for Copper-Base Alloy Continuous Castings.
.7 ASTM B584, Specification for Copper Alloy Sand Castings for General Applications.

.3 Canadian Standards Association (CSA)

.1 CSA B242, Groove and Solder Type Mechanical Pipe Couplings.

.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.

1.4 SUBMITTALS

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

.2 Product Data: submit WHMIS SDS – Safety Data Sheets.

.1 Submit shop drawings and product data in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit data for valves specified this section.

.3 Grooved joint couplings and fittings to be indicated on product submittals and to be specifically identified with the applicable style or series designation.

.3 Closeout Submittals

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

1.5 QUALITY ASSURANCE

.1 Health and Safety

.1 Do construction occupational health and safety in accordance with Section 01 35 29.06 – Health and Safety Requirements.

.2 All grooved joint couplings, fittings, valves, and specialties to be the products of a single manufacturer. Grooving tools to be of the same manufacturer as the grooved components.

1.6 DELIVERY, STORAGE AND DISPOSAL

.1 Waste Management and Disposal

.1 Separate and recycle waste materials in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

.2 Collect and separate for disposal, paper, plastic, polystyrene, corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

1.7 MAINTENANCE

.1 Extra Materials

.1 Furnish following spare parts:

.1 Gaskets for flanges: one for every 10 flanged joints.

.2 Grooved couplings: IPS and copper-tube dimensioned, one for every 10 (ten) grooved joints.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Except for specialty valves, to be single manufacturer.

.2 All products to have Canadian registration numbers (CRN).

.3 End Connections

.1 Connection into adjacent piping/tubing:

.1 Steel pipe systems: Screwed ends to ANSI/ASME B1.20.1.

.2 Copper tube systems.

.1 Solder ends ANSI/ASME B16.18.

.2 Grooved ends to copper tube dimensions and CSA B242.

.3 Push-to-connect ends to ANSI/ASME B16.22 and manufacturer's standards.

.4 Lockshield Keys

.1 Where lockshield valves are specified, provide 10 keys of each size: malleable iron cadmium plated.

2.2 GATE VALVES

.1 Requirements common to all gate valves, unless specified otherwise:

.1 Standard specification: MSS SP-80.

.2 Bonnet: with hex. shoulders.

.3 Connections: with hex. shoulders.

.4 Inspection and pressure testing: to MSS SP-80. Tests to be hydrostatic.

.5 Packing: high grade non-asbestos packing.

.6 Handwheel: non-ferrous.

.7 Handwheel Nut: bronze to ASTM B62.

.8 Class 125, WP=860 kPa steam, 1.4 mPa WOG

.9 Class 150 WP=1.03 mPa steam, 2.07 mPa WOG.

.2 NPS 2 and under, non-rising stem, solid wedge disc, Class 125:

.1 Body: with long disc guides, screwed bonnet with stem retaining nut.

.2 Operator: Handwheel

.3 NPS 2 and under, non-rising stem, solid wedge disc, Class 150:

.1 Body: with long disc guides, screwed bonnet with stem retaining nut.
.2 Operator: Handwheel

.4 NPS 2 and under, rising stem, split wedge disc, Class 125:

.1 Body: with long disc guides, screwed bonnet.
.2 Disc: split wedge, bronze to ASTM B283, loosely secured to stem.
.3 Operator: Handwheel

.5 NPS 2 and under, rising stem, solid wedge disc, Class 125:

.1 Body: with long disc guides, screwed bonnet.
.2 Operator: Handwheel

.6 NPS 2 and under, rising stem, solid wedge disc, Class 150:

.1 Body: with long disc guides, screwed bonnet.
.2 Operator: Handwheel

2.3 GLOBE VALVES

.1 Requirements common to all globe valves, unless specified otherwise:

.1 Standard specification: MSS SP-80.
.2 Bonnet: union with hex. shoulders.
.3 Connections: screwed with hex. shoulders.
.4 Inspection and pressure testing: to MSS SP-80. Tests to be hydrostatic.
.5 Packing: non-asbestos.
.6 Handwheel: non-ferrous.
.7 Handwheel Nut: bronze to ASTM B62.
.8 Class 125, WP=860 kPa steam, 1.4 MPa WOG
.9 Class 150 WP=1.03 mPa steam, 2.07 MPa WOG.

.2 NPS 2 and under, composition disc, Class125:

.1 Body and bonnet: screwed bonnet.
.2 Disc and seat: renewable rotating PTFE disc regrindable bronze seat, loosely secured to bronze stem to ASTM B505.
.3 Operator: Handwheel.

.3 NPS 2 and under, composition disc, Class 150:

.1 Body and bonnet: union bonnet.
.2 Disc and seat: renewable rotating PTFE disc in easily removable disc holder, regrindable bronze seat, loosely secured to bronze stem to ASTM B505.

.3 Operator: Handwheel

.4 NPS 2 and under, plug disc, Class 150, screwed ends:

.1 Body and bonnet: union bonnet.

.2 Disc and seat ring: tapered plug type with disc stem ring of stainless steel to ASTM A276, loosely secured to stem.

.3 Operator: Handwheel

.5 Angle valve, NPS 2 and under, composition disc, Class 150:

.1 Body and bonnet: union bonnet.

.2 Disc and seat: renewable rotating PTFE disc in slip-on easily removable disc holder having integral guides, regrindable bronze seat, loosely secured to stem.

.3 Operator: Handwheel.

2.4 CHECK VALVES

.1 Requirements common to all check valves, unless specified otherwise:

.1 Standard specification: MSS SP-80.

.2 Connections: with hex agonal shoulders.

.3 Class 125, WP=860 kPa steam, 1.4 MPa WOG

.4 Class 150 WP=1.03 mPa steam, 2.07 MPa WOG

.5 Class 200 1.4 MPa CWP

.2 NPS 2 and under, swing type, bronze disc, Class 125:

.1 Body: Y-pattern with integral seat at 45°, screw-in cap with hex head.

.2 Disc and seat: renewable rotating disc, two-piece hinge disc construction; seat: regrindable.

.3 NPS 2 and under, swing type, bronze disc, Class 150:

.1 Body: Y-pattern with integral seat at 45°, screw-in cap with hex head.

.2 Disc and seat: renewable rotating disc, two-piece hinge disc construction; seat: regrindable.

.4 NPS 2 and under, swing type, composition disc, Class 200:

.1 Body: Y-pattern with integral seat at 45°, screw-in cap with hex. head.

.2 Disc: renewable rotating disc, of number 6 composition to suit service conditions, bronze two-piece hinge disc construction.

.5 NPS 2 and under, horizontal lift type, composition disc, Class150:

.1 Body: with integral seat, union bonnet ring with hex. shoulders, cap.

.2 Disc: renewable PTFE for steam, #6 composition rotating disc for water, oil or gas service in disc holder having guides top and bottom, of bronze to ASTM B62.

.6 NPS 2 and under, vertical lift type, bronze disc, Class 125:

.1 Disc: rotating disc having guides top and bottom, disc guides, retaining rings.

.7 NPS 2 and under, vertical or horizontal, lift type, 1380 kPa CWP.

.1 Disc: 301 stainless steel, center guided.

2.5 SILENT CHECK VALVES

.1 NPS 2 and under:

.1 Body: cast high tensile bronze to ASTM B62 with integral seat.
.2 Pressure rating: Class 125.
.3 Connections: screwed ends to ANSI B1.20.1 and with hex. shoulders.
.4 Disc and seat: renewable rotating disc.
.5 Stainless steel spring, heavy duty.
.6 Seat: regrindable.

2.6 BALL VALVES

.1 NPS 2 and under:

.1 Body and cap: cast high tensile bronze to ASTM B16 or ASTM B62.
.2 Pressure rating: Class 125, 860 MPa steam.
.3 Connections: Screwed ends to ANSI B1.20.1 and with hex. shoulders. Push-to-connect, Pressfit ends.
.4 Stem: tamperproof ball drive.
.5 Stem packing nut: external to body.
.6 Ball and seat: replaceable stainless steel or hard chrome, plated brass solid ball and teflon seats.
.7 Stem seal: TFE, EPDM, Nitrile, Fluoroelastomer with with external packing nut.
.8 Operator: removable lever handle with extension for insulated pipe.
.9 Cap and drain for drain service.

2.7 BUTTERFLY VALVES

.1 NPS 2-1/2 through NPS 6.

.1 Body: cast bronze per CDA-836 (85-5-5-5).
.2 Pressure rating: 2065-kPa CWP.
.3 Connections: copper tube dimensioned grooved ends.
.4 Disc: ductile iron per ASTM A536 with elastomer coating.
.5 Stem: integrally cast with disc.
.6 Stem Nuts: nickel plated 416 stainless steel.

.7 Operator: gear operator, NPS and over.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install rising stem valves in upright position with stem above horizontal.

.2 Remove internal parts before soldering.

.3 Adjoining tube, couplings, and fittings with grooved joint valves shall be copper-tube dimensioned. Flaring tube or fitting ends to accommodate IPS sized valves is not permitted.

.4 Install valves with unions at each piece of equipment arranged to allow servicing, maintenance, and equipment removal.

.1 Unions are not required in installations using grooved mechanical couplings. The couplings shall serve as unions.

3.2 COMMISSIONING

.1 As part of commissioning activities, develop schedule of valves and record thereon identifier, location, service, purchase order number and date, manufacturer, identification data specified above.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

.1 Valves Cast Steel, gate, globe, and check.

1.2 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures

.2 Section 01 35 29.06 – Health and Safety Requirements.

.3 Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

.4 Section 01 78 00 – Closeout Submittals.

.5 Section 23 05 15 - Common Installation Requirements for HVAC Pipework.

1.3 REFERENCES

.1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)

.1 ANSI/ASME B16.5, Pipe Flanges and Flanged Fittings: NPS through NPS 24 Metric/Inch Standard.

.2 ANSI/ASME B16.10, Face-to-Face and End-to-End Dimensions Valves.

.3 ANSI/ASME B16.25, Buttwelding Ends.

.4 ANSI/ASME B16.34, Valves-Flanged, Threaded, and Welding End.

.2 American Petroleum Institute (API)

.1 API 598, Valve Inspection and Testing

.3 American Society for Testing and Materials International (ASTM)

.1 ASTM A49, Standard Specification for Heat-Treated Carbon Steel Joint Bars, Micro Alloyed Joint Bars, and Forged Carbon Steel Comprise Joint Bars.

.2 ASTM A193/A193M, Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature or High Pressure Service and Other Special Purpose Applications.

.3 ASTM A 194/A194M, Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service.

.4 ASTM A 216/A216M, Specification for Steel Castings, Carbon Suitable for Fusion Welding for High Temperature Service.

.5 ASTM B 85, Specification for Aluminum-Alloy Die Castings.

.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-61, Pressure Testing of Steel Values.

1.4 SUBMITTALS

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

.2 Product Data: submit WHMIS SDS – Safety Data Sheets in accordance with Section 01 33 00 – Submittal Procedures.

.1 Submit shop drawings and product data in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit data for valves specified this section.

.3 Submit product data in accordance with Section 01 33 00 – Submittal Procedures.

.3 Closeout Submittals

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

1.5 QUALITY ASSURANCE

.1 Health and Safety

.1 Do construction occupational health and safety in accordance with Section 01 35 29.06 – Health and Safety Requirements.

1.6 DELIVERY, STORAGE AND DISPOSAL

.1 Waste Management and Disposal

.1 Separate and recycle waste materials in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

.2 Collect and separate for disposal, paper, plastic, polystyrene, corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

1.7 MAINTENANCE

.1 Extra Materials

.1 Furnish following spare parts:

.2 Valve seats: one for every 10 valves each size. Minimum 1.

.3 Discs: one for every 10 valves, each size. Minimum 1.

.4 Stem packing: one for every 10 valves, each size. Minimum 1.

.5 Valve handles: 2 of each size.

.6 Gaskets for flanges: one for every 10 flanged joints.

PART 2 PRODUCTS

2.1 MATERIAL

.1 Except for specialty valves, to be of single manufacturer.

.2 Valves to be individually tested.

.3 Requirements common to valves, unless specified otherwise:

- .1 Pressure-temperature ratings: to ANSI B16.34.
- .2 Inspections and tests: to API 598.
- .3 Pressure Testing: to MSS SP-61.
- .4 Flanged valves:
  - .1 Face-to-face dimensions: to ANSI B16.10.
  - .2 Flange dimensions: to ANSI B16.5 with 1.6 mm raised face
- .5 Butt-weld valves:
  - .1 End-to-end dimensions: to ANSI B16.10.
  - .2 End dimensions: to ANSI B16.25 bored for standard pipe schedule
- .6 Hand wheel: non-heating type with raised rim of die-cast aluminum alloy to ASTM B85 or malleable iron to ASTM A49.
- .7 Markings: to MSS SP-25.
- .8 Identification:
  - .1 Plate showing catalogue number, size, material of body, disc, stem seat, fluid, pressure-temperature rating.
  - .2 Body markings: manufacturer, size, primary service rating, material symbol.
- .9 Canadian Registration Number (CRN) required for all products.

2.2 GATE VALVES

.1 NPS 2 1/2 - 12, rising stem, OS&Y, flexible wedge disc, flanged ends, Class150 or 300:

- .1 Body and multiple-bolted integral yoke and bonnet: cast steel to ASTM A216 WCB, with full length disc guides designed to ensure correct re-assembly.
- .2 Body/bonnet joint: Flat face male-female with corrugated metallic gasket.
- .3 Bonnet studs: to ASTM A193/A193M Type B7.
- .4 Bonnet nuts: to ASTM A194/A194M Type 2H.
- .5 Stuffing box: including non-galling two-piece ball jointed packing gland, with swing-type eye bolts and nuts.
- .6 Gland packing: containing corrosion inhibitor to prevent stem pitting.
- .7 Yoke sleeve: Ni-Resist, minimum melting point above 954°C.

.8 Hydraulic grease fitting: for lubrication of yoke sleeve bearing surfaces.

.9 Disc: with disc stem ring to connect to stem, guided throughout its travel.

.1 NPS 2 1/2 - 6: Solid corrosion and heat resistant 13% chromium steel with minimum hardness of 350 HB.

.2 NPS 8 and larger: Carbon steel faced with corrosion and heat resistant 13% chromium steel with minimum hardness of 350 HB.

.10 Seat ring: seamless carbon steel with hard-faced cobalt-chromium-tungsten alloy seating surface, slipped in, seal welded, ground to match disc.

.11 Stem: heat treated corrosion and heat resistant 13% chromium steel with accurately-cut precision-machined Acme or 60□ V threads, top screwed for handwheel nut, T-head disc-stem connection.

.12 Operator: see elsewhere this section.

2.3 GLOBE VALVES

.1 NPS 2 1/2 - 12, rising stem, OS&Y, flanged butt-weld ends, Class150 or 300:

.1 Body and multiple-bolted integral yoke and bonnet: cast steel to ASTM A216/A216M WCB.

.2 Body/bonnet joint: Male-female face with corrugated metallic gasket.

.3 Bonnet studs: to ASTM A193/A193M Type B7.

.4 Bonnet nuts: to ASTM A194/A194M Type 2H.

.5 Stuffing box: including non-galling two-piece ball-jointed packing gland, with swing-type eye bolts and nuts.

.6 Gland packing: containing corrosion inhibitor to prevent stem pitting.

.7 Yoke bushing: Ni-Resist, minimum melting point above 954□C.

.8 Hydraulic grease fitting: for lubrication of yoke sleeve bearing surfaces.

.9 Disc: Plug type with 15□ taper seat and bottom guide.

.10 Seat rings: with 1.6 mm thick cobalt-chromium-tungsten alloy facings with minimum hardness of 375 HB (cold), slipped in, seal welded, ground to match disc.

.11 Stem: heat treated corrosion and heat resistant 13% chromium steel with bonnet bushing, long engagement with yoke bushing for accurate seating, accurately-cut precision-machined Acme or 60□ V threads, top screwed for handwheel nut.

.12 Operator: see elsewhere this section.

2.4 VALVE OPERATORS

.1 Handwheel: on all gate and globe valves except as specified.

.2 Handwheel with chain operators: on valves installed more than 2400 mm above floor in Boiler Rooms and Mechanical Equipment Rooms.

2.5 BYPASSES FOR GATE AND GLOBE VALVES

.1 Locations: on valves as indicated.

.2 Position of bypass valve on main valves: stem vertical or parallel position.

.3 Size of bypass valve:

.1 Main valve up to NPS 8: NPS 3/4.

.2 Main valve NPS 10 and over: NPS 1.

.4 Type of bypass valves:

.1 On gate valve: globe, with composition disc, bronze trim, to Section 23 05 23.01 - Valves - Bronze

.2 On globe valve: globe, with composition disc, bronze trim, to Section 23 05 23.01 – Valves - Bronze

2.6 CHECK VALVES

.1 NPS 2 1/2 and over, flanged - ends, Class150 or 300: swing check.

.1 Body and multiple-bolted cap: cast steel to ASTM A216/A216M WCB.

.2 Cap studs: to ASTM A193/A193M Type B7.

.3 Cap nuts: to ASTM A194/A194M Type 2H.

.4 Body/cap joint: male-female face with corrugated metallic gasket.

.5 Disc: heat treated corrosion and heat resistant 13% chromium steel.

.6 Seat rings: heat treated corrosion and heat resistant 13% chromium steel, slipped in, seal welded, ground to match disc.

.7 Hinge: ASTM A 216 WCB.

.8 Hinge pin: 410 Stainless Steel.

2.7 SILENT CHECK VALVES

.1 Construction

.1 Body: Cast steel to ASTM with integral seat.

.2 Pressure rating: Class 125, 250.

.3 Connections: Flanged ends.

.4 Double bronze disc with SS seat and stem. Renewable disc, seat, stem and spring, Spring rating must match system design for silent operation and installation.

.5 Stainless steel spring, heavy duty.

.6 Seat: regrindable.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install in accordance with manufacturer's recommendations in upright position with stem above horizontal.

3.2 COMMISSIONING

.1 As part of commissioning activities, develop schedule of valves and record thereon identifier, location, service, purchase order number and date, manufacturer, identification data specified above.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

.1 Section includes:

.1 Concrete housekeeping pads, hangers and supports for mechanical piping, ducting and equipment.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 21 – Construction/Demolition Waste Management and Disposal

.3 Section 03 30 00 - Cast-in-Place Concrete.

.4 Section 05 12 23 - Structural Steel for Buildings.

.5 Section 05 50 00 - Metal Fabrications.

1.3 REFERENCES

.1 American National Standards Institute/ American Society of Mechanical Engineers (ANSI/ASME)

.1 ANSI/ASME B31.1, Power Piping, (SI Edition).

.2 American Society for Testing and Materials (ASTM)

.1 ASTM A125, Specification for Steel Springs, Helical, Heat-Treated.

.2 ASTM A307, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.3 ASTM A563, Specification for Carbon and Alloy Steel Nuts.

.3 Factory Mutual (FM)

.4 Health Canada / Workplace Hazardous Materials Information System (WHMIS).

.1 Safety Data Sheets (SDS).

.5 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)

.1 MSS SP-58, Pipe Hangers and Supports - Materials, Design and Manufacture.

.2 ANSI/MSS SP-69, Pipe Hangers and Supports - Selection and Application.

.3 MSS SP-89, Pipe Hangers and Supports - Fabrication and Installation Practices.

.6 Underwriter's Laboratories of Canada (ULC)

1.4 SYSTEM DESCRIPTION

.1 Design Requirements

.1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.

.2 Base maximum load ratings on allowable stresses prescribed by MSS SP58 or ASME B31.1.

.3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.

.4 Design hangers and supports to support systems under all conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.

.5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment to be in accordance with MSS SP58.

.2 Performance Requirements

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

1.5 SUBMITTALS

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

.2 Shop drawings: submit drawings stamped and signed for approval by Owner.

.3 Submit shop drawings and product data for following items:

.1 Bases, hangers and supports.

.2 Connections to equipment and structure.

.3 Structural assemblies.

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

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

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

.5 Closeout Submittals:

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

1.6 QUALITY ASSURANCE

.1 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.

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

.2 Waste Management and Disposal:

.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 PRODUCTS

2.1 GENERAL

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

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

2.2 PIPE HANGERS

.1 Finishes:

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

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

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

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

.1 Cold piping NPS 2 maximum: malleable iron C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip.

.1 Rod: 9 mm UL listed, 13 mm FM approved.

.2 Cold piping NPS 2 1/2 or greater, hot piping: Malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, UL listed, FM approved where required to MSS-SP58 and MSS-SP69.

.3 Upper attachment structural: Suspension from upper flange of I-Beam.

.1 Cold piping NPS 2 maximum: Ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, UL listed FM approved where required to MSS SP69.

.2 Cold piping NPS 2 1/2 or greater, all hot piping: Malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nut UL listed, FM approved where required.

.4 Upper attachment to concrete.

.1 Ceiling: Carbon steel welded eye rod, clevis plate, clevis pin and cotters with weldless forged steel eye nut. Ensure eye 6 mm minimum greater than rod diameter.

.2 Concrete inserts: wedge shaped body with knockout protector plate UL listed FM approved where required to MSS SP-69.

.5 Shop and field-fabricated assemblies.

.1 Trapeze hanger assemblies: MSS SP-89.

.2 Steel brackets: MSS SP-89.

.3 Sway braces for seismic restraint systems: to MSS SP-89.

.6 Hanger rods: threaded rod material to MSS SP-58.

.1 Ensure that hanger rods are subject to tensile loading only.

.2 Provide linkages where lateral or axial movement of pipework is anticipated.

.3 Do not use 22 mm or 28 mm rod.

.7 Pipe attachments: material to MSS SP-58.

.1 Attachments for steel piping: carbon steel galvanized.

.2 Attachments for copper piping: copper plated black steel.

.3 Use insulation saddles for hot pipework.

.4 Oversize pipe hangers and supports for insulated pipes.

.8 Adjustable clevis: material to MSS SP-69, UL listed FM approved, where required clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.

.1 Ensure "U" has hole in bottom for rivetting to insulation shields.

.9 Yoke style pipe roll: carbon steel yoke, rod and nuts with cast iron roll, to MSS SP-69.

.10 U-bolts: carbon steel to MSS SP-69 with 2 nuts at each end to ASTM A563.

.1 Finishes for steel pipework: galvanized.

.2 Finishes for copper, glass, brass or aluminum pipework: black with formed portion plastic coated or epoxy coated.

.11 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP-69.

2.3 RISER CLAMPS

.1 Steel or cast iron pipe: galvanized black carbon steel to MSS SP-58, type 42, UL listed FM approved where required.

.2 Copper pipe: carbon steel copper plated to MSS SP-58, type 42.

.3 Bolts: to ASTM A307.

.4 Nuts: to ASTM A563.

2.4 INSULATION PROTECTION SHIELDS

.1 Insulated cold piping:

.1 64 kg/m^3 density insulation plus insulation protection shield to: MSS SP-69, galvanized sheet carbon steel. Length designed for maximum 3.0 m span.

.2 Insulated hot piping:

.1 Curved plate 300 mm long, with edges turned up, welded-in centre plate for pipe sizes NPS 12 and over, carbon steel to comply with MSS SP-69.

2.5 CONSTANT SUPPORT SPRING HANGERS

.1 Springs: alloy steel to ASTM A125, shot peened, magnetic particle inspected, with +/-5% spring rate tolerance, tested for free height, spring rate, loaded height and provided with Certified Mill Test Report(CMTR).

.2 Load adjustability: 10 % minimum adjustability each side of calibrated load. Adjustment without special tools. Adjustments not to affect travel capabilities.

.3 Provide upper and lower factory set travel stops.

.4 Provide load adjustment scale for field adjustments.

.5 Total travel to be actual travel + 20%. Difference between total travel and actual travel 25 mm minimum.

.6 Individually calibrated scales on each side of support calibrated prior to shipment, complete with calibration record.

2.6 VARIABLE SUPPORT SPRING HANGERS

.1 Vertical movement: 13 mm minimum, 50 mm maximum, use single spring pre-compressed variable spring hangers.

.2 Vertical movement greater than 50 mm: use double spring pre-compressed variable spring hanger with 2 springs in series in single casing.

.3 Variable spring hanger to be complete with factory calibrated travel stops. Provide certificate of calibration for each hanger.

.4 Steel alloy springs: to ASTM A125, shot peened, magnetic particle inspected, with +/-5 % spring rate tolerance, tested for free height, spring rate, loaded height and provided with CMTR.

2.7 EQUIPMENT SUPPORTS

.1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel meeting requirements of Section 05 12 23 - Structural Steel for Buildings. Submit calculations with shop drawings.

2.8 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

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

2.9 PLATFORMS AND CATWALKS

.1 To Section 05 50 00 - Metal Fabrication.

2.10 HOUSE-KEEPING PADS

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

.2 Concrete: to Section 03 30 00 - Cast-in-place Concrete by Division 3.

2.11 OTHER EQUIPMENT SUPPORTS

.1 From structural grade steel meeting requirements of Section 05 12 23 - Structural Steel for Buildings.

.2 Submit structural calculations with shop drawings.

PART 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install in accordance with:

.1 Manufacturer's instructions and recommendations.

.2 Vibration Control Devices:

.1 Install on piping systems at pumps, boilers, chillers, cooling towers, elsewhere as indicated.

.3 Clamps on riser piping:

.1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.

.2 Bolt-tightening torques to be to industry standards.

.3 Steel pipes: Install below coupling or shear lugs welded to pipe.

.4 Cast iron pipes: Install below joint.

.4 Clevis plates:

.1 Attach to concrete with 4 minimum concrete inserts, one at each corner.

.5 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.

.6 Use approved constant support type hangers where:

.1 vertical movement of pipework is 13 mm or more,

.2 transfer of load to adjacent hangers or connected equipment is not permitted.

.7 Use variable support spring hangers where:

.1 transfer of load to adjacent piping or to connected equipment is not critical.

.2 variation in supporting effect does not exceed 25 % of total load.

3.3 HANGER SPACING

.1 Plumbing piping: most stringent requirements of Canadian Plumbing Code

.2 Fire protection: to applicable fire code.

.3 Gas and fuel oil piping: up to NPS 1/2: every 1.8 m.

.4 Copper piping: up to NPS 1/2: every 1.5 m.

.5 Hydronic, steam, condensate, rigid, and flexible joint roll groove pipe: in accordance with table below, but not less than one hanger at joints.

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

.6 Within 300 mm of each elbow.

.7 Pipework greater than NPS 12: to MSS SP69.

3.4 HANGER INSTALLATION

.1 Install hanger so that rod is vertical under operating conditions.

.2 Adjust hangers to equalize load.

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

3.5 HORIZONTAL MOVEMENT

.1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4 degrees from vertical.

.2 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.

3.6 FINAL ADJUSTMENT

.1 Adjust hangers and supports:

.1 Ensure that rod is vertical under operating conditions.

.2 Equalize loads.

.2 Adjustable clevis:

.1 Tighten hanger load nut securely to ensure proper hanger performance.

.2 Tighten upper nut after adjustment.

.3 C-clamps:

.1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.

.4 Beam clamps:

.1 Hammer jaw firmly against underside of beam.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Materials and requirements for the identification of piping systems, duct work, valves and controllers, including the installation and location of identification systems.

.2 Sustainable requirements for construction and verification.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 21 – Construction/Demolition Waste Management and Disposal

.3 Section 09 91 23 - Interior Painting.

1.3 REFERENCES

.1 Canadian Gas Association (CGA)

.1 CSA/CGA B149.1, Natural Gas and Propane Installation Code.

.2 CSAZ7396.1 Medical Gas pipeline Systems – Part 1: Pipelines for medical gases and vacuum.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-24.3, Identification of Piping Systems.

.3 National Fire Protection Association (NFPA)

.1 NFPA 13, Standard for the Installation of Sprinkler Systems.

.2 NFPA 14, Standard for the Standpipe and Hose Systems.

1.4 SUBMITTALS

.1 Product Data:

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

.2 Product data to include paint colour chips, other products specified in this section.

.3 Samples:

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

.2 Samples to include nameplates, labels, tags, lists of proposed legends.

1.5 QUALITY ASSURANCE

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

.2 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 29.06 – Health and Safety Requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with Section 01 61 00 – Common Product Requirements.

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

.2 Waste Management and Disposal:

.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.2 Dispose of unused paint coating material at official hazardous material collections site approved by Owner.

.3 Do not dispose of unused paint coating material into sewer system, into streams, lakes, onto ground or in locations where it will pose health or environmental hazard.

PART 2 PRODUCTS

2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES

.1 Metal or plastic laminate nameplate mechanically fastened to each piece of equipment by manufacturer.

.2 Lettering and numbers to be raised or recessed.

.3 Information to include, as appropriate:

.1 Equipment: Manufacturer's name, model, size, serial number, capacity.

.2 Motor: voltage, Hz, phase, power factor, duty, frame size.

2.2 SYSTEM NAMEPLATES

.1 Colours:

.1 Hazardous: red letters, white background.

.2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).

.2 Construction:

.1 3 mm thick laminated plastic or white anodized aluminum, matte finish, with square corners, letters accurately aligned and machine engraved into core.

.3 Sizes:

.1 Conform to following table:

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

.2 Use maximum of 25 letters/numbers per line.

.4 Locations:

.1 Terminal cabinets, control panels: Use size # 5.

.2 Equipment in Mechanical Rooms: Use size # 9.

2.3 EXISTING IDENTIFICATION SYSTEMS

.1 Apply existing identification system to new work.

.2 Where existing identification system does not cover for new work, use identification system specified this section.

.3 Before starting work, obtain written approval of identification system from Owner.

2.4 PIPING SYSTEMS GOVERNED BY CODES

.1 Identification:

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

.2 Propane gas: to CSA/CGA B149.1 authority having jurisdiction.

.3 Sprinklers: to NFPA 13.

.4 Standpipe and hose systems: to NFPA 14.

.5 Medical Gas: to CAN/CSA Z7396.1.

2.5 IDENTIFICATION OF PIPING SYSTEMS

.1 Identify contents by background colour marking, pictogram (as necessary), legend; direction of flow by arrows. To CAN/CGSB 24.3 except where specified otherwise.

.2 Pictograms:

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

.3 Legend:

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

.4 Arrows showing direction of flow:

.1 Outside diameter of pipe or insulation less than 75 mm: 100 mm long x 50 mm high.

.2 Outside diameter of pipe or insulation 75 mm and greater: 150 mm long x 50 mm high.

.3 Use double-headed arrows where flow is reversible.

.5 Extent of background colour marking:

.1 To full circumference of pipe or insulation.

.2 Length to accommodate pictogram, full length of legend and arrows.

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

.1 Pipes and tubing 20 mm and smaller: Waterproof and heat-resistant pressure sensitive plastic marker tags.

.2 All other pipes: Pressure sensitive plastic-coated cloth or vinyl with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100%RH and continuous operating temperature of 150^{o}C and intermittent temperature of 200^{o}C.

.7 Colours and Legends:

.1 Where not listed, obtain direction from Owner.

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

Background colour	Legend, arrows
Yellow	BLACK
Green	WHITE
Red	WHITE

.3 Background colour marking and legends for piping systems:

Contents	Background colour marking	Legend

** Add design temperature
++ Add design temperature and pressure

Contents	Background colour marking	Legend
** Add design temperature		
++ Add design temperature and pressure		
Raw water	Green	RAW WATER
Hot water heating supply	Yellow	HEATING SUPPLY
Hot water heating return	Yellow	HEATING RETURN
Steam ___kPa	Yellow	___kPa STEAM
Steam condensate (gravity)	Yellow	ST.COND.RET (GRAVITY)
Steam condensate (pumped)	Yellow	ST.COND.RET (PUMPED)
Safety valve vent	Yellow	STEAM VENT
Intermittent blow-off	Yellow	INT. BLOW-OFF
Continuous blow-off	Yellow	CONT. BLOW-OFF
Conduit for low voltage control wiring	To Section 25 05 54 – EMCS: Identification	

2.6 IDENTIFICATION DUCTWORK SYSTEMS

.1 50 mm high stencilled letters and directional arrows 150 mm long x 50 mm high.

.2 Colours: Black, or co-ordinated with base colour to ensure strong contrast.

.3 Identify system: e.g. Supply AHU-1, Exhaust F-7.

2.7 VALVES, CONTROLLERS

.1 Brass tags 12 mm diameter with stamped identification data filled with black paint.

.2 Include flow diagrams for each system, of approved size, showing charts and schedules with identification of each tagged item, valve type, service, function, normal position, location of tagged item.

2.8 CONTROLS COMPONENTS IDENTIFICATION

.1 Identify all systems, equipment, components, controls, sensors with system nameplates specified in section 25 05 54 – EMCS: Identification. If no EMCS included in project, identification as per this section.

.2 Inscriptions to include function and (where appropriate) fail-safe position, component ID name.

2.9 LANGUAGE

.1 Identification to be in English.

PART 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 TIMING

.1 Provide identification only after all painting specified in Section 09 91 23 - Interior Painting has been completed.

3.3 INSTALLATION

.1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.

.2 Provide ULC and/or CSA registration plates as required by respective agency.

3.4 NAMEPLATES

.1 Locations:

.1 In conspicuous location to facilitate easy reading and identification from operating floor.

.2 Standoffs:

.1 Provide for nameplates on hot and/or insulated surfaces.

.3 Protection

.1 Do not paint, insulate or cover in any way.

3.5 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS

.1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels: At not more than 17 m intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles.

.2 Adjacent to each change in direction.

.3 At least once in each small room through which piping or ductwork passes.

.4 On both sides of visual obstruction or where run is difficult to follow.

.5 On both sides of separations such as walls, floors, partitions.

.6 Where system is installed in pipe chases, ceiling spaces, galleries, confined spaces, at entry and exit points, and at access openings.

.7 At beginning and end points of each run and at each piece of equipment in run.

.8 At point immediately upstream of major manually operated or automatically controlled valves, dampers, etc. Where this is not possible, place identification as close as possible, preferably on upstream side.

.9 Identification to be easily and accurately readable from usual operating areas and from access points.

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

3.6 VALVES, CONTROLLERS

.1 Valves and operating controllers, except at plumbing fixtures, radiation, or where in plain sight of equipment they serve: Secure tags with non-ferrous chains or closed "S"hooks.

.2 Install one copy of flow diagrams, valve schedules mounted in frame behind non-glare glass where directed by Owner. Provide one copy (reduced in size if required) in each operating and maintenance manual.

.3 Number valves in each system consecutively.

3.7 CLEANING

.1 Proceed in accordance with Section 01 74 00 – Cleaning.

.2 Upon completion and verification of performance of installation, remove surplus materials, rubbish, tools and equipment.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

.1 TAB is used throughout this Section to describe the process, methods and requirements of testing, adjusting and balancing for HVAC.

.2 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do other work as specified in this Section.

1.2 QUALIFICATIONS OF TAB PERSONNEL

.1 Submit names of personnel certified to AABC, NEBB or SMACNA to perform TAB to Owner within 90 days of award of contract.

.2 Provide documentation confirming qualifications, successful experience. TAB contractor shall have a minimum of 5 (five) years experience to AABC, NEBB or SMACNA.

.3 TAB: performed in accordance with the requirements of standard under which TAB Firm's qualifications are approved:

- .1 Associated Air Balance Council, (AABC) National Standards for Total System Balance, MN-1.
- .2 National Environmental Balancing Bureau (NEBB) TABES, Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems.
- .3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), HVAC TAB HVAC Systems – Testing, Adjusting and Balancing.

.4 Recommendations and suggested practices contained in the TAB Standard: mandatory.

.5 Use TAB Standard provisions, including checklists, and report forms to satisfy Contract requirements.

.6 Use TAB standard for TAB, including qualifications for TAB Firm and Specialist and calibration of TAB instruments.

.7 Where instrument manufacturer calibration recommendations are more stringent than those listed in the TAB standard, use manufacturer's recommendations.

.8 TAB Standard quality assurance provisions such as performance guarantees form part of this contract.

- .1 For systems or system components not covered in TAB standard, use TAB procedures developed by TAB Specialist.
- .2 Where new procedures and requirements are applicable to Contract requirements have been published or adopted by body responsible for TAB Standard used

(AABC, NEBB, or SMACNA), requirements and recommendations contained in these procedures and requirements are mandatory.

1.3 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 other related systems under normal and emergency loads and operating conditions.

.3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.

1.4 EXCEPTIONS

.1 TAB of systems and equipment regulated by codes, standards to be to satisfaction of authority having jurisdiction.

1.5 CO-ORDINATION

.1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule so as to ensure completion before acceptance of project.

.2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.

1.6 PRE-TAB REVIEW

.1 Review contract documents before project construction is started and confirm in writing to Owner adequacy of provisions for TAB and other aspects of design and installation pertinent to success of TAB.

.2 Review specified standards and report to Owner in writing all proposed procedures which vary from standard.

.3 During construction, co-ordinate location and installation of TAB devices, equipment, accessories, measurement ports and fittings.

1.7 PRE TAB WORK – PRIOR TO DEMOLITION

.1 Measure supply airflow of existing dual duct system main hot deck and cold deck ducting in vicinity of mechanical room. Measure return airflow, OA airflow and exhaust airflow. Measure Amps on supply and exhaust fans. Provide report prior to commencement of demolition.

1.8 START-UP

.1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.

.2 Follow special start-up procedures specified elsewhere in other Divisions.

1.9 OPERATION OF SYSTEMS DURING TAB

.1 Operate systems for length of time required for TAB and as required by Owner for verification of TAB reports.

1.10 START OF TAB

.1 Notify Owner seven (7) working days prior to start of TAB.

.2 Start TAB when building is essentially completed, including:

.1 Installation of ceilings, doors, windows, other construction affecting TAB.
.2 Application of weatherstripping, sealing, caulking.
.3 All pressure, leakage, other tests specified elsewhere in other Divisions.
.4 All provisions for TAB installed and operational.

.3 Start-up, verification for proper, normal and safe operation of mechanical and associated electrical and control systems affecting TAB including but not limited to:

.1 Proper thermal overload protection in place for electrical equipment.
.2 Air systems:
.1 Filters in place, clean.
.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 Access doors, installed, closed.
.8 Outlets installed, volume control dampers open.
.3 Liquid systems:
.1 Flushed, filled, vented.
.2 Correct pump rotation.
.3 Strainers in place, baskets clean.
.4 Isolating and balancing valves installed, open.
.5 Calibrated balancing valves installed, at factory settings.

.6 Chemical treatment systems complete, operational.

1.11 APPLICATION TOLERANCES

.1 Do TAB to following tolerances of design values:

.1 Laboratory HVAC systems: plus 10%, minus 0%.
.2 Other HVAC systems: plus 5%, minus 5%.
.3 Hydronic systems: plus or minus 10 %.
.4 Refrigeration systems: plus or minus 10%.

1.12 ACCURACY TOLERANCES

.1 Measured values to be accurate to within plus or minus 2 % of actual values.

1.13 INSTRUMENTS

.1 Prior to TAB, submit to Owner list of instruments to be used together with serial numbers.

.2 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.

.3 Calibrate within 3 (three) months of TAB. Provide certificate of calibration to Owner.

1.14 SUBMITTALS

.1 Submit, prior to commencement of TAB:

.2 Proposed methodology and procedures for performing TAB if different from referenced standard.

1.15 PRELIMINARY TAB REPORT

.1 Submit for checking and approval of Owner, prior to submission of formal TAB report, sample of rough TAB sheets. Include:

.1 Details of instruments used.
.2 Details of TAB procedures employed.
.3 Calculations procedures.
.4 Summaries.

1.16 TAB REPORT

.1 Format to be in accordance with referenced standard.

.2 TAB report to show results in SI units and to include:

.1 Project record drawings.

.2 System schematics.

.3 Submit 3 (three) copies of TAB Report to Owner for verification and approval, in English in D-ring binders, complete with index tabs.

1.17 VERIFICATION

.1 Reported results subject to verification by Owner.

.2 Provide manpower and instrumentation to verify up to 30% of reported results.

.3 Number and location of verified results to be at discretion of Owner.

.4 Bear costs to repeat TAB as required to satisfaction of Owner.

1.18 SETTINGS

.1 After TAB is completed to satisfaction of Owner, replace drive guards, close access doors, lock devices in set positions, ensure sensors are at required settings.

.2 Permanently mark settings to allow restoration at any time during life of facility. Markings not to be eradicated or covered in any way.

1.19 COMPLETION OF TAB

.1 TAB to be considered complete when final TAB Report received and approved by Owner.

1.20 AIR SYSTEMS

.1 Standard: TAB to be to most stringent of this section or TAB standards of AABC or NEBB.

.2 Do TAB of systems, equipment, components, controls specified in other Divisions.

.3 Qualifications: personnel performing TAB to be qualified to standards of AABC or NEBB.

.4 Quality assurance: Perform TAB under direction of supervisor qualified to standards of AABC or NEBB.

.5 Measurements: to include, but not limited to, following as appropriate for systems, equipment, components, controls: air velocity, static pressure, flow rate, pressure drop (or loss), temperatures (dry bulb, wet bulb, dewpoint), duct cross-sectional area, RPM, electrical power, voltage, noise, vibration, amperage and volts for each stage of electrical heating coils.

.6 Locations of equipment measurements: To include, but not be limited to, following as appropriate:

.1 Inlet and outlet of dampers, filter, coil, humidifier, fan, other equipment causing changes in conditions.

.2 At controllers, controlled device.

.7 Locations of systems measurements to include, but not be limited to, following as appropriate: Main ducts, main branch, sub-branch, run-out (or grille, register or diffuser).

1.21 HYDRONIC SYSTEMS

.1 Definitions: for purposes of this section, to include low pressure hot water heating, chilled water, condenser water, glycol systems.

.2 Standard: TAB to be to most stringent of TAB standards of AABC or NEBB.

.3 Do TAB of systems, equipment, components, controls specified in other Divisions.

.4 Qualifications: personnel performing TAB to be qualified to standards of AABC or NEBB.

.5 Quality assurance: perform TAB under direction of supervisor qualified to standards of AABC or NEBB.

.6 Measurements: to include, but not limited to, following as appropriate for systems, equipment, components, controls: flow rate, static pressure, pressure drop (or loss), temperature, specific gravity, density, RPM, electrical power, voltage, noise, vibration.

.7 Locations of equipment measurement: to include, but not be limited to, following as appropriate:

.1 Inlet and outlet of heat exchangers (primary and secondary sides), boiler, chiller, coil, humidifier, cooling tower, condenser, pump, PRV, control valve, other equipment causing changes in conditions.

.2 At controllers, controlled device.

.8 Locations of systems measurements to include, but not be limited to, following as appropriate: supply and return of primary and secondary loops (main, main branch, branch, sub-branch) of all hydronic systems, inlet connection of make-up water.

1.22 OTHER SYSTEMS

1.23 OTHER TAB REQUIREMENTS

.1 General requirements applicable to work specified this paragraph:

.1 Qualifications of TAB personnel: as for air systems specified this section.

.2 Quality assurance: as for air systems specified this section.

.2 Building pressure conditions:

.1 Adjust HVAC systems, equipment, controls to ensure specified pressure conditions during winter and summer design conditions.

.3 Zone pressure differences:

.1 Adjust HVAC systems, equipment, controls to establish specified air pressure differentials, with all systems in all possible combinations of normal operating modes.

.4 Smoke management systems:

.1 Test for proper operation of all smoke and fire dampers, sensors, detectors, installed as component parts of air systems specified in other Divisions.

.5 Measurement of noise and vibration from equipment specified in Mechanical Division.

.1 Standard: 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment and 23 32 48 – Acoustical Air Plenums.

.2 Vibration measurements around each piece of rotating equipment.

.3 Sound measurements in each octave band around each piece of rotating equipment.

.4 Induct sound measurements in each octave band at each fan inlet and discharge.

.5 Induct sound measurements in each octave band at each air handling unit intake, return and discharge.

.6 Sound measurements in each octave band for each normally occupied room with air handling equipment running.

.6 Measurement of spatial noise:

.1 Standard: Section 23 32 48 – Acoustical Air Plenums.

1.24 POST- OCCUPANCY TAB

.1 Measure DBT, WBT (or %RH), air velocity, air flow patterns, NC levels, in occupied zone of areas designated by Owner.

.2 Participate in systems checks twice during Warranty Period - #1 approximately three (3) months after acceptance and #2 within three (3) months of termination of Warranty Period.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

.1 Section Includes:

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

1.2 RELATED SECTIONS:

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 35 29.06 - Health and Safety Requirements.

.3 Section 01 45 00 - Quality Control.

.4 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.5 Section 01 78 00 - Closeout Submittals.

.6 Section 01 91 13.13 - Commissioning (Cx) Requirements.

1.3 REFERENCES

.1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Safety Data Sheets (SDS).

.2 Sheet Metal and Air Conditioning Contractor's National Association (SMACNA)

.1 SMACNA HVAC Air Duct Leakage Test Manual.

1.4 SUBMITTALS

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

.2 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties. Include pressure test information and results as follows:

.1 Submit proposed report form and test report format to Owner for approval at least three (3) months before proposed date of first series of tests. Do not start tests until approval received in writing from Owner.

.2 Prepare report of results and submit to Owner within two (2) working days of completion of tests. Include:

.1 Schematic of entire system.

.2 Schematic of section under test showing test site.

.3 Required and achieved static pressures.

.4 Orifice differential pressure at test sites.

.5 Permissible and actual leakage flow rate (L/s) for test sites.

.6 Witnessed certification of results.

.3 Include test reports in final TAB report.

.4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.5 Instructions: submit manufacturer's installation instructions.

.6 Manufacturer's field reports specified.

1.5 QUALITY ASSURANCE

.1 Pre-Installation Meetings:

.1 Convene pre-installation meeting one week prior to beginning work of this Section and on-site installations.

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Co-ordination with other building subtrades.

.4 Review manufacturer's installation instructions and warranty requirements.

.2 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

PART 2 PRODUCTS

2.1 TEST INSTRUMENTS

.1 Test apparatus to include:

.1 Fan capable of producing required static pressure.

.2 Duct section with calibrated orifice plate mounted and accurately located pressure taps.

.3 Flow measuring instrument compatible with the orifice plate.

.4 Calibration curves for orifice plates used.

.5 Flexible duct for connecting to ductwork under test.

.6 Smoke bombs for visual inspections.

.2 Test apparatus: accurate to within +/- 3 % of flow rate and pressure.

.3 Submit details of test instruments to be used to Owner at least three (3) months before anticipated start date.

.4 Test instruments: calibrated and certificate of calibration deposited with Owner no more than 28 days before start of tests.

.5 Re-calibrated every six (6) months thereafter.

2.2 EQUIPMENT LEAKAGE TOLERANCES

.1 Equipment and system components such as VAV boxes, duct heating leakage: 2%.

PART 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 TEST PROCEDURES

.1 Maximum lengths of ducts to be tested consistent with capacity of test equipment.

.2 Section of duct to be tested to include:

.1 Fittings, branch ducts, tap-ins.

.3 Repeat tests until specified pressures are attained. Bear costs for repairs and repetition to tests.

.4 Base partial system leakage calculations on SMACNA HVAC Air Duct Leakage Test Manual.

.5 Seal leaks that can be heard or felt, regardless of their contribution to total leakage.

3.3 SITE TOLERANCES

.1 System leakage tolerances specified are stated as percentage of total flow rate handled by system. Pro-rate specified system leakage tolerances. Leakage for sections of duct systems: not to exceed total allowable leakage.

.2 Leakage tests on following systems not to exceed specified leakage rates.

.1 Small duct systems up to 250 Pa: leakage 2 %.

.2 VAV box and duct on downstream side of VAV box: leakage 2 %.

.3 Large low pressure duct systems up to 500 Pa: leakage 2 %.

.4 HP duct systems up to 1000 Pa pressure classification, including upstream side of VAV boxes: leakage 1%.

.3 Evaluation of test results to use surface area of duct and pressure in duct as basic parameters.

3.4 TESTING

.1 Test ducts before installation of insulation or other forms of concealment.

.2 Test after seals have cured.

.3 Test when ambient temperature will not affect effectiveness of seals, and gaskets.

.4 Flexible connections to VAV boxes.

3.5 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services.

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

.2 Manufacturer's Field Services: provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.3 Schedule site visits, to review Work, at stages listed:

.1 After delivery and storage of products, and when preparatory Work, or other Work, on which the Work of this Section depends, is complete but before installation begins.

.2 Twice during progress of Work at 25% and 60% complete.

.3 Upon completion of the Work, after cleaning is carried out.

.4 Obtain reports, within three (3) days of review, and submit, immediately, to Owner.

.2 Performance Verification:

.1 Owner to witness tests and to verify reported results.

.2 To be certified by same TAB agency approved by Owner to undertake TAB on this project.

3.6 CLEANING

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

END OF SECTION

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 21 - Construction/Demolition Waste Management and Disposal

.3 Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment

.4 Section 23 05 53.01 – Mechanical Identification.

1.2 REFERENCES

.1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

.1 ANSI/ASHRAE/IESNA 90.1, SI; Energy Standard for Buildings Except Low-Rise Residential Buildings.

.2 American Society for Testing and Materials International, (ASTM)

.1 ASTM B209M, Specification for Aluminum and Aluminum Alloy Sheet and Plate (Metric).

.2 ASTM C335, Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.

.3 ASTM C411, Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.

.4 ASTM C449/C449M, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.

.5 ASTM C547, Specification for Mineral Fiber Pipe Insulation.

.6 ASTM C553, Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

.7 ASTM C612, Specification for Mineral Fiber Block and Board Thermal Insulation.

.8 ASTM C795, Specification for Thermal Insulation for Use with Austenitic Stainless Steel.

.9 ASTM C921, Standard Practice for Determining Properties of Jacketing Materials for Thermal Insulation.

.3 Canadian General Standards Board (CGSB)

.1 CGSB 51-GP-52Ma, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.

.4 Thermal Insulation Association of Canada (TIAC): National Insulation Standards.

.5 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S102, Surface Burning Characteristics of Building Materials and Assemblies.

.6 National Energy Code of Canada for Buildings (NECB)

1.3 DEFINITIONS

.1 For purposes of this section:

.1 "CONCEALED" - insulated mechanical services and equipment in suspended ceilings and non-accessible chases and furred-in spaces.

.2 "EXPOSED" - will mean "not concealed" as defined herein.

.3 Insulation systems - insulation material, fasteners, jackets, and other accessories.

.2 TIAC Codes:

.1 CRD: Commercial Round Ductwork,

.2 CRF: Commercial Rectangular Finish.

1.4 SHOP DRAWINGS

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

.2 Submit for approval manufacturer's catalogue literature related to installation, fabrication for duct jointing recommendations.

1.5 SAMPLES

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

.2 Submit for approval: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed. Mount sample on 12 mm plywood board. Affix typewritten label beneath sample indicating service.

1.6 MANUFACTURERS' INSTRUCTIONS

.1 Submit manufacturer's installation instructions in accordance with Section 01 33 00 - Submittal Procedures.

.2 Installation instructions to include procedures used and installation standards achieved.

1.7 QUALIFICATIONS

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

1.8 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.2 Protect from weather and construction traffic.

.3 Protect against damage from any source.

.4 Store at temperatures and conditions recommended by manufacturer.

1.9 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 21 – Construction / Demolition Waste Management and Disposal.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal, paper, plastic, polystyrene, corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Divert unused metal materials from landfill to metal recycling facility approved by Owner.

.5 Divert unused adhesive material from landfill to official hazardous material collections site approved by Owner.

.6 Do no dispose of unused adhesive materials into sewer systems, into lakes, streams, onto ground or in other locations where it will pose health or environmental hazard.

PART 2 PRODUCTS

2.1 FIRE AND SMOKE RATING

.1 In accordance with CAN/ULC-S102:

.1 Maximum flame spread rating: 25.

.2 Maximum smoke developed rating: 50.

2.2 INSULATION

.1 Mineral fibre: as specified includes glass fibre, rock wool, slag wool.

.2 Thermal conductivity ("k" factor) not to exceed specified values at 24°C mean temperature when tested in accordance with ASTM C335.

.3 TIAC Code C-1: Rigid mineral fibre board to ASTM C612, with factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this Section).

.4 TIAC Code C-2: Mineral fibre blanket to ASTM C553 faced with factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this section).

.1 Mineral fibre: to ASTM C553.

.2 Jacket: to CGSB 51-GP-52Ma.

.3 Maximum "k" factor: to ASTM C553.

2.3 JACKETS

.1 Canvas:

.1 220 gm/m^2 cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.

.2 Lagging adhesive: Compatible with insulation.

.3 Aluminum:

.1 To ASTM B209 with moisture barrier as scheduled in PART 3 of this section.
.2 Thickness: 0.40 mm sheet.
.3 Finish: Stucco embossed or corrugated.
.4 Jacket banding and mechanical seals: 12 mm wide, 0.5 mm thick stainless steel.

.4 Stainless steel:

.1 Type: 304 or 316 where additional corrosion protection is required.
.2 Thickness: 0.25 mm sheet.
.3 Finish: Corrugated or stucco embossed.
.4 Jacket banding and mechanical seals: 12mm wide, 0.5 mm thick stainless steel.

2.4 ACCESSORIES

.1 Vapour retarder lap adhesive:

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

.2 Indoor Vapour Retarder Finish:

.1 Vinyl emulsion type acrylic, compatible with insulation.

.3 Insulating Cement: hydraulic setting on mineral wool, to ASTM C449.

.4 ULC Listed Canvas Jacket:

.1 220 gm/m^2 cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.

.5 Outdoor Vapour Retarder Mastic:

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

.6 Tape: self-adhesive, aluminum, reinforced, 75 mm wide minimum.

.7 Contact adhesive: quick-setting

.8 Canvas adhesive: washable.

.9 Tie wire: 1.5 mm stainless steel.

.10 Banding: 12 mm wide, 0.5 mm thick stainless steel.

.11 Facing: 25 mm galvanized steel hexagonal wire mesh stitched on one face of insulation.

.12 Fasteners: 4 mm diameter pins with 35 mm diameter or square clips, length to suit thickness of insulation.

PART 3 EXECUTION

3.1 PRE-INSTALLATION REQUIREMENTS

.1 Pressure testing of ductwork systems complete, witnessed and certified.

.2 Surfaces clean, dry, free from foreign material.

3.2 INSTALLATION

.1 Install in accordance with TIAC National Standards.

.2 Apply materials in accordance with manufacturer's instructions and as indicated.

.3 Use two layers with staggered joints when required nominal thickness exceeds 75 mm.

.4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.

.1 Hangers, supports to be outside vapour retarder jacket.

.5 Supports, Hangers in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment

.1 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork.

.6 Fasteners: At 300 mm oc in horizontal and vertical directions, minimum two rows each side.

3.3 DUCTWORK INSULATION SCHEDULE

.1 Insulation types and thicknesses: Conform to following Table:

.2

	TIAC Code	Vapour Retarder	Thickness (mm)
Rectangular cold and dual temperature supply air ducts (exposed)	C-1	yes	50
Round cold and dual temperature supply air ducts (concealed)	C-2	yes	50
Rectangular warm air ducts (exposed)	C-1	no	25

	TIAC Code	Vapour Retarder	Thickness (mm)
Round warm air ducts (exposed)	C-1	no	25
Rectangular cold and dual temperature supply air ducts (concealed)	C-2	Yes	25
Round cold and dual temperature supply air ducts (exposed)	C-1	yes	50
Rectangular warm air ducts (concealed)	C-2	No	25
Round warm air ducts (concealed)	C-2	No	25
Supply, return and exhaust ducts exposed in space being served			none
Outside air ducts to mixing plenum	C-1	yes	50
Mixing plenums	C-1	yes	25
Exhaust duct between dampers and louvers	C-1	no	50
Rectangular ducts outside	C-1	special	50
Round ducts outside	C-1	special	50
Acoustically lined ducts	See Section 23 33 53- Duct Liners		

.3 Exposed round ducts 600 mm and larger, smaller sizes where subject to abuse:

.1 Use TIAC code C-1 insulation, scored to suit diameter of duct.

.4 Finishes: Conform to following table:

	TIAC Code Rectangular	Round
Indoor, concealed	None	none
Indoor, exposed within mechanical room	CRF/1	CRD/2
Indoor, exposed elsewhere	CRF/2	CRD/3
Outdoor, exposed to precipitation	CRF/3	CRD/4
Outdoor, elsewhere	CRF/4	CRD/5

END OF SECTION

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 35 21 – LEED® Requirements.

.3 Section 01 74 21 – Construction/Demolition Waste Management and Disposal

.4 Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

.5 Section 23 05 53.01 – Mechanical Identification.

1.2 REFERENCES

.1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

.1 ANSI/ASHRAE/IESNA 90.1 SI, Energy Standard for Buildings except Low-Rise Residential Buildings.

.2 American Society for Testing and Materials (ASTM International)

.1 ASTM B209M, Specification for Aluminum and Aluminum Alloy Sheet and Plate.

.2 ASTM C335, Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.

.3 ASTM C411, Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.

.4 ASTM C449/C449M, Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.

.5 ASTM C533, Specification for Calcium Silicate Block and Pipe Thermal Insulation.

.6 ASTM C547, Specification for Mineral Fiber Pipe Insulation.

.7 ASTM C553, Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

.8 ASTM C612, Specification for Mineral Fiber Block and Board Thermal Insulation.

.9 ASTM C795, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.

.10 ASTM C921, Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

.3 Canadian General Standards Board (CGSB)

.1 CGSB 51-GP-52Ma, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.

.4 Thermal Insulation Association of Canada (TIAC)

.1 National Insulation Standards.

.5 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S102, Surface Burning Characteristics of Building Materials and Assemblies.

.6 National Energy Code of Canada for Buildings (NECB).

1.3 PRODUCT DATA

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

1.4 SAMPLES

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

.2 Submit for approval: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed. Mount sample on 12 mm plywood board. Affix typewritten label beneath sample indicating service.

1.5 MANUFACTURER'S INSTRUCTIONS

.1 Submit manufacturer's installation instructions in accordance with 01 33 00 - Submittal Procedures.

.2 Installation instructions to include procedures to be used, installation standards to be achieved.

1.6 QUALIFICATIONS

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

1.7 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.2 Protect from weather and construction traffic.

.3 Protect against damage from any source.

.4 Store at temperatures and conditions recommended by manufacturer.

1.8 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 21 – Construction/Demolition Waste Management And Disposal.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal, paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site for recycling in accordance with Waste Management Plan.

.4 Divert unused metal materials from landfill to metal recycling facility approved by Owner.

.5 Divert unused adhesive materials from landfill to official hazardous material collections site approved by Owner.

.6 Do not dispose of unused adhesive materials into sewer systems, into lakes, streams, onto ground or in other location where it will pose health or environmental hazard.

PART 2 PRODUCTS

2.1 FIRE AND SMOKE RATING

.1 In accordance with CAN/ULC-S102:

.1 Maximum flame spread rating: 25.

.2 Maximum smoke developed rating: 50.

2.2 INSULATION

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

.2 Thermal conductivity ("k" factor) not to exceed specified values at 24°C mean temperature when tested in accordance with ASTM C335.

.3 TIAC Code A-1: Rigid moulded mineral fibre without factory applied vapour retarder jacket.

.1 Mineral fibre: ASTM C547.

.2 Maximum "k" factor: ASTM C547.

.4 TIAC Code A-2: Rigid moulded calcium silicate in sections and blocks, and with special shapes to suit project requirements.

.1 Insulation: ASTM C533.

.2 Maximum "k" factor: ASTM C533.

.3 Design to permit periodic removal and re-installation

.5 TIAC Code A-3: Rigid moulded mineral fibre with factory applied vapour retarder jacket.

.1 Mineral fibre: ASTM C547.

.2 Jacket: to CGSB 51-GP-52Ma.

.3 Maximum "k" factor: ASTM C547.

.6 TIAC Code A-6: Flexible unicellular tubular elastomer.

.1 Insulation: with vapour retarder jacket to ASTM C534.
.2 Jacket: to CGSB 51-GP-52Ma.
.3 Maximum "k" factor: C534.
.4 Certified by manufacturer free of potential stress corrosion cracking corrodants.
.5 Flame spread index less than 25, and smoke developed index less than 50.

.7 TIAC Code C-1: Rigid mineral fibre board, unfaced.

.1 Mineral fibre: ASTM C612.
.2 Maximum "k" factor: ASTM C612.

.8 TIAC Code C-2: Mineral fibre blanket unfaced or faced with factory applied vapour retarder jacket (as scheduled in PART 3 of this section).

.1 Mineral fibre: ASTM C553.
.2 Jacket: to CGSB 51-GP-52Ma.
.3 Maximum "k" factor: ASTM C553.

.9 TIAC Code C-4: Rigid mineral fibre board faced with factory applied vapour retarder jacket.

.1 Mineral fibre: ASTM C612.
.2 Jacket: to CGSB 51-GP-52Ma.
.3 Maximum "k" factor: ASTM C612.

2.3 CEMENT

.1 Thermal insulating and finish

.1 To: ASTM C449/C449M.
.2 Hydraulic setting or air drying on mineral wool, to ASTM C449.

2.4 JACKETS

.1 Polyvinyl Chloride (PVC):

.1 One-piece moulded type and sheet to CGSB 51-GP-53M with pre-formed shapes as required.
.2 Colours: to match adjacent finish paint. Confirm with Owner.
.3 Minimum service temperatures: -20°C.
.4 Maximum service temperature: 65°C.
.5 Moisture vapour transmission: 0.02 perm.
.6 Thickness: 0.56 mm.
.7 Fastenings:

.1 Use solvent weld adhesive compatible with insulation to seal laps and joints.

.2 Tacks.

.3 Pressure sensitive vinyl tape of matching colour.

.8 Special requirements:

.1 Indoor: flame spread rating 25. Smoke developed 50.

.2 Outdoor: UV rated material at least 0.5 mm thick.

.9 Covering adhesive: Compatible with insulation.

.2 Canvas:

.1 220 gm/m^2 cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.

.2 Lagging adhesive: Compatible with insulation.

.3 Aluminum:

.1 To ASTM B209.

.2 Thickness: 0.50 mm sheet.

.3 Finish: Stucco embossed or corrugated.

.4 Joining: Longitudinal and circumferential slip joints with 50 mm laps.

.5 Fittings: 0.5 mm thick die-shaped fitting covers with factory-attached protective liner.

.6 Metal jacket banding and mechanical seals: stainless steel, 19 mm wide, 0.5 mm thick at 300 mm spacing.

.4 Stainless steel:

.1 Type: 304 or 316.

.2 Thickness: 0.25 mm.

.3 Finish: Smooth, corrugated or stucco embossed.

.4 Joining: Longitudinal and circumferential slip joints with 50 mm laps.

.5 Fittings: 0.50 mm thick die-shaped fitting covers with factory-attached protective liner.

.6 Metal jacket banding and mechanical seals: stainless steel, 19 mm wide, 0.5 mm thick at 300 mm spacing.

2.5 REMOVABLE INSULATION COVERS

.1 General:

.1 All Covers shall be sewn, stapled or" hog-ringed" covers shall not be acceptable.

.2 Covers on shell and tube exchangers shall be removable and shall permit separate access to the exchanger head and shell. Velcro access panels shall

be included over serial plates as well as several locations on the shell body and head for NDT measurements without having to remove the cover.

.3 Covers shall conform to the configuration of the items being insulated.

.4 Covers shall include openings for all protrusions such as pipes, packing glands on valves and expansion joints, hangers, supports, instrument lines, and other appurtenances.

.5 Covers shall be designed so that no force bending or folding of the cover is necessary for installation.

.6 Minimum 50mm wide flaps at terminal ends are to be provided to overlap adjacent covers to ensure a good heat seal.

.7 Parting seems shall be at the installed low points (gravitational bottom) of the cover to allow drainage without the use of weep tubes or grommets.

.8 Valve bonnets are to be covered, but packing glands shall remain exposed.

.9 Valve covers are to be designed such that the bonnet section is sewn to the body section. For larger valves, the cover may be fabricated in two sections, each section containing one half of the valve body and bonnet.

.10 Covers with a weight of 18.1 Kg or less are to be fabricated in one piece.

.11 Covers with a weight of more than 18.1 Kg are to be fabricated in more than one piece.

.2 Insulation Core:

.1 The insulation core shall be fabricated in one piece, wherever possible.

.2 To prevent insulation settlement, the insulation core shall be secured within the jacket through the weather barrier (outer jacketing), the insulation, and the liner (inner jacketing).

.3 Insulating cores with more than one piece shall have staggered joints to prevent hot spots and heat loss. The joint edges shall be butted together and extra securement provided at those edges.

.4 Insulation core shall be comprised of 50mm thick fiberglass insulation of non-combustible wool with resilient inorganic glass fibers bonded with a thermosetting resin. Insulation density to be 38 Kg/m³. Insulation thermal conductivity to be 0.044W/m.°C at a mean temperature of 100°C.

.3 Jacket:

.1 The jacket shall be fabricated in one piece, wherever possible.

.2 Gusset walls shall be required for covers with core insulation thickness in excess of 25mm.

.3 All seams, except the final closing seam, shall be inside seams. The jackets are to be sewn inside out, then turned correct side out before inserting the insulation core. The final closing seam shall be sewn on the exterior of the jacket. Seams shall be sewn with Teflon® coated fiberglass thread or Kevlar® coated stainless steel thread.

.4 Machine stitching shall be used for all sewing. Sewing shall be 6-8 stitches per centimeter.

.5 Draw cords are to be placed along the outer edge of the flap and the outer edge of the flap then rolled back inside and double stitched.

.6 Draw cords are to be of sufficient length to allow 150mm of cord to protrude from each side of the flap.

.7 The inner and outer jacket shall be comprised of a fiberglass fabric impregnated with silicone rubber. The silicone rubber shall be flame retardant and suitable for high temperature usage. Outer jacket density shall be 595 gms/m².

.4 Securement devices:

.1 The securement belts and D-ring belts shall be of the same material as the weather barrier (exterior jacket).

.2 The belts shall be placed 50mm back from the parting seams and on 150mm centers.

.3 Fire retardant Velcro® shall be used to fasten the securement belt to the weather barrier after the belt passed through the Stainless Steel D-rings.

.5 Identification tags:

.1 Each cover shall be identified by a permanently attached stainless steel tag.

.2 An identification legend shall be mechanically embossed into the tag.

.3 The tags shall be located in the same areas on similar type covers.

.4 Should a cover require more than one piece for its construction, each piece to be identified and numbered (i.e. 1of 3).

.5 Each tag shall include at least the following information, but may also include any pertinent information required by the end user.

.1 Type of item being covered.

.2 Location of item.

.3 Recording and tracking information.

.6 Warranty:

.1 Provide a 5-year product Warranty

.7 Acceptable manufacturers:

.1 Advanced Industrial Systems Inc.., Thermo Help Canada Inc., Advanced Thermal Corp.

2.6 INSULATION SECUREMENTS

.1 Tape: Self-adhesive, aluminum, reinforced, 50 mm wide minimum.

.2 Contact adhesive: Quick setting.

.3 Canvas adhesive: Washable.

.4 Tie wire: 1.5 mm diameter stainless steel.

.5 Bands: Stainless steel, 19 mm wide, 0.5 mm thick.

.6 Facing: 25 mm galvanized steel hexagonal wire mesh on one face of insulation.

.7 Fasteners: 4 mm diameter pins with 35 mm diameter or square clips. Length of pin to suit thickness of insulation.

2.7 VAPOUR RETARDER LAP ADHESIVE

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

2.8 INDOOR VAPOUR RETARDER FINISH

.1 Vinyl emulsion type acrylic, compatible with insulation.

.2 Reinforcing fabric: Fibrous glass, untreated 305 g/m^2.

2.9 OUTDOOR VAPOUR RETARDER MASTIC

.1 Vinyl emulsion type acrylic, compatible with insulation.

.2 Reinforcing fabric: Fibrous glass, untreated 305 g/m2.

PART 3 EXECUTION

3.1 PRE- INSTALLATION REQUIREMENTS

.1 Pressure testing of equipment and adjacent piping systems complete, witnessed and certified.

.2 Surfaces clean, dry, free from foreign material.

3.2 INSTALLATION

.1 Install in accordance with TIAC National Standards

.1 Hot equipment: To TIAC code 1503-H.

.2 Cold equipment: to TIAC code 1503-C or 1503-CA.

.2 Elastomeric Insulation: to remain dry. Overlaps to manufacturer's instructions. Joints tight and sealed properly.

.3 Provide vapour retarder as recommended by manufacturer.

.4 Apply materials in accordance with insulation and equipment manufacturer's instructions and this specification.

.5 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm.

.6 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.

.1 Hangers, supports outside vapour retarder jacket.

.7 Supports, Hangers:

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

3.3 EQUIPMENT INSULATION SCHEDULES

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

.2 Hot Equipment:

.1 TIAC code A-1 or C-1 with mechanical fastenings or wire or bands and 13 mm cement reinforced with one layer of reinforcing mesh.

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

.3 TIAC code C-2 unfaced with wire or bands and 13 mm cement precede by one layer of reinforcing mesh.

.4 Thicknesses:

.1 Domestic hot water storage tanks 25 mm
.2 Shell and tube heat exchangers 50 mm
.3 Steam condensate receivers 50 mm
.4 Deaerator-feedwater heaters 50 mm
.5 Chilled and hot water buffer tanks

.3 Breechings, engine exhausts and mufflers:

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

.2 Cement reinforced with one layer of reinforcing mesh.

.4 Cold equipment:

.1 TIAC A-3 or C-4 with mechanical fastenings or wire or bands and 13 mm cement reinforced with one layer of reinforcing mesh.

.2 TIAC C-2 faced with vapour retardant jacket and with wire or bands and 13 mm cement preceded by one layer of reinforcing mesh.

.3 TIAC A-6 or C-4 with mechanical fastenings or wire or bands, adhesive.

.1 Thicknesses: Chillers (except factory insulated) 50 mm A-3, A-6 or C-4.

.5 Finishes:

.1 Engine exhaust piping and muffler: To TIAC code CEF-4.

.2 Equipment in mechanical rooms: TIAC code CEF/1 with aluminum jacket.

.3 Equipment elsewhere: TIAC code CEF/2 with 13 mm cement and canvas jacket.

3.4 REMOVABLE INSULATION COVERS

.1 Installation to permit movement of expansion joint and to permit periodic removal and replacement without damage to adjacent insulation.

.2 Removable insulation covers shall be provided for the following:

.1 Hydronic heating system pump assemblies:-pumps, suction diffusers, triple duty valves.

.2 Hydronic heating system valves NPS 2½ and larger -gate, globe and butterfly.

.3 Hydronic heating system flex connections, expansion joints.

.4 Hydronic heating system expansion tanks.

.5 Hydronic heating system air separators.

.6 Hydronic heating system plate and frame heat exchangers.

.7 Hydronic heating system shell and tube heat exchangers removable heads.

.8 Balancing valves NPS 2½ and above.

.9 Two-Way Control valves NPS 2½ and larger.

.10 Three-Way Control valves NPS 2½ and larger.

.11 Condensate receivers.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

.1 Section Includes:

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

1.2 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 01 74 21 – Construction/Demolition Waste Management and Disposal

.3 Section 07 92 00 – Joint Sealing.

.4 Section 23 07 16 – HVAC Equipment Insulation.

.5 Section 23 05 53.01 – Mechanical Identification.

1.3 REFERENCES

.1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

.1 ASHRAE Standard 90.1, Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings (Including all Addenda).

.2 American Society for Testing and Materials (ASTM)

.1 ASTM B209M, Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate Metric.

.2 ASTM C335, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.

.3 ASTM C411, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.

.4 ASTM C449/C449M, Standard Specification for Mineral Fibre-Hydraulic-Setting Thermal Insulating and Finishing Cement.

.5 ASTM C533 Standard specification for Calium Silicate Insulation Block and Pipe.

.6 ASTM C547 Standard Specification for Mineral Fibre Pipe Insulation.

.7 ASTM C795, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.

.8 ASTM C921, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

.9 ASTM D1784, Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.

.3 Canadian General Standards Board (CGSB)

.1 CGSB 51-GP-52Ma, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.

.2 CAN/CGSB-51.53, Poly (Vinyl Chloride) Jacketting Sheet, for Insulated Pipes, Vessels and Round Ducts

.4 Department of Justice Canada (Jus)

.1 Canadian Environmental Assessment Act (CEAA), c. 37.

.2 Canadian Environmental Protection Act, (CEPA), c. 33.

.3 Transportation of Dangerous Goods Act (TDGA), c. 34.

.5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets.

.6 Manufacturer's Trade Associations

.1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards.

.7 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC-S102, Surface Burning Characteristics of Building Materials and Assemblies.

.8 National Energy Code of Canada for Buildings (NECB).

1.4 DEFINITIONS

.1 For purposes of this section:

.1 "CONCEALED" - insulated mechanical services in suspended ceilings and non-accessible chases and furred-in spaces.

.2 "EXPOSED" - will mean "not concealed" as defined herein.

.2 TIAC ss:

.1 CRF: Commercial Rectangular Finish

.2 CPF: Commercial Piping Finish.

1.5 SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Safety Data Sheets (SDS) in accordance with Section 01 33 00 - Submittal Procedures.

.3 Shop Drawings:

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

.4 Samples:

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

.2 Submit for approval: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed. Mount sample on 12 mm plywood board. Affix label beneath sample indicating service.

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

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions to Owner.

1.6 QUALITY ASSURANCE

.1 Qualifications:

.1 Installer: certified in performing work of this Section, and have at least 5 years successful experience in this size and type of project, qualified to standards of TIAC.

.2 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Packing, shipping, handling and unloading:

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

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

.3 Deliver materials to site in original factory packaging, labeled with manufacturer's name, address.

.2 Storage and Protection:

.1 Protect from weather, construction traffic.

.2 Protect against damage.

.3 Store at temperatures and conditions required by manufacturer.

.3 Waste Management and Disposal:

.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.2 Place excess or unused insulation and insulation accessory materials in designated containers.

.3 Divert unused metal materials from landfill to metal recycling facility approved by Owner.

.4 Dispose of unused adhesive material at official hazardous material collections site approved by Owner.

PART 2 PRODUCTS

2.1 FIRE AND SMOKE RATING

.1 In accordance with CAN/ULC-S102.

.1 Maximum flame spread rating: 25.

.2 Maximum smoke developed rating: 50.

2.2 INSULATION

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

.2 Thermal conductivity ("k" factor) not to exceed specified values at 24 ^{o}C mean temperature when tested in accordance with ASTM C335.

.3 TIAC Code A-2: Rigid moulded calcium silicate in sections and blocks, and with special shapes to suit project requirements.

.1 Insulation: to ASTM C533.

.2 Maximum "k" factor: to 0.075 W/m ^{o}C @ 500 ^{o}C.

.3 Design to permit periodic removal and re-installation.

.4 TIAC Code A-3: Rigid moulded mineral fibre with factory applied vapour retarder jacket.

.1 Mineral fibre: to CAN/ULC-S702 and ASTM C547.

.2 Jacket: to CGSB 51-GP-52Ma.

.3 Maximum "k" factor: to CAN/ULC-S702.

.5 TIAC Code A-6: Flexible unicellular tubular elastomer.

.1 Insulation: with vapour retarder jacket to ASTM C534.

.2 Jacket: to CGSB 51-GP-52Ma.

.3 Maximum "k" factor: 0.039 W/m – ^{o}C.

.4 To be certified by manufacturer to be free of potential stress corrosion cracking corrodants

.5 Flame spread index less than 25, and smoke developed index less than 50.

.6 TIAC Code C-2: Mineral fibre blanket faced with factory applied vapour retarder jacket (as scheduled in PART 3 of this section).

.1 Mineral fibre: to ASTM C547.

.2 Jacket: to CGSB 51-GP-52Ma.

.3 Maximum "k" factor: to CAN/ULC-S702.

2.3 INSULATION SECUREMENT

.1 Tape: Self-adhesive, aluminum, plain reinforced, 50 mm wide minimum.

.2 Contact adhesive: Quick setting.

.3 Canvas adhesive: Washable.

.4 Tie wire: 1.5 mm diameter stainless steel.

.5 Bands: Stainless steel, 19 mm wide, 0.5 mm thick.

2.4 CEMENT

.1 Thermal insulating and finishing cement:

.1 Hydraulic setting or air drying on mineral wool, to ASTM C449/C449M.

2.5 VAPOUR RETARDER LAP ADHESIVE

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

2.6 INDOOR VAPOUR RETARDER FINISH

.1 Vinyl emulsion type acrylic, compatible with insulation.

2.7 OUTDOOR VAPOUR RETARDER FINISH

.1 Vinyl emulsion type acrylic, compatible with insulation.

.2 Reinforcing fabric: Fibrous glass, untreated 305 g/m^2.

2.8 JACKETS

.1 Polyvinyl Chloride (PVC):

.1 One-piece moulded type and sheet to ASTM D1784 with pre-formed shapes as required.

.2 Colours: to match adjacent finish paint. Confirm colour with Owner.

.3 Minimum service temperatures: -20°C.

.4 Maximum service temperature: 65°C.

.5 Moisture vapour transmission: 0.02 perm.

.6 Thickness: 0.55 mm.

.7 Fastenings:

.1 Use solvent weld adhesive compatible with insulation to seal laps and joints.

.2 Tacks.

.3 Pressure sensitive vinyl tape of matching colour.

.8 Special requirements:

.1 Indoor: flame spread rating 25, smoke developed rating 50.

.2 Outdoor: UV rated material at least 0.5 mm thick.

.2 Canvas:

.1 220gm/m^2 cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.

.2 Lagging adhesive: Compatible with insulation.

.3 Aluminum:

.1 To ASTM B209.

.2 Thickness: 0.50 mm sheet.

.3 Finish: Embossed or corrugated.

.4 Joining: Longitudinal and circumferential slip joints with 50 mm laps.

.5 Fittings: 0.5 mm thick die-shaped fitting covers with factory-attached protective liner.

.6 Metal jacket banding and mechanical seals: stainless steel, 19 mm wide, 0.5 mm thick at 300 mm spacing.

.4 Stainless steel:

.1 Type: 304 or type 316.

.2 Thickness: 0.25 mm.

.3 Finish: Smooth.

.4 Joining: Longitudinal and circumferential slip joints with 50 mm laps.

.5 Fittings: 0.5 mm thick die-shaped fitting covers with factory-attached protective liner.

.6 Metal jacket banding and mechanical seals: stainless steel, 19 mm wide, 0.5 mm thick at 300 mm spacing.

2.9 WEATHERPROOF CAULKING FOR JACKETS INSTALLED OUTDOORS

.1 Caulking to: Section 07 92 00 - Joint Sealing.

PART 3 EXECUTION

3.1 MANUFACTURE'S INSTRUCTIONS

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

3.2 PRE- INSTALLATION REQUIREMENT

.1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed and certified.

.2 Surfaces to be clean, dry, free from foreign material.

3.3 INSTALLATION

.1 Install in accordance with TIAC National Standards.

.2 Apply materials in accordance with manufacturers instructions and this specification.

.3 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm.

.4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.

.1 Install hangers, supports outside vapour retarder jacket.

.5 Supports, Hangers:

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

3.4 REMOVABLE, PRE-FABRICATED, INSULATION AND ENCLOSURES

.1 See Section 23 07 16 – HVAC Equipment Insulation.

3.5 INSTALLATION OF ELASTOMERIC INSULATION

.1 Insulation to remain dry. Overlaps to manufacturers instructions. Ensure tight joints.

.2 Provide vapour retarder as recommended by manufacturer.

3.6 PIPING INSULATION SCHEDULES

.1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified. Insulate vent pipes 3.0 m from roof penetration.

.2 TIAC Code: A-2.

.1 Insulation securements: 18 ga SS wire or 12 mm x 0.51 mm SS bands at 300 mm oc.

.2 Seals: lap seal adhesive, lagging adhesive.

.3 Installation: TIAC Code: 1501-H.

.3 TIAC Code: A-3.

.1 Securements: Tape at 300 mm oc.

.2 Seals: VR lap seal adhesive, VR lagging adhesive.

.3 Installation: TIAC Code: 1501-C.

.4 TIAC Code: A-6.

.1 Insulation securements: as per manufacturer's recommendation.

.2 Seals: lap seal adhesive, lagging adhesive.

.3 Installation: TIAC Code: 1501-CA.

.5 TIAC Code: C-2 with vapour retarder jacket.

.1 Insulation securements: 18 ga SS wire or 12 mm x 0.5 mm SS bands at 300 mm oc.

.2 Seals: lap seal adhesive, lagging adhesive.

.3 Installation: TIAC Code: 1501-C.

.6 Thickness of insulation to be as listed in following table.

.1 Run-outs to individual units and equipment not exceeding 4000 mm long.

.2 Do not insulate exposed runouts to plumbing fixtures, chrome plated piping, valves, fittings.

Application	Temp °C	TIAC code	Pipe sizes (NPS) and insulation thickness (mm)					
	Run out			*to 1*	*1 1/4 to 2*	*2 1/2 to 4*	*5 to 6*	*8 & over*
Steam	up to 175	A-3	38	50	65	75	90	90
Steam, Saturated and Superheated	over 175	A-3	38	65	65	75	90	90
Condensate Return	60 - 94	A-3	25	38	38	38	38	38
Pumped Condensate return	up to 94	A-3	25	38	38	38	38	38

Application	Temp °C	TIAC code	Pipe sizes (NPS) and insulation thickness (mm)					
	Run out			*to 1*	*1 1/4 to 2*	*2 1/2 to 4*	*5 to 6*	*8 & over*
Steam	up to 175	A-3	38	50	65	75	90	90
Steam, Saturated and Superheated	over 175	A-3	38	65	65	75	90	90
Condensate Return	60 - 94	A-3	25	38	38	38	38	38
Pumped Condensate return	up to 94	A-3	25	38	38	38	38	38
Hot Water Heating	60 - 94	A-3	25	38	38	38	38	38
Hot Water Heating	up to 59	A-3	25	25	25	25	38	38
Glycol Heating	60 - 94	A-3	25	38	38	38	38	38
Glycol Heating	up to 59	A-3	25	25	25	25	38	38
Domestic CWS		A-3	25	25	25	25	25	25
Vent Pipe Steam		A-3	38	65	65	75	90	90

.7 Finishes:

.1 Exposed indoors: PVC jacket.

.2 Exposed in mechanical rooms: PVC jacket.

.3 Concealed, indoors: canvas on valves, fittings. No further finish.

.4 Use vapour retarder jacket on TIAC code A-3 insulation compatible with insulation.

.5 Outdoors: Water-proof Aluminium, or SS jacket.

.6 Finish attachments: SS screws or bands, at 150 mm oc. Seals: wing or closed.

.7 Installation: To appropriate TIAC code CPF/1 through CPF/5.

3.7 CLEANING

.1 Proceed in accordance with Section 01 74 00 – Cleaning.

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

END OF SECTION

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 91 13.13 – Commissioning (Cx) Requirements: supplemented as specified herein.

.2 Section 22 05 15 – Plumbing Specialities and Accessories.

.3 Section 23 05 93 – Testing, Adjusting and Balancing for HVAC.

.4 Section 23 08 02 – Cleaning and Start-up of Mechanical Piping Systems.

.5 Section 23 11 13 – Facility Fuel-Oil Piping.

.6 Section 22 11 18 – Domestic Water Piping Copper.

.7 Section 23 21 13.02 – Hydronic Systems: Steel.

.8 Section 23 23 00 – Copper Tubing and Fittings Refrigerant.

1.2 REFERENCES

.1 ASTM E202, Standard Test Methods for Analysis of Ethylene Glycols and Propylene Glycols.

1.3 CLEANING AND START-UP OF MECHANICAL PIPING SYSTEMS

.1 In accordance with Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.

1.4 HYDRONIC SYSTEMS - PERFORMANCE VERIFICATION (PV)

.1 Perform hydronic systems performance verification after cleaning is completed and system is in full operation.

.2 When systems are operational, perform following tests:

.1 Conduct full scale tests at maximum design flow rates, temperatures and pressures for continuous consecutive period of two (2) working days to demonstrate compliance with design criteria.

.2 Verify performance of hydronic system circulating pumps as specified in relevant technical sections, recording system pressures, temperatures, fluctuations by simulating maximum design conditions and varying.

.1 Pump operation.
.2 Boiler and/or chiller operation.
.3 Pressure bypass open/closed.
.4 Control pressure failure.
.5 Maximum heating demand.
.6 Maximum cooling demand.
.7 Boiler and/or chiller failure.
.8 Cooling tower (and/or industrial fluid cooler) fan failure.
.9 Outdoor reset. Re-check heat exchanger output supply temperature at 100% and 50% reset, maximum water temperature.

1.5 HYDRONIC SYSTEM CAPACITY TEST

.1 Timing: After:

.1 TAB has been completed
.2 Verification of operating, limit, safety controls.
.3 Verification of primary and secondary pump flow rates.
.4 Verification of accuracy of temperature and pressure sensors and gauges.

.2 Calculate system capacity at test conditions.

.3 Using manufacturer's published data and calculated capacity at test conditions, extrapolate system capacity at design conditions.

.4 When capacity test is completed, return controls and equipment status to normal operating conditions.

.5 Submit sample of system water to approved testing agency to determine if chemical treatment is correct. Include cost.

.6 Heating system capacity test:

.1 Perform capacity test when ambient temperature is within 10% of design conditions. Simulate design conditions by:

.1 Increasing OA flow rates through heating coils (in this case, monitor heating coil discharge temperatures at all times to ensure that coils are not subjected to freezing conditions) or
.2 Reducing space temperature by turning off heating system for sufficient period of time before starting testing.

.2 Test procedures:

.1 Open fully heat exchanger, heating coil and radiation control valves.

.2 With boilers on full firing and hot water heating supply temperature stabilized, record flow rates and supply and return temperatures simultaneously.

.3 Conduct flue gas analysis test on boilers at full load and at low fire conditions.

.7 Chilled water system capacity test:

.1 Perform capacity test when ambient temperature is within 10% of design conditions. Simulate design conditions by:

.1 Adding heat from building heating system or

.2 Raising space temperature by turning off cooling and air systems for sufficient period of time before starting testing and pre-heating building to summer design space temperature (occupied) or above. Set OAD and RAD for minimum outside air if OAT is near outside design temperature or to maximum recirculation if RAT is greater that OAT. RAT to be at least 23^0C.

.2 Test procedures:

.1 Open fully cooling coil control valves.

.2 Set thermostats on associated AHU's for maximum cooling.

.3 Set AHU's for design maximum air flow rates.

.4 Set load or demand limiters on chillers to 100%

.5 After system has stabilized, record chilled water, condenser water, etc., flow rates and supply and return temperatures simultaneously.

1.6 CONDENSER WATER AND HUMIDIFICATION SYSTEMS

.1 In addition to procedures specified above, perform following:

.1 Add chemicals once or twice per week as required.

.2 Perform TAB as specified Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

.3 Set up and adjust drip feeders, timer controls, and pump strokes as required to maintain required chemical feed rates.

.4 Inject inhibitor into cooling tower sump.

1.7 STEAM SYSTEMS

.1 Performance verification:

.1 When systems are operational, perform relevant tests of steam and condensate return piping systems as specified under hydronic systems.

.2 Verify operation of components of steam system including:

.1 Steam traps by:

.1 Measuring temperature of condensate return and/or using audio-sensing devices.

.2 Use of other approved methods.

.2 Flash tanks.

.3 Thermostatic vents.

.3 Verify performance of condensation units, including:

.1 Pump capacity at design temperature.

.2 Controls.

.4 Verify performance of condensate return system to ensure return of maximum quantity of condensate return water at with minimum temperature drop.

.5 Adjust piping system as required to eliminate water hammer.

.2 Monitor system continuously until acceptance for proper operation components including steam traps, thermostatic vents, flash tanks and condensate pumping units.

1.8 GLYCOL SYSTEMS

.1 Test to prove concentration will prevent freezing to minus 40^0C Test inhibitor strength and include in procedural report. Refer to ASTM E202.

.2 Refer to SECTION 23 21 13.02 HYDRONIC SYSTEMS: STEEL

1.9 REPORTS

.1 In accordance with Section 01 91 13.13 –Commissioning (Cx) Requirements: supplemented as specified herein.

1.10 TRAINING

.1 In accordance with Section 01 91 13.13 –Commissioning (Cx) Requirements: supplemented as specified in relevant specification sections

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Procedures and cleaning solutions for cleaning mechanical piping systems.

1.2 RELATED SECTIONS

.1 Section 01 74 21 – Construction/Demolition Waste Management and Disposal

.2 Section 23 05 93 - Testing, Adjusting and Balancing of HVAC

.3 Section 23 25 00 - HVAC Water Treatment.

1.3 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM E202 – Standard Test Methods for Analysis of Ethylene Glycols and Propylene Glycols.

.2 Health Canada / Workplace Hazardous Materials Information System (WHMIS).

.1 Safety Data Sheets (SDS).

1.4 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 – Submittal Procedures. Include product characteristics, performance criteria, and limitations.

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

.1 Instructions: submit manufacturer's installation instructions.

.1 Owner will make available one (1) copy of systems supplier installation instructions.

1.5 QUALITY ASSURANCE

.1 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 29.06 – Health and Safety Requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading.

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

.2 Waste Management and Disposal:

.1 Construction / Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction / Demolition Waste Management and Disposal.

PART 2 PRODUCTS

2.1 CLEANING SOLUTIONS

.1 Low foaming detergent at all temperatures

.2 No pH neutralization required

.3 Designed for use on most metals including aluminium

.4 Bio-degradable

.5 Phosphate Free

.6 Nitrite Free

PART 3 EXECUTION

3.1 CLEANING HYDRONIC AND STEAM SYSTEMS

.1 Timing

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

.2 Cleaning Agency:

.1 Retain qualified water treatment specialist to perform system cleaning.

.3 Install instrumentation such as flow meters, orifice plates, pitot tubes, flow metering valves only after cleaning is certified as complete by water treatment specialist.

.4 Cleaning procedures:

.1 Provide detailed report outlining proposed cleaning procedures at least 4 weeks prior to proposed starting date. Report to include:

.1 Cleaning procedures, flow rates, elapsed time.

.2 Chemicals and concentrations to be used.

.3 Inhibitors and concentrations.

.4 Specific requirements for completion of work.

.5 Special precautions for protecting piping system materials and components.

.6 Complete analysis of water to be used to ensure water will not damage systems or equipment.

.5 Conditions at time of cleaning of systems

.1 Systems to be free from construction debris, dirt and other foreign material.

.2 Control valves to be operational, fully open to ensure that terminal units can be cleaned properly.

.3 Strainers to be clean prior to initial fill.

.4 Install temporary filters on pumps not equipped with permanent filters.

.5 Install pressure gauges on strainers to detect plugging.

.6 Report on Completion of Cleaning

.1 When cleaning is completed, submit report, complete with certificate of compliance with specifications of cleaning component supplier.

.7 Hydronic Systems:

.1 Flush system thoroughly with water, back flush pump, strainers, blow down drain valves and risers to remove all loose debris. Remove accumulated sludge in boilers if necessary.

.2 Then add 2% solution of low foaming detergent to the system through a by-pass feeder or another feeding device.

.3 Circulate for 36 hours at 82° C. For chilled systems, circulate at least 48 hours at ambient temperature.

.4 During recirculation, back flush strainers, drain valves and risers at their lowest point once every 8 hours.

.5 Drain cleaning water completely.

.6 Then fill and drain system several times. Circulate 30 minutes every time the system is refilled.

.7 Bleed system at several points until water is clear and non-foaming. Clean pump strainers.

.8 Draw a water sample from the system and send it to out laboratory for analysis.

.9 If the laboratory report is satisfactory, the system must then be treated with the appropriate formula.

.8 Glycol Systems:

.1 In addition to procedures specified above perform procedures specified herein.

.2 Test to prove concentration will prevent freezing to minus 40° C. Test inhibitor strength and include in procedural report. Refer to ASTM E202.

.3 Refer to SECTION 23 21 13.02 HYDRONIC SYSTEMS: STEEL

.9 Steam Systems: In addition to general requirements as specified above, perform following:

.1 Remove internal components of steam traps until flushing and warm-up have been completed.

.2 Open drip points to atmosphere. If needed for protection of personnel or environment, install flexible hose and direct discharge to safe location.

.3 Starting at drip point closest to source, verify removal of condensate, then re-install steam trap internal parts. Repeat sequence down the line.

.4 Water hammer: Determine source and eliminate cause.

.10 Steam boilers:

.1 Isolate boilers from piping system.

.2 Fill to normal operating level. Add cleaner. Fire to 50% of design operating steam pressure. Maintain for 24 h, during which blow down boiler every 4 h including water columns, controls, skimmer lines and valves, test cocks, blowdown valves. Add water to return to operating level.

.3 Allow boiler to cool, then drain, flush and inspect.

.4 Reconnect to piping system.

.5 Refill boiler with clean softened water and immediately add chemical inhibitors.

.6 Apply heat slowly and raise to normal design operating steam pressure. Maintain for 4 h.

.7 Discharge condensate from steam system to sewer for 96 h after initial operation. During this period continue chemical treatment of boilers with inhibitors to ensure complete removal of oils, grease and millscale from steam and condensate return piping steam.

.8 Drain steam condensate until it is clean and free from suspended matter. Ensure proper operation of steam traps.

.9 Allow boiler to cool, drain, open inspection ports and wash out with clean water.

.10 If boiler is not to be used immediately, refill with softened water, add sodium sulphite, bring up to pressure. Test for residual sulphite.

.11 After cleaning is completed and system is filled, perform relevant start-up procedures as specified for hydronic systems:

3.2 START-UP OF HYDRONIC SYSTEMS

.1 After cleaning is completed and system is filled:

- .1 Establish circulation and expansion tank level, set pressure controls.
- .2 Ensure air is removed.
- .3 Check pumps to be free from air, debris, possibility of cavitation when system is at design temperature.
- .4 Dismantle system pumps used for cleaning, inspect, replace worn parts, install new gaskets and new set of seals.
- .5 Clean out strainers repeatedly until system is clean.
- .6 Commission water treatment systems as specified in Section 23 25 00 - HVAC Water Treatment.
- .7 Check water level in expansion tank with cold water with circulating pumps OFF and again with pumps ON.
- .8 Repeat with water at design temperature.
- .9 Check pressurization to ensure proper operation and to prevent water hammer, flashing, cavitation. Eliminate water hammer and other noises.
- .10 Bring system up to design temperature and pressure slowly over a 48 hour period.
- .11 Perform TAB as specified in Section 23 05 93 - Testing, Adjusting and Balancing (TAB).
- .12 Adjust pipe supports, hangers, springs as necessary.
- .13 Monitor pipe movement, performance of expansion joints, loops, guides, anchors.
- .14 If sliding type expansion joints bind or if bellows type expansion joints flex incorrectly, shut down system, re-align, repeat start-up procedures.
- .15 Re-tighten bolts, etc. using torque wrench, to compensate for heat-caused relaxation. Repeat several times during commissioning.
- .16 Check operation of drain valves.
- .17 Adjust valve stem packings as systems settle down.
- .18 Fully open all balancing valves (except those that are factory-set).
- .19 Check operation of over-temperature protection devices on circulating pumps.
- .20 Adjust alignment of piping at pumps to ensure flexibility, adequacy of pipe movement, absence of noise or vibration transmission.

3.3 CLEANING

.1 Provide in accordance with Section 01 74 00 – Cleaning.

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

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

.1 Section Includes.

.1 Materials and installation for steel piping, valves and fittings for hydronic systems in building services piping.

1.2 RELATED SECTIONS.

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 35 29.06- Health and Safety Requirements.

.3 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.4 Section 01 78 00 - Closeout Submittals.

.5 Section 21 05 01 - Common Work Results -Mechanical.

.6 Section 23 05 00 – Common Work Results for Plumbing.

.7 Section 23 05 15 - Common Installation Requirements for HVAC Pipework.

.8 Section 23 05 17 - Pipe Welding.

.9 Section 23 05 23.01 - Valves - Bronze.

.10 Section 23 05 23.02 - Valves - Cast Iron

.11 Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

.12 Section 23 07 13 – Duct Insulation.

.13 Section 23 10 16 – HVAC Equipment Insulation.

.14 Section 23 07 19 – HVAC Piping Insulation.

.15 Section 23 08 01 - Performance Verification of Mechanical Piping.

.16 Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.

1.3 REFERENCES

.1 American Society of Mechanical Engineers (ASME).

.1 ASME B16.1, Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.

.2 ASME B16.3, Malleable Iron Threaded Fittings: Classes 150 and 300.

.3 ASME B16.5, Pipe Flanges and Flanged Fittings: NPS through NPS 24 Metric/Inch Standard.

.4 ASME B16.9, Factory-Made Wrought Buttwelding Fittings.

.5 ASME B18.2.1, Square Hex, Heavy Hex and Askew Head Bolts and Hex, Heavy Hex, Hex Flange. Loded Head and Lag Screws (Inch Series).

.6 ASME B18.2.2, Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series).

.2 American Society for Testing and Materials International, (ASTM).

.1 ASTM A47/A47M, Standard Specification for Ferritic Malleable Iron Castings.

.2 ASTM A53/A53M, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless.

.3 ASTM A536, Standard Specification for Ductile Iron Castings.

.4 ASTM B61, Standard Specification for Steam or Valve Bronze Castings.

.5 ASTM B62, Standard Specification for Composition Bronze or Ounce Metal Castings.

.6 ASTM E202, Standard Test Method for Analysis of Ethylene Glycols and Propylene Glycols.

.3 American Water Works Association (AWWA).

.1 AWWA C111, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

.4 Canadian Standards Association (CSA International).

.1 CSA B242, Groove and Shoulder Type Mechanical Pipe Couplings.

.2 CAN/CSA W48, Filler Metals and Allied Materials for Metal Arc Welding.

.5 Manufacturer's Standardization of the Valve and Fittings Industry (MSS).

.1 MSS-SP-67, Butterfly Valves.

.2 MSS-SP-70, Cast Iron Gate Valves, Flanged and Threaded Ends.

.3 MSS-SP-71, Cast Iron Swing Check Valves Flanged and Threaded Ends.

.4 MSS-SP-80, Bronze Gate, Globe, Angle and Check Valves.

.5 MSS-SP-85, Cast Iron Globe and Angle Valves, Flanged and Threaded Ends.

.6 Province of Newfoundland and Labrador Boiler, Pressure Vessel and Compressed Gas Regulations.

1.4 SUBMITTALS

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

.2 Closeout Submittals.

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 – Closeout Submittals, and include the following:

.1 Special servicing requirements.

.3 Grooved joint couplings and fittings to be indicated on product submittals and to be specifically identified with the applicable style or series designation.

.4 Grooved products manufacturer to supply on site tools and products for installation training.

.5 All grooved products to be of one manufacturer.

.6 Groove products to have current CRN numbers.

1.5 QUALITY ASSURANCE

.1 Health and Safety.

.1 Do construction occupational health and safety in accordance with Section 01 35 29.06 – Health and Safety Requirements.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Waste Management and Disposal.

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal, paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Fold up metal and plastic banding, flatten and place in designated area for recycling.

1.7 MAINTENANCE

.1 Extra Materials.

.1 Provide following spare parts:

.1 Valve seats: one for every ten valves, each size. Minimum one.

.2 Discs: one for every ten valves, each size. Minimum one.

.3 Stem packing: one for every ten valves, each size. Minimum one.

.4 Valve handles: two of each size.

.5 Gaskets for flanges: one for every ten flanges.

PART 2 PRODUCTS

2.1 PIPE

.1 Steel pipe: to ASTM A53/A53M, Grade B as follows:

.1 To NPS 6: schedule 40.
.2 NPS 8 and 10: schedule 40.
.3 NPS 12 and over, 10 mm wall thickness.

2.2 PIPE JOINTS

.1 NPS 2 and under: screwed fittings with PTFE tape or lead-free pipe dope.

.2 NPS 2-1/2 and over: welding fittings and flanges to CAN/CSA W48.

.3 Roll grooved: rigid coupling to CSA B242.

.4 Flexible couplings to CSA B242 to be used where noted on drawings and on elbows utilized on expansion joints.

.5 Flanges: plain ASME, B16.1, raised face, slip-on or weld neck to ASME B16.5.

.6 Orifice flanges: slip-on raised face, 2100 kPa.

.7 Flange gaskets: to AWWA C111

.8 Pipe thread: taper.

.9 Bolts and nuts: to ASME B18.2.1 and ASME B18.2.2.

.10 Roll grooved coupling gaskets: NPS 2 to 8, type EHP, EPDM high performance, -40°C to +120°C for continuous operation, NPS 10 and above type EPDM, -30°C to +110°C for continuous acceptable on hot hater, glycol water, chilled water and condenser water.

2.3 FITTINGS

.1 Screwed fittings: malleable iron, to ASME B16.3, Class 150.

.2 Pipe flanges and flanged fittings:

.1 Cast iron: to ASME B16.1, Class 125.
.2 Steel: to ASME B16.5.

.3 Butt-welding fittings: steel, to ASME B16.9.

.4 Unions: malleable iron, to ASTM A47/A47M and ASME B16.3.

.5 Fittings for roll grooved piping: malleable iron to ASTM A47/A47M, ductile iron to ASTM A536.

2.4 VALVES

.1 Connections:

.1 NPS2 and smaller: screwed ends.

.2 NPS2.1/2 and larger: Flanged or grooved ends.

.2 Gate valves: to MSS-SP-70 and MSS-SP-80 Application: Isolating equipment, control valves, pipelines:

.1 NPS 2 and under:

.1 Mechanical Rooms: Class 125 rising stem, solid wedge disc, as specified Section 23 05 23.01 – Valves – Bronze.

.2 Elsewhere: Class 125, non- rising stem, solid wedge disc, as specified Section 23 05 23.01 – Valves – Bronze.

.2 NPS 21/2 and over:

.1 Mechanical Rooms: rising stem, solid wedge disc, lead free bronze trim, as specified Section 23 05 23.02 – Valves – Cast Iron.

.2 Elsewhere: Non- rising stem, solid wedge disc, lead free bronze trim, as specified Section 23 05 23.02 – Valves – Cast Iron.

.3 Butterfly valves: to MSS-SP-67 Application: Isolating cells or section of multiple component equipment (eg. multi-section coils, multi-cell cooling towers).

.1 NPS 2 1/2 and over: Lug type or Grooved ends: as specified Section 23 05 17 – Pipe Welding.

.4 Globe valves: to MSS-SP-80 and 85 Application: Throttling, flow control, emergency bypass.

.1 NPS 2 and under:

.1 Mechanical Rooms: with plug disc, as specified Section 23 05 23.01 – Valves – Bronze.

.2 Elsewhere: Globe, with composition disc, as specified Section 23 05 23.01 – Valves - Bronze.

.2 NPS 2 1/2 and over:

.1 With composition bronze disc, bronze trim, as specified Section 23 05 23.02 – Valves – Cast Iron.

.5 Balancing, for TAB:

.1 Sizes: Calibrated balancing valves, as specified this section.

.2 NPS 2 and under:

.1 copper alloy body threaded and, 2.1 MPa rating, globe style, self sealing measuring ports for temperature or pressure probes, locking tamper proof setting.

.2 Mechanical Rooms and Elsewhere: Globe, with plug disc as specified Section 23 05 23.01 - Valves – Bronze.

.3 In lieu of standard malleable iron or copper fittings the Contractor may install the following component system:

.1 Union port fitting with air vent and pressure/temperature port.

.2 Balancing valve, strainer with drain valve, ball valve combination may also be used.

.3 NPS 2 ½ and over:

.1 Ductile iron body, flanged or grooved connections, 1700 kPa rating minimum, globe style, self sealing measurement parts for temperature or pressure probes, locking tamper proof setting.

.6 Drain valves: Gate, Class 125 non-rising stem, solid wedge disc, as specified Section 23 05 23.01 – Valves - Bronze.

.7 Bypass valves on gate and globe valves NPS 8 and larger: NPS ¾ as specified Section 23 05 23.01 – Valves - Bronze.

.8 Swing check valves: to MSS-SP-71.

.1 NPS 2 and under:

.1 Class 125 swing, with composition disc, as specified Section 23 05 23.01 – Valves - Bronze.

.2 NPS 2 1/2 and over:

.1 Flanged or grooved ends: as specified Section 23 05 23.02 – Valves – Cast Iron.

.9 Silent check valves:

.1 NPS 2 and under:

.1 As specified Section 23 05 23.01 – Valves – Bronze.

.2 NPS 2 1/2 and over:

.1 Flanged or grooved or wafer style ends: as specified Section 23 05 23.02 – Valves – Cast Iron.

.10 Ball valves:

.1 NPS 2 and under: as specified Section 23 05 23.01 – Valves - Bronze.

2.5 PROPYLENE GLYCOL

.1 PROPYLENE GLYCOL Industrially inhibited propylene glycol suitable for HVAC systems.

.2 Concentration: 40% by volume.

.3 Freeze protection: approximately -21°C.

.4 pH (new fluid): 9.5 to 10.5.

.5 Reserve alkalinity:

.1 Minimum 10.0 mL (standard inhibited fluids)
.2 Minimum 15.0 mL where high-performance inhibitor package is specified

.6 Fluid shall include corrosion inhibitors suitable for:

.1 Steel
.2 Copper and brass
.3 Cast iron
.4 Aluminum (if present in system)

.7 Basis of design:

.1 DOWFROST or approved equal

PART 3 EXECUTION

3.1 PIPING INSTALLATION

.1 Install pipework in accordance with Section 23 05 15 - Common Installation Requirements for HVAC Pipework by certified journeyperson and authority having jurisdiction.

3.2 CIRCUIT BALANCING VALVES

.1 Install flow measuring stations and flow balancing valves as indicated.

3.3 CLEANING, FLUSHING AND START-UP

.1 In accordance with Section 23 08 02 – Cleaning and Start-up of Mechanical Piping Systems.

3.4 TESTING

.1 Test system in accordance with Section 21 05 01 – Common Work Results - Mechanical. Minimum 1.5 times working pressure or 1000 kPa.

.2 For glycol systems, retest with ethylene glycol to ASTM E202, inhibited, for use in building system after cleaning. Repair leaking joints, fittings or valves.

3.5 BALANCING

.1 Balance water systems to within plus or minus 5 % of design output.

.2 Refer to Section 23 05 93 – Testing, Adjusting and Balancing for HVAC, for applicable procedures.

3.6 GLYCOL CHARGING

.1 Provide mixing tank and positive displacement pump for glycol charging.

.2 Retest for concentration to ASTM E202 after cleaning.

.3 Clean and flush system prior to glycol fill.

.4 Fill system with specified glycol mixture and purge all air.

.5 Do not mix different manufacturers' inhibitor chemistries without approval.

.6 Verify glycol concentration using refractometer. Test and record:

.1 Freeze point

.2 .pH

.3 Reserve alkalinity

.7 Submit test results prior to system operation.

.8 Adjust glycol concentration to achieve specified freeze protection.
.Restore inhibitor levels if reserve alkalinity is below manufacturer recommendations.

.9 Provide final report including:

.1 Glycol type and concentration, Test results, Confirmation of system compatibility

3.7 PERFORMANCE VERIFICATION

.1 In accordance with Section 23 08 01 – Performance Verification of Mechanical Systems.

.2 Provide copies of test reports for Commissioning Manuals.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

.1 Section includes:

.1 The supply and installation of hydronic specialties equipment.

1.2 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 01 35 29.06– Health and Safety Requirements

.3 Section 01 74 21 – Construction/Demolition Waste Management and Disposal

.4 Section 01 78 00 – Closeout Submittals.

.5 Section 23 05 15 - Common Installation Requirements for HVAC Pipework.

.6 Section 23 08 01 – Performance Verification of Mechanical Piping Systems.

1.3 REFERENCES

.1 American Society of Mechanical Engineers (ASME)

.1 ANSI/ASME, Boiler and Pressure Vessels Code.

.2 American Society for Testing and Materials (ASTM)

.1 ASTM A47/A47M, Specification for Ferritic Malleable Iron Castings.

.2 ASTM A48, Standard Specification for Gray Iron Castings.

.3 ASTM A216, Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, For high Temperature Service.

.4 ASTM A278M, Specification for Gray Iron Castings for Pressure-Containing Parts for Temperatures up to 345° C.

.5 ASTM A516/A516M, Specification for Pressure Vessel Plates, Carbon Steel, for Moderate and Lower Temperature Service.

.6 ASTM A536, Specification for Ductile Iron Castings.

.7 ASTM B62, Specification for Composition Bronze or Ounce Metal Castings.

.3 Canadian Standards Association (CSA)

.1 CSA B51, Boiler, Pressure Vessel, and Pressure Piping Code.

.4 Provincial Boiler, Pressure Vessel and Compressed Gas Regulations.

1.4 SUBMITTALS

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

.2 Product Data: Submit WHMIS SDS – Safety Data Sheets.

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

.2 Indicate on product data expansion tanks, air vents, separators, valves, and strainers.

.3 Closeout Submittals:

.1 Submit maintenance data in accordance with Section 01 78 00 – Closeout Submittals.

1.5 QUALITY ASSURANCE

.1 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 29.06 – Health and Safety Requirements.

1.6 DELIVERY STORAGE AND DISPOSAL

.1 Waste Management and Disposal:

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

.2 Collect and separate for disposal, paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

PART 2 PRODUCTS

2.1 CANADIAN REGISTRATION NUMBERS (CRN)

.1 Required on all products as per Provincial Regulations and CSA B51.

2.2 DIAPHRAGM TYPE EXPANSION TANK

.1 Horizontal or vertical as indicated steel pressurized diaphragm type expansion tank.

.2 Capacity: as indicated

.3 Size: length and diameter as indicated.

.4 Diaphragm sealed in elastomer or EPDM suitable for 115°C operating temperature.

.5 Working pressure: 860 kPa with ASME stamp and certification.

.6 Air precharged to 84 kPa (initial fill pressure of system) or as indicated.

.7 Saddles for horizontal installation, base mount for vertical installation.

.8 Supports: Provide supports with hold down bolts and installation templates.

.9 Renewable diaphragm.

2.3 AUTOMATIC AIR VENT

.1 Standard float vent: brass body and NPS 1/8 connection and rated at 1000 kPa working pressure.

.2 Industrial float vent: ASTM A48 Class 30 cast iron body and NPS 1/2 connection and rated at minimum 860 kPa working pressure.

.3 Float: solid material suitable for 115°C working temperature.

2.4 AIR SEPARATOR - EXPANSION TANK FITTING

.1 Complete with adjustable vent tube and built-in manual vent valve.

.2 Working pressure: 860 kPa.

2.5 AIR SEPARATOR - IN-LINE

.1 Working pressure: 860 kPa.

.2 Size: for 0.15 m/s

.3 Shell: steel to ASME BPVC Section VIII.

.4 Removable stainless steel collection tube.

2.6 COMBINATION SEPARATORS/STRAINERS

.1 Steel, tested and stamped in accordance with ANSI/ASME BPVC, for 860 kPa operating pressure, with stainless steel integral strainer with 5.0 mm perforations, tangential inlet and outlet connections, and internal stainless steel air collector tube.

2.7 COMBINATION LOW PRESSURE RELIEF AND REDUCING VALVE

.1 Adjustable pressure setting: 206 kPa relief, 55 to 172 kPa reducing or as indicated.

.2 Low inlet pressure check valve.

.3 Removable strainer.

2.8 PIPE LINE STRAINER

.1 NPS 1/2 to 2: 1.7 MPa steam non-shock bronze body to ASTM B62, screwed or grooved connections, Y pattern.

.2 NPS 2 1/2 to 12: Class 150 cast steel body to ASTM A216 GR.WCB or cast iron body Class 125 to ASTM-A48, Class 30, flanged connections.

.3 NPS 2 to 12: T type 2.1 MPa with ductile iron body to ASTM A536 or malleable iron body to ASTM A47M, grooved ends.

.4 Blowdown connection: NPS 1.

.5 Screen: stainless steel with 1.19 mm perforations.

.6 Working pressure: 860 kPa.

PART 3 EXECUTION

3.1 GENERAL

.1 Install as indicated and to manufacturer's recommendations.

.2 Run drain lines and blow off connections to terminate above nearest drain.

.3 Maintain proper clearance to permit service and maintenance.

.4 Should deviations beyond allowable clearances arise, request and follow Owner’s directive.

.5 Check shop drawings for conformance of all tappings for ancillaries and for equipment operating weights.

3.2 STRAINERS

.1 Install in horizontal or down flow lines.

.2 Ensure clearance for removal of basket.

.3 Install ahead of each pump.

.4 Install ahead of each automatic control valve larger than NPS 1 and radiation and as directed.

3.3 AIR VENTS

.1 Install at high points of systems.

.2 Install gate valve on automatic air vent inlet. Run discharge to nearest drain or service sink.

3.4 EXPANSION TANKS

.1 Adjust expansion tank pressure to suit design criteria.

.2 Install lockshield type valve at inlet to tank.

3.5 PRESSURE SAFETY RELIEF VALVES

.1 Run discharge pipe to terminate above nearest drain. Or as indicated.

3.6 SUCTION DIFFUSERS

.1 Install on inlet to pumps having suction size greater than 50.

3.7 PERFORMANCE VERIFICATION

.1 In accordance with Section 23 08 01 - Performance Verification of Mechanical Piping Systems, supplemented as specified herein.

.2 Provide copies of test reports for Commissioning Manuals.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

.1 Materials, equipment selection, installation and start up for hydronic system pumps.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 21 - Construction/Demolition Waste Management and Disposal

.3 Section 01 35 29.06- Health and Safety Requirements.

.4 Section 01 78 00 - Closeout Submittals.

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.

.2 National Energy Code of Canada for Buildings (NECB).

.3 Canadian Standards Association (CSA International).

.1 CAN/CSA-B214, Installation Code for Hydronic Heating Systems.

.4 National Electrical Manufacturer’s Association (NEMA)

.1 NEMA MG 1, Motors and Generators.

.5 American National Standards Institute/Hydraulics Institute (ANSI/HI)

.1 ANSI/HI 1.3, Rotodynamic (Centrifugal) Pumps for Design and Application.

1.4 SUBMITTALS

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

.2 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

.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.

.4 Submit product data of pump curves for review showing point of operation.

.5 Indicate piping, valves and fittings shipped loose by packaged equipment supplier, showing their final location in field assembly.

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

1.5 HEALTH AND SAFETY

.1 Do construction occupational health and safety in accordance with Section 01 35 29.06 – Health and Safety Requirements.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste material for reuse and recycling in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal, paper, plastic, polystyrene, corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Separate for reuse and recycling and place in designated containers, steel, metal, plastic waste in accordance with Waste Management Plan.

.5 Fold up metal banding, flatten and place in designated area for recycling.

1.7 EXTRA MATERIALS

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Furnish following spare parts:

.1 Mechanical seal for each pump.
.2 Packing for each pump.
.3 Set of gaskets for each pump.

PART 2 PRODUCTS

2.1 EQUIPMENT

.1 Do component selection and sizing to CAN/CSA-B214.

2.2 IN-LINE CIRCULATORS

.1 Volute: cast iron radially split, with screwed or flanged design suction and discharge connections.

.2 Impeller: alloy steel, cast bronze, or cast iron to suit application.

.3 Shaft: stainless steel with bronze sleeve bearing, integral thrust collar.

.4 Seal assembly: mechanical for service to 135 ^{0}C.

.5 Coupling: flexible self-aligning.

.6 Motor: as per Section 23 05 13 – Common Motor Requirements for HVAC Equipment and as per manufacturer's recommendations. Speed and power as indicated in the pump schedule.

.7 Capacity: as indicated in the pump schedule.

.8 Design pressure: 1200 kPa.

2.3 IN-LINE WET ROTOR CIRCULATORS

.1 Pump body: Cast iron

.2 Impellor: polypropylene (glass filled)

.3 Shaft: stainless steel

.4 Bearings: Graphite

.5 Gasket material: EPDM.

.6 Maximum fluid temperature: 110^{o} C.

.7 Maximum working pressure: 1000 kPa.

.8 Capacity: as indicated in pump schedule.

.9 Connections: union or flanged.

2.4 VERTICAL IN-LINE CIRCULATORS

.1 Volute: cast iron radially split, with tapped openings for venting, draining and gauge connections, with screwed or flanged suction and discharge connections.

.2 Impeller: bronze or cast iron, dynamically balanced.

.3 Shaft: stainless steel with bronze sleeve bearing, integral thrust collar.

.4 Seal assembly: outside balanced, mechanical for service to 135^{0} C. Flush line fittings to include 50 micron filter and sight flow indicator, if pump differential exceeds 200 kPa replace filter with cyclone type separator.

.5 Coupling: flexible self-aligning.

.6 Motor: NEMA base, drip proof, ball bearing as per Section 23 05 13 – Common Motor Requirements for HVAC Equipment, speed and power as indicated in pump schedule.

.7 Capacity: as indicated in pump schedule.

.8 Design pressure: 1200 kPa.

2.5 SINGLE SUCTION CENTRIFUGAL PUMP

.1 General: all iron pump complete with motor.

.2 Base: common cast iron or fabricated steel with drip rim and tapping for drain connection.

.3 Volute: cast iron radially split, back pull out end suction, screwed or flanged suction and discharge, with drain plug and vent cock, suction and discharge pressure gauge tappings.

.4 Impeller: cast iron or stainless steel enclosed type, keyed drive with locking nut or screw, dynamically balanced.

.5 Shaft: stainless steel with two point support for ball bearing mounting hardened wear rings at packing gland.

.6 Seal assembly: mechanical seal, oil or grease lubricated. On open system flush line with 50 micron filter and site flow indicator. When differential exceeds 200 kPa use cyclone type separator.

.7 Coupling: flexible self-aligning complete with coupling guard.

.8 Motor: NEMA Class B, squirrel cage induction, premium efficiency continuous duty, drip proof, ball bearing, maximum temperature rise 50^0 C, as per Section 23 05 13 - Common Motor Requirements for HVAC Equipment, speed and power as indicated in pump schedule.

.9 Capacity: as indicated in pump schedule.

.10 Design pressure: 1200 kPa.

2.6 HORIZONTAL SPLIT CASE CENTRIFUGAL PUMP

.1 General: all iron pump complete with motor.

.2 Base: common cast iron or fabricated steel base with drip rim and tapping for drain connection.

.3 Volute: cast iron horizontally split, with suction and discharge nozzles integrally cast in lower half, flanged suction and discharge, with drain plug and vent cock, suction and discharge pressure tappings.

.4 Impeller: bronze enclosed type, keyed drive.

.5 Shaft: alloy steel stainless steel with two point support for ball bearing mounting hardened wear rings at packing gland.

.6 Seal assembly: mechanical seal, oil or grease lubricated. On open system flush line with 50 micron filter and site flow indicator, when differential exceeds 200 kPa cyclone type separator.

.7 Coupling: flexible self-aligning complete with coupling guard.

.8 Motor: NEMA Class B, squirrel cage induction, speed and power as indicated in pump schedule, continuous duty, drip proof, ball bearing, maximum temperature rise 50^0 C, premium efficiency, as per Section 23 05 13 - Common Motor Requirements for HVAC Equipment.

.9 Capacity: as indicated in pump schedule.

.10 Design pressure: 1200 kPa.

PART 3 EXECUTION

3.1 INSTALLATION

.1 In line circulators: install as indicated by flow arrows. Support at inlet and outlet flanges or unions. Install with bearing lubrication points accessible.

.2 Base mounted type: supply templates for anchor bolt placement. Furnish anchor bolts with sleeves. Place level, shim unit and grout. Align coupling in accordance with manufacturer's recommended tolerance. Check oil level and lubricate.

.3 Ensure that pump body does not support piping or equipment. Provide stanchions or hangers for this purpose. Refer to manufacturer's installation instructions for details.

.4 Pipe drain tapping to floor drain.

.5 Install volute venting pet cock in accessible location.

.6 Check rotation prior to start-up.

.7 Install pressure gauge ball valves.

3.2 START-UP

.1 General

.1 In accordance with Section 01 91 13.13 – Commissioning (Cx) Requirements, supplemented as specified herein.

.2 In accordance with manufacturer's recommendations.

.2 Procedures:

.1 Before starting pump, check that cooling water system, over-temperature and other protective devices are installed and operative.

.2 After starting pump, check for proper, safe operation.

.3 Check installation, operation of mechanical seals, packing gland type seals. Adjust as necessary.

.4 Check base for free-floating, no obstructions under base.

.5 Run-in pumps for 12 continuous hours.

.6 Verify operation of over-temperature and other protective devices under low- and no-flow condition.

.7 Eliminate air from scroll casing.

.8 Adjust water flow rate through water-cooled bearings.

.9 Adjust alignment of piping and conduit to ensure true flexibility at all times.

.10 Eliminate cavitation, flashing and air entrainment.

.11 Adjust pump shaft seals.

.12 Measure pressure drop across strainer when clean and with flow rates as finally set.

.13 Replace seals if pump used to degrease system or if pump used for temporary heat.

.14 Verify lubricating oil levels.

3.3 PERFORMANCE VERIFICATION (PV) AND COMMISSIONING

.1 General

.1 In accordance with Section 01 91 13.13 – Commissioning (Cx) Requirements, supplemented as specified herein.

.2 In accordance with manufacturer's recommendations.

.2 Assumptions: These PV procedures assume that:

.1 Manufacturer's performance curves are accurate.

.2 Valves on pump suction and discharge provide tight shut-off.

.3 Net Positive Suction Head (NPSH):

.1 Application: Measure NPSH for pumps which operate on open systems and with water at elevated temperatures.

.2 Measure using procedures prescribed in the ANSI/HI 1.6.

.3 Where procedures do not exist, discontinue PV, report to Owner and await instructions.

.4 Multiple Pump Installations - Series and Parallel:

.1 Repeat PV procedures specified above for pump performance and pump BHP for combinations of pump operations.

.5 Mark points of design and actual performance at design conditions as finally set upon completion of TAB.

.6 Commissioning Reports: In accordance with Section 01 91 13.13 –Commissioning (Cx) Requirements Reports supplemented as specified herein. Reports to include:

.1 Record of point(s) of actual performance at maximum and minimum conditions and for single and parallel operation as finally set at completion of commissioning on pump curves.

.2 Report forms as specified Section 01 91 13.13 – Commissioning (Cx) Requirements.

.3 Pump performance curves (family of curves).

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

.1 Section Includes.

.1 Materials and installation for steel piping, valves and fittings for steam systems in building services piping.

1.2 Related Sections.

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 35 29.06- Health and Safety Requirements.

.3 Section 21 05 01 - Common Work Results -Mechanical.

.4 Section 23 05 00 – Common Work Results for Plumbing.

.5 Section 23 05 05 - Installation of Pipework.

.6 Section 23 05 17 - Pipe Welding.

.7 Section 23 05 23.03 - Valves - Cast Steel

.8 Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

.9 Section 23 07 13 – Duct Insulation.

.10 Section 23 10 16 – HVAC Equipment Insulation.

.11 Section 23 07 19 – HVAC Piping Insulation.

.12 Section 23 08 01 - Performance Verification of Mechanical Piping.

.13 Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.

1.3 REFERENCES

.1 Canadian Standards Association

.1 CSA B51 Boiler, pressure vessel, and pressure piping code.

.2 AMERICAN WEDLING SOCIETY

.1 AWS Z49.1 (2012) Safety in Welding and Cutting and Allied Processes

.3 American Society of Mechanical Engineers (ASME).

.1 ASME A13.1 (2015) Scheme for the Identification of Piping Systems

.2 ASME B1.1 (2003; R 2008) Unified Inch Screw Threads (UN and UNR Thread Form)

.3 ASME B1.20.1 (2013) Pipe Threads, General Purpose (Inch)

.4 ASME B16.11 (2011) Forged Fittings, Socket-Welding and Threaded

.5 ASME B16.18 (2012) Cast Copper Alloy Solder Joint Pressure Fittings

.6 ASME B16.20 (2012) Metallic Gaskets for Pipe Flanges - Ring-Joint, Spiral Wound, and Jacketed

.7 ASME B16.21 (2011) Nonmetallic Flat Gaskets for Pipe Flanges

.8 ASME B16.22 (2013) Standard for Wrought Copper and Copper Alloy Solder Joint Pressure Fittings

.9 ASME B16.24 (2011) Cast Copper Alloy Pipe Flanges and Flanged Fittings: Classes 150, 300, 600, 900, 1500, and 2500

.10 ASME B16.3 (2011) Malleable Iron Threaded Fittings, Classes 150 and 300

.11 ASME B16.34 (2013) Valves - Flanged, Threaded and Welding End ASME B16.39 (2014) Standard for Malleable Iron Threaded Pipe Unions; Classes 150, 250, and 300 ASME B16.5 (2013) Pipe Flanges and Flanged Fittings:

.12 ASME B16.1,Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, NPS 1/2 Through NPS 24 Metric/Inch Standard

.13 ASME B16.9 (2012) Standard for Factory-Made Wrought Steel Buttwelding Fittings

.14 ASME B18.2.1 (2012; Errata 2013) Square and Hex Bolts and Screws (Inch Series)

.15 ASME B18.2.2 (2015) Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series)

.16 ASME B31.1 (2016) Power Piping

.17 ASME B40.100 (2013) Pressure Gauges and Gauge Attachments

.18 ASME BPVC (2010) Boiler and Pressure Vessels Code ASME BPVC SEC IX (2010) BPVC Section IX-Welding and Brazing Qualifications ASME BPVC SEC VIII D1 (2015) BPVC Section VIII-Rules for Construction of Pressure Vessels Division 1

.4 American Society for Testing and Materials International, (ASTM).

.1 ASTM A106/A106M (2014) Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service

.2 ASTM A194/A194M (2016a) Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure or High-Temperature Service, or Both

.3 ASTM A307 (2014) Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength

.4 ASTM A53/A53M (2012) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

.5 ASTM B32 (2008; R 2014) Standard Specification for Solder Metal

.6 ASTM B88 (2016) Standard Specification for Seamless Copper Water Tube

.7 ASTM B88M (2016) Standard Specification for Seamless Copper Water Tube (Metric)

.5 Canadian Standards Association (CSA International).

.1 CAN/CSA W48, Filler Metals and Allied Materials for Metal Arc Welding.

.6 Manufacturer's Standardization of the Valve and Fittings Industry (MSS).

.1 MSS SP-45 (2003; R 2008) Bypass and Drain Connections

.2 MSS SP-58 (1993; Reaffirmed 2010) Pipe Hangers and Supports - Materials, Design and Manufacture, Selection, Application, and Installation

.3 MSS SP-69 (2003; Notice 2012) Pipe Hangers and Supports - Selection and Application

.7 Province of Newfoundland and Labrador Boiler, Pressure Vessel and Compressed Gas Regulations.

1.4 SUBMITTALS

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

.2 Closeout Submittals.

.1 Provide maintenance data for incorporation into manual specified in Front End Documents, and include the following:

.1 Special servicing requirements.

.3 All Products to have current CRN numbers for NL. Identify CRN for each product. Classes and Maximum Working Pressures Equipment, piping, and piping components shall be suitable for use under the maximum working pressure indicated. Except as modified herein, the pressure temperature limitations shall be as specified in the referenced standards and specifications.

1.5 QUALITY ASSURANCE

.1 Health and Safety.

.1 Do construction occupational health and safety in accordance with Section 01 35 29.06 – Health and Safety Requirements.

.2 Welding Procedure Submit welding procedure specification for metals included in the work, together with proof of the procedure's qualifications as outlined in ASME B31.1.

.3 Welder's Performance Qualification Record per 23 05 17 Pipe Welding.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Waste Management and Disposal.

.1 Separate waste materials for reuse and recycling in accordance with Front End Documents.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal, paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Fold up metal and plastic banding, flatten and place in designated area for recycling.

1.7 DEFINITIONS

.1 High Pressure Piping System A system whose pressure is greater than 103 kPa (gage) 15 psig and shall conform to ASME B31.1.

.2 Low Pressure Piping System A system whose pressure is 103 kPa (gage) 15 psig or less and shall conform to ASME B31.1..

PART 2 PRODUCTS

.1 Includes pipe, tubing, flanges, bolting, gaskets, valves, safety valves, fittings, and pressure containing parts of other piping components, hangers, supports, guides, expansion joints, anchors, and other equipment items necessary to prevent overstressing the pressure containing parts.

2.2 PIPE

.1 High Pressure Steam Piping System (Over 103 kPa (Gage)Over 15 psig)

.1 ASME B31.1 for a steam working pressure of 485 kPa. condensate pressure 485 kPa.

.2 STEAM - ASTM A106/A106M, Grade B, Schedule 40, black steel, seamless. Use ASTM A53/A53M pipe for bending.

.3 CONDENSATE - ASTM A106/A106M Grade B, Schedule 80, black steel, seamless.

.2 Low Pressure Steam Piping System

.1 ASME B31.1 for a steam working pressure of 103 kPa or less, a condensate pressure of 103 or less kPa

.2 STEAM - ASTM A106/A106M, Grade B, Schedule 40, black, seamless.

.3 CONDENSATE - ASTM A106/A106M53M, Schedule 80, black, seamless. Use ASTM A53/A53Mpipe for bending.

.3 All condensate system piping for high and low pressure systems shall be Schedule 80 pipe.

2.3 FITTINGS

.1 Provide fittings compatible in all respects (material, size, pressure, and temperature limitations) with the pipe being used and within any further limitations of ASME B31.1.

.2 Fittings for Steel Pipe

.1 Sizes 3 to 50 mm

.1 Steel Fittings: ASME B16.11, socket welding or threaded. Where pressure exceeds 103 kPa (gage) 15 psig, provide socket-welding type only.

.2 Sizes 65 mm 2 1/2 inches and larger:

.1 Steel Fittings: ASME B16.9, buttwelding or ASME B16.5, flanged.

.3 Unions for Steel Pipe

.1 ASME B16.39, threaded.

.4 Steel Flanges

.1 ASME B16.5, forged steel, welding type.

2.4 VALVES

.1 Connections:

.1 NPS2 and smaller: Socket Weld, screwed ends.

.2 NPS2.1/2 and larger: Flanged

.2 Gate valves:

.1 Steel Gate Valves: ASME B16.34. Provide outside screw and yoke type with solid wedge or flexible wedge disc, and with trim suitable for the service temperature and pressure.

.3 Globe valves:

.1 Steel Globe and Angle Valves: ASME B16.34, with trim suitable for the service temperature and pressure.

.4 Check valves

.1 Steel Check Valves: with trim suitable for the service temperature and pressure.

.1 Swing Check Valves: Shall have bolted caps.

.2 Lift Check Valves: Shall have threaded or bolted caps.

.5 Safety Valves

.1 Sized in accordance with ASME BPVC. Set point shall be as indicated, cast iron prohibited

.6 End Connections

.1 Steel Piping Sizes 50 mm 2 inches and smaller threaded or socket welded; sizes 65 mm 2 1/2 inches and larger flanged or butt welded.

.1 Threaded Joints: ASME B1.20.1.

.2 Flanged Joints: Flanges shall conform to paragraph entitled "Flanges." Bolting and gaskets shall be as follows:

.1 Bolting: Material used for bolts and studs shall conform to ASTM A307, Grade B; and material for nuts shall conform to ASTM A194/A194M, Grade 2. Dimensions of bolts, studs, and nuts shall conform to ASME B18.2.1 and ASME B18.2.2 with threads conforming to ASME B1.1coarse type, with Class 2A fit for bolts and studs, and Class 2B fit for nuts. Bolts or bolt-studs shall extend completely through the nuts and may have reduced shanks of a diameter not less than the diameter at root of threads. Carbon steel bolts shall have American Standard regular square or heavy hexagon heads and shall have American

Standard heavy semifinished hexagonal nuts, conforming to ASME B18.2.1 and ASME B18.2.2.

.3 Butt Weld Joints:

.1 ASME B31.1.

.2 The use of backing rings are not permitted.

.4 Socket Weld Joints:

.1 ASME B31.1.

2.5 INSTRUMENTATION

.1 Pressure and Vacuum Gages ASME B40.100 with restrictor, locate as indicated. Provide scale range for intended service. Scale range not to exceed two times (2X) the indicated pressure of piping.

.2 Indicating Thermometers Thermometers shall be dial type with an adjustable angle suitable for the service. Provide thermowell sized for each thermometer in accordance with the thermowell specification. Fluid-filled thermometers (mercury is not acceptable) shall have a nominal scale diameter of 125 mm 5 inches. Construction shall be stainless-steel case with molded glass cover, stainless-steel stem, and bulb. Stem shall be straight, length as required to fit well. Bimetal thermometers shall have a scale diameter of 90 mm 3 1/2 inches. Case shall be hermetic. Case and stem shall be constructed of stainless steel. Bimetal stem shall be straight and of a length as required to fit the well.

2.6 MISCELLANEOUS PIPELINE COMPONENTS

.1 Strainers

.1 For Class 125 and 250 piping in sizes 15 to 200 mm inclusive, locate as indicated, cast iron prohibited.

.2 Hangers, Supports, Spacing Requirements, and Attachments

.1 MSS SP-58 and ASME B31.1 for materials, design, and manufacture. MSS SP-69 for selection and application.

2.7 CONDENSATE RECOVERY

.1 Refer to schedules.

PART 3 EXECUTION

3.1 PIPING INSTALLATION

.1 Install pipework in accordance with Section 23 05 05 – Installation of Pipework by certified journeyperson and authority having jurisdiction.

.2 Fabricate, assemble, weld, solder, braze, and install piping and pipe system in accordance with

ASME B31.1 and as further qualified herein. Piping shall follow the general arrangement shown. Cut piping accurately to measurements established, for the work shown, by the Contractor, and work into place without springing or forcing, Locate piping and equipment within buildings entirely out of the way of lighting fixtures, conduit, and doors, windows, and other openings.

.3 Run overhead piping in buildings in the most inconspicuous positions. Provide adequate clearances from walls, ceilings, and floors to permit the welding of joints; at least 150 mm for pipe sizes 100 mm and smaller, 250 mm for pipe sizes larger than 100 mm, and in corners provide sufficient clearance to permit the welder to work between the pipe and one wall.

.4 Make provision for expansion and contraction of pipe lines. Do not bury, conceal, or insulate piping until it has been inspected, tested, and approved. Do not conceal piping in walls, partitions, underground, or under the floor except as indicated. Where pipe passes through building structure, do not conceal pipe joints, but locate where they may be readily inspected and not weaken building structure.

.5 Run insulated pipe as shown and as required with sufficient clearance to permit application of insulation. Use flanged joints only where necessary for normal maintenance and where required to match valves and equipment. Gaskets, packing, and thread compounds shall be suitable for the service. Apply joint compound or tape on male thread only. Use long radius ells wherever possible to reduce pressure drops.

.6 Mitering of pipe to form elbows, notching straight runs to form full sized tees, or any similar construction shall not be used.

.7 Make branch connections with welding tees except factory made forged welding branch outlets or nozzles having integral reinforcements conforming to ASME B31.1 may be used, provided the nominal diameter of the branch is at least one pipe size less than the nominal diameter of the run.

.8 Run piping as indicated, and avoid interference with other piping, conduit, or equipment. Run vertical piping plumb and straight and parallel to walls, except where specifically shown otherwise.

.9 Use reducing fittings for changes in pipe sizes, eccentric fittings are to be used to allow condensate to drain. The use of bushings is prohibited. In horizontal lines 65 mm and larger, use reducing fittings of the eccentric type to maintain the bottom of the lines in the same plane for steam lines and to maintain the top of the lines in the same plane for condensate lines except where a trap or pocket would result.

.10 Provide suitable size sleeves for lines passing through building structure. Install piping connected to equipment to provide flexibility for thermal stresses and for vibration. Support and anchor pipe so that strain from weight and thermal movement of piping is not imposed on the equipment.

.11 Thoroughly clean each section of pipe, fittings, and valves of foreign matter before erection. Before placing in position, clean the inside of black steel pipe by rapping along its full length to loosen sand, mill scale, and other foreign matter; pipe 50 mm and larger shall have a wire brush of a diameter larger than that of the inside of the pipe drawn through its entire length several times.

.12 Before final connections are made to the apparatus, thoroughly wash out the piping interior with water. Blow out steam piping with high-pressure steam, if available, or compressed air, removing rust, oil, chips, sand, and other material. Plug or cap open ends of mains during shutdown periods.

Do not leave lines open at any place where any foreign matter might accidentally enter pipe.

.13 Route all pressure reliefs to roof. Support relief line at all building elevations. Extend relief lines 2.0 m min above roof.

3.2 WELDING

.1 Welding of Piping: Welding of joints in piping, butt welds, fillet welds, bends, loops, offsets, and preparation and cleaning of pipe shall be in accordance with ASME B31.1. Welds shall be visually examined and meet acceptance standards indicated in Chapter VI of ASME B31.1.

.2 Specification section 23 05 17 PIPE WELDING

3.3 HANGERS AND SUPPORTS

.1 23 05 29 Hangers and Supports for HVAC Piping

3.4 GRADING AND VENTING

.1 Grading and Venting of Pipe Lines Unless otherwise indicated, install horizontal lines of steam and return piping to grade down in the direction of flow with a pitch of not less than 25 mm in 9 meters, except in loop mains and main headers where the flow may be in either direction. When counterflow of condensate within the steam pipe occurs in a portion of a pipeline, pitch up in the direction of steam flow a minimum of 150 mm per 30 meters and increase pipe diameters by one standard pipe size.. Air vents shall be provided at the highest point of any vertical riser.

3.5 PIPE SLEEVES

.1 Provide pipe sleeves where pipes and tubing pass through masonry or concrete walls, floors, roofs, and partitions. Use Schedule 40 galvanized steel pipe sleeves in outside walls below and above grade, in floor, and in roof slabs. Sleeves in partitions shall be zinc-coated sheet steel having a weight of not less than 4.43 kg per square meter (0.907 psf). Space between pipe, tubing, or insulation and the sleeve shall be not less than 25 mm. Hold sleeves securely in proper position and location before and during construction. Sleeves shall be of sufficient length to pass through entire thickness of walls, partitions, or slabs. Sleeves in floor slabs shall extend 50 mm 2 inches above the finished floor. Roof penetrations flashings shall permit pipe movement and prevent ingress of water and shall be insulated and shall be sealed with gasketing material suitable for steam temperature and ambient temperature extremes.

3.6 FLOOR, WALL, AND CEILING PLATES

.1 Secure plates to the pipe with enough clearance for thermal expansion of pipe. Use 304 stainless steel for pipes passing through floors and partitions in exposed areas.

3.7 UNIONS AND FLANGES

.1 Provide unions and flanges where necessary to permit easy disconnection of piping and apparatus, and as indicated. Provide a union for each threaded end valve. Use unions on piping smaller than

50 mm in diameter, and use flanges on piping 50 mm 2 inches and larger in diameter. Provide dielectric unions or flanges between ferrous and non-ferrous piping, equipment, and fittings. Dielectric fittings shall utilize a non-metallic filler which will prevent current flow. The spacer shall be suitable for the pressure and temperature of the service.

3.8 TRAPS AND CONNECTIONS

.1 Traps shall be of the type and capacity for the service and shall be properly supported and connected. Except for thermostatic traps in pipe coils, radiators, and convectors, install traps with a dirt pocket and strainer between it and the piping or apparatus it drains. Provide a check valve on the discharge side of the trap whenever the trap is installed for lift or operating against a back pressure, or discharges into a common return line. Provide line drain “tattle tails” after steam traps for checking of steam trap operation. Provide line drains at strainers for line blow down.

.2 Traps shall be provided as indicated and at all risers, and changes in elevation.

3.9 VALVES

.1 General Install valves in conformance with ASME B31.1, and as required herein, at the locations indicated and elsewhere as required for the proper functioning of the system. Use gate valves unless otherwise directed. Install stop valves in the supply lines equipped or located so as to permit operation from floor level, or provided with safe access in the form of walkways or ladders. Install valves in positions accessible for operation and repair.

.2 Pressure Reducing valves

.1 Provide the steam line entering each pressure-reducing valve with a strainer. Provide each pressure-reducing valve unit with two cutout valves and with a globe or angle bypass valve and bypass piping. Provide each pressure-reducing valve unit with an indicating steam gage to show the reduced pressure, and a safety valve on the low pressure side with sufficient capacity to relieve the high pressure steam.

.2 On all reducing stations provide downstream safety relief valves, drip pan elbow and vent routed to extend above roof. Reducing stations reliefs shall be sized to permit upstream high-pressure relief to protect the down stream components at the downstream component allowable pressure.

.3 Safety Valves Provide with drip pan elbows.

3.10 THERMOMETERS

.1 Provide thermometers and thermal sensing elements of control valves with a separable socket. Install separable sockets in pipe lines in such a manner to sense the temperature of the flowing fluid and minimize obstruction to flow.

3.11 STRAINERS

.1 Provide strainers with meshes suitable for the services where indicated, and where dirt might interfere with the proper operation of valve parts, orifices, and moving parts of equipment.

3.12 CLEANING, FLUSHING AND START-UP

.1 In accordance with Section 23 08 02 – Cleaning and Start-up of Mechanical Piping Systems.

3.13 FIELD INSPECTIONS

.1 Inspect piping system prior to initial operation, for conformance to drawings, specifications, and ASME B31.1. Equipment, material, or work rejected because of defects or non-conformance with drawings, specifications, and ASME B31.1 shall be replaced or corrected by the Contractor.

3.14 TESTING

.1 Test system in accordance with Section 21 05 01 – Common Work Results - Mechanical. Minimum 1.5 times working pressure or 1000 kPa.

3.15 PERFORMANCE VERIFICATION

.1 In accordance with Section 23 08 01 – Performance Verification of Mechanical Systems.

.2 Provide copies of test reports for Commissioning Manuals.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

.1 Section includes:

.1 Materials and installation of low-pressure metallic ductwork, joints and accessories.

.2 ALL SUPPLY DUCTWORK ASSOCIATED WITH THE AHU, INCLUDING HOT DECK DISCHARGE AND SUPPLY RISERS, OPERATING AT PRESSURES EXCEEDING 500 Pa (UP TO 1200 Pa), SHALL BE CONSTRUCTED AND INSTALLED IN ACCORDANCE WITH SMACNA 2000 PA PRESSURE DUCT CONSTRUCTION STANDARDS, INCLUDING APPROPRIATE GAUGE, REINFORCEMENT, SEALING CLASS, AND LEAKAGE CRITERIA.

1.2 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 01 35 29.06 – Health and Safety Requirements

.3 Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

.4 Section 01 91 13.13 – Commissioning (Cx) Requirements.

.5 Section 07 84 00 – Firestopping

.6 Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment.

.7 Section 23 05 94 – Pressure Testing of Ducted Air Systems.

.8 Section 23 40 00 – HVAC Air Filtration

1.3 REFERENCES

.1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).

.2 American Society for Testing and Materials International, (ASTM).

.1 ASTM A 480/A480M, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.

.2 ASTM A635/A635M, Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Alloy, Carbon, Structural, High-Strength Low-Alloy, and High-Strength Low-Alloy with Improved Formability, General Requirements for.

.3 ASTM A 653/A653M, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.

.3 Department of Justice Canada (Jus).

.1 Canadian Environmental Protection Act (CEPA).

.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.

.3 NFPA 96, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

.6 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).

.1 SMACNA HVAC Duct Construction Standards - Metal and Flexible.

.2 SMACNA HVAC Air Duct Leakage Test Manual.

.3 IAQ Guideline for Occupied Buildings Under Construction, 1st Edition.

.7 Transport Canada (TC).

.1 Transportation of Dangerous Goods Act (TDGA).

1.4 SUBMITTALS

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data: submit WHMIS SDS - Safety Data for the following:

.1 Sealants.

.2 Tape.

.3 Proprietary Joints.

1.5 QUALITY ASSURANCE

.1 Certification of Ratings:

.1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

.2 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

.2 During construction meet or exceed the requirements of SMACNA IAQ Guideline for Occupied Buildings under Construction.

.3 Installers to be certified to journeyperson level in sheet metal work.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Protect on site stored or installed absorptive material from moisture damage.

.2 Waste Management and Disposal:

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal, paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Separate for reuse and recycling and place in designated containers steel, metal, plastic waste in accordance with Waste Management Plan.

.5 Place materials defined as hazardous or toxic in designated containers.

.6 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal regulations.

.7 Fold up metal and plastic banding, flatten and place in designated area for recycling.

PART 2 PRODUCTS

2.1 PRESSURE CLASS

.1 All duct shall be constructed to pressure class of ESP of the connected fan.

.2 Classification as follows:

Design Operating Pressure	**SMACNA Pressure Class**
≤500 Pa	Low Pressure (existing requirements apply)
>500 Pa to ≤2000 Pa	SMACNA 2000 Pa (10 in. w.g.)

Ductwork shall be constructed in accordance with the **SMACNA HVAC Duct Construction Standards** for the applicable pressure class indicated above.

2.2 SEAL CLASSIFICATION

.1 Seal all duct to Class A.

.2 Seal classification:

.1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant and tape.

.2 Class B: longitudinal seams, transverse joints and connections made airtight with sealant tape or combination thereof.

.3 Class C: transverse joints and connections made air tight with gaskets, sealant tape or combination thereof. Longitudinal seams unsealed.

2.3 SEALANT

.1 Sealant: oil resistant, polymer type flame resistant duct sealant. Temperature range of minus 30°C to plus 93°C.

2.4 TAPE

.1 Tape: polyvinyl treated, open weave fiberglass tape, 50 mm wide.

2.5 DUCT LEAKAGE

.1 In accordance with SMACNA HVAC Duct Leakage Test Manual.

2.6 FITTINGS

.1 Fabrication: to SMACNA.

.2 Radiused elbows:

.1 Rectangular: Centreline radius: 1.5 times width of duct.

.2 Round: smooth radius or five piece. Centreline radius: 1.5 times diameter.

.3 Mitred elbows, rectangular:

.1 To 400 mm: with single thickness turning vanes.

.2 Over 400 mm: with double thickness turning vanes.

.4 Branches:

.1 Rectangular main and branch: with radius on branch 1.5 times width of duct or 45^0 entry on branch.

.2 Round main and branch: enter main duct at 45^0 with conical connection.

.3 Provide volume control damper in branch duct near connection to main duct.

.4 Main duct branches: with volume control damper.

.5 Transitions:

.1 Diverging: 20^0 maximum included angle.

.2 Converging: 30^0 maximum included angle.

.6 Offsets:

.1 Full short radiused elbows as indicated.

.7 Obstruction deflectors: maintain full cross-sectional area. Maximum included angles: as for transitions.

2.7 FIRESTOPPING

.1 Retaining angles around duct, on both sides of fire separation in accordance with Section 07 84 00 – Firestopping.

.2 Firestopping material and installation must not distort duct.

2.8 GALVANIZED STEEL

.1 Lock forming quality: to ASTM A653, G90 zinc coating.

.2 Thickness, fabrication and reinforcement: to SMACNA.

.3 Joints: to SMACNA or proprietary manufactured duct joint. Proprietary manufactured flanged duct joint to be considered to be a class A seal.

2.9 STAINLESS STEEL

.1 To ASTM A480/A480M, Type 316

.2 Finish: No 4. finish on exposed side of duct in finished area's, No. 3 finish or lower where concealed.

.3 Thickness, fabrication and reinforcement: to SMACNA.

.4 Joints: to SMACNA; provide continuous GTAW (TIG) welds using compatible 316 filler metal.

2.10 HANGERS AND SUPPORTS

.1 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct. Maximum size duct supported by strap hanger: 500 mm.

.2 Hanger configuration: to SMACNA.

.3 Hangers: galvanized steel angle with black steel rods to ASHRAE or SMACNA following table:

Duct Size (mm)	Angle Size (mm)	Rod Size (mm)

Duct Size	Angle Size	Rod Size
up to 750	25x25x3	6
751 to 1050	40x40x3	6
1051 to 1500	40x40x3	10
1501 to 2100	50x50x3	10
2101 to 2400	50x50x5	10
2401 and over	50 x 50 x 6	10

.4 Upper hanger attachments:

.1 For concrete: manufactured concrete inserts.

.2 For steel joist: manufactured joist clamp steel plate washer.

.3 For steel beams: manufactured beam clamps:

PART 3 EXECUTION

3.1 GENERAL

.1 Do work in accordance with NFPA 90A, NFPA 90B, and SMACNA.

.2 Do not break continuity of insulation vapour barrier with hangers or rods. Insulate strap hangers 100 mm beyond insulated duct.

.3 Support risers in accordance with SMACNA.

.4 Install breakaway joints in ductwork on sides of fire separation. Do not place fire stopping material in expansion space between damper sleeve and fire partition.

.5 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.

.6 Manufacture duct in lengths and diameter to accommodate installation of acoustic duct lining.

3.2 HANGERS

.1 Strap hangers: install in accordance with SMACNA.

.2 Angle hangers: complete with locking nuts and washers.

.3 Hanger spacing: in accordance with SMACNA or as follows:

Duct Size (mm)	Spacing (mm)
to 1500	3000
1501 and over	2500

3.3 WATERTIGHT DUCT

.1 Provide watertight duct for:

.1 Fresh air intake.

.2 As indicated.

.2 Form bottom of horizontal duct without longitudinal seams. Solder or weld joints of bottom and side sheets. Seal other joints with duct sealer.

.3 Slope horizontal branch ductwork down towards fume hoods served. Slope header ducts down toward risers.

.4 Fit base of riser with 150 mm deep drain sump and NPS 1 ½ drain connected, with deep seal trap and valve and discharging to open funnel drain or service sink or as approved by Owner.

3.4 SEALING AND TAPING

.1 Apply sealant to outside of joint to manufacturer's recommendations.

.2 Bed tape in sealant and recoat with minimum of one coat of sealant to manufacturers recommendations. Sealant and tape to be applied to full perimeter of duct.

3.5 LEAKAGE TESTS/COMMISSIOONING

.1 Refer to Section 23 05 94 - Pressure Testing of Ducted Air Systems.

.2 In accordance with SMACNA HVAC Duct Leakage Test Manual.

.3 Do leakage tests in sections.

.4 Make trial leakage tests as instructed to demonstrate workmanship.

.5 Install no additional ductwork until trial test has been passed.

.6 Test all duct.

.7 Complete test before insulation or concealment.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Materials and installation for duct accessories including flexible connections, access doors, vanes and collars.

1.2 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 01 35 29.06 – Health and Safety Requirements.

.3 Section 01 45 00 – Quality Control.

.4 Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

.5 Section 01 78 00 – Closeout Submittals.

1.3 REFERENCES

.1 Health Canada/Workplace Hazardous Materials Information System (WHMIS).

.1 Safety Data Sheets (SDS).

.2 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).

.1 SMACNA – HVAC Duct Construction Standards – Metal and Flexible.

1.4 SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheet. Indicate the following:

.1 Flexible connections

.2 Duct access doors.

.3 Turning vanes.

.4 Instrument test ports.

.2 Submit WHMIS SDS in accordance with Section 01 33 00 - Submittal Procedures. Indicate VOC's for adhesive and solvents during application and curing.

.3 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.

.1 Certification of ratings: catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

.4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.5 Instructions: submit manufacturer's installation instructions.

.6 Manufacturer's Field Reports: manufacturer's field reports specified.

.7 Closeout Submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 – Closeout Submittals.

1.5 QUALITY ASSURANCE

.1 Pre-Installation Meetings:

.1 Convene pre-installation meeting one week prior to beginning work of this Section and on-site installations.

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Co-ordination with other building subtrades.

.4 Review manufacturer's installation instructions and warranty requirements.

.2 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 29.06 – Health and Safety Requirements.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Waste Management and Disposal:

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene, and corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan (WMP).

.4 Separate for reuse and recycling and place in designated containers steel, metal, and plastic waste in accordance with Waste Management Plan (WMP).

.5 Divert unused metal materials from landfill to metal recycling facility as approved by Owner.

PART 2 PRODUCTS

2.1 GENERAL

.1 Manufacture in accordance with SMACNA - HVAC Duct Construction Standards.

2.2 FLEXIBLE CONNECTIONS

.1 Frame: galvanized sheet metal frame 0.66 mm thick with fabric clenched by means of double locked seams.

.2 Material:

.1 Fire resistant, self extinguishing, neoprene coated glass fabric, temperature rated at minus 40^0C to plus 90^0C, density of 1.3 kg/m^2.

2.3 ACCESS DOORS IN DUCTS

.1 Non-insulated ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame.

.2 Insulated ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame and 25 mm thick rigid glass fibre insulation.

.3 Gaskets: neoprene.

.4 Hardware:

.1 Hold open devices.
.2 300 x 300 mm glass viewing panels.
.3 Up to 300 x 300 mm: two sash locks complete with safety chain.
.4 301 to 450 mm: four sash locks complete with safety chain.
.5 451 to 1000 mm: piano hinge and minimum two sash locks.
.6 Doors over 1000 mm: piano hinge and two handles operable from both sides.
.1 Hold open devices.
.2 300 X 300 mm glass viewing panels.

2.4 TURNING VANES

.1 Factory or shop fabricated double thickness with trailing edge, to recommendations of SMACNA and as indicated.

2.5 INSTRUMENT TEST PORTS

.1 1.6 mm thick steel zinc plated after manufacture.

.2 Cam lock handles with neoprene expansion plug and handle chain.

.3 28 mm minimum inside diameter. Length to suit insulation thickness.

.4 Neoprene mounting gasket.

2.6 SPIN-IN COLLARS

.1 Conical galvanized sheet metal spin-in collars with lockable butterfly damper.

.2 Sheet metal thickness to co-responding round duct standards.

PART 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Flexible connections:

.1 Install in following locations:

.1 Inlets and outlets to supply air units and fans.

.2 Inlets and outlets of exhaust and return air fans.

.3 As indicated.

.2 Length of connection: 100 mm.

.3 Minimum distance between metal parts when system in operation: 75 mm.

.4 Install in accordance with recommendations of SMACNA.

.5 When fan is running:

.1 Ducting on sides of flexible connection to be in alignment.

.2 Ensure slack material in flexible connection.

.2 Access doors and viewing panels:

.1 Size:

.1 600 x 600 mm for person size entry.

.2 450 x 450 mm for servicing entry.

.3 300 x 300 mm for viewing.

.4 As indicated.

.2 Locations:

.1 Fire and smoke dampers.

.2 Control dampers.

.3 Devices requiring maintenance.

.4 Required by code.

.5 Reheat coils.

.6 Elsewhere as indicated.

.3 Instrument test ports.

.1 General:

.1 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.

.2 Locate to permit easy manipulation of instruments.

.3 Install insulation port extensions as required.

.4 Locations.

.1 For traverse readings:

.1 Ducted inlets to roof and wall exhausters.

.2 Inlets and outlets of other fan systems.

.3 Main and sub-main ducts.

.4 And as indicated.

.2 For temperature readings:

.1 At outside air intakes.

.2 In mixed air applications in locations as approved by Owner.

.3 At inlet and outlet of coils.

.4 Downstream of junctions of two converging air streams of different temperatures.

.5 And as indicated.

.4 Turning vanes:

.1 Install in accordance with recommendations of SMACNA and as indicated.

3.3 FIELD QUALITY CONTROL

.1 Manufacturer’s Field Services:

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

.2 Manufacturer's Field Services: provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.3 Schedule site visits, to review Work, at stages listed:

.1 After delivery and storage of products, and when preparatory Work, or other Work, on which the Work of this Section depends, is complete but before installation begins.

.2 Twice during progress of Work at 25% and 60% complete.

.3 Upon completion of the Work, after cleaning is carried out.

.4 Obtain reports, within three (3) working days of review, and submit, immediately, to Owner.

3.4 CLEANING

.1 Perform cleaning operations as specified in Section 01 74 00 – Cleaning and in accordance with Manufacturer's recommendations.

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

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Operating dampers for mechanical forced air ventilation and air conditioning systems.

.2 ALL DAMPERS USED ON THIS PROJECT SHALL BE MARINE GRADE SUITABLE FOR SALT WATER ENVIRONMENTS. REFER TO DRAWINGS FOR FURTHER DETAILS

1.2 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 01 35 29.06 – Health and Safety Requirements.

.3 Section 01 45 00 – Quality Control.

.4 Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

.5 Section 01 78 00 – Closeout Submittals.

1.3 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM A 653/A653M-04a, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Safety Data Sheets (SDS).

1.4 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.2 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Safety Data Sheets (SDS) in accordance with Section 01 33 00 - Submittal Procedures.

.3 Indicate the following:

.1 Performance data.

.2 Specifications

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

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

.3 Closeout Submittals:

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

1.5 QUALITY ASSURANCE

.1 Health and Safety Requirements: Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

.2 Certificates:

.1 Catalogue or published ratings those obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

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

.2 Deliver, store and handle materials in accordance with manufacturer’s written instructions.

.2 Waste Management and Disposal:

.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 PRODUCTS

2.1 MULTI-LEAF DAMPERS

.1 Opposed or parallel blade type as indicated.

.2 Structurally formed steel or extruded aluminum, interlocking blades, complete with extruded vinyl seals, spring stainless steel side seals, structurally formed and welded galvanized steel or extruded aluminum frame.

.3 Pressure fit self-lubricated bronze bearings.

.4 Linkage: plated steel tie rods, brass pivots and plated steel brackets, complete with plated steel control rod.

.5 Operator: to Section 25 30 02 – EMCS: Field Control Devices.

.6 Performance:

.1 Leakage: in closed position to be less than 2% of rated air flow at 500 Pa differential across damper.

.2 Pressure drop: at full open position to be less than 25 Pa differential across damper at 10 m/s.

.7 Insulated aluminum dampers:

.1 Frames: insulated with extruded polystyrene foam with RSI factor of 5.0.

.2 Blades: constructed from aluminum extrusions with internal hollows insulated with polyurethane or polystyrene foam, RSI factor of 5.0.

2.2 DISC TYPE DAMPERS

.1 Frame: insulated brake formed, welded, 1.6 mm thick, galvanized steel to ASTM A 653M.

.2 Disc: insulated spin formed, 1.6 mm thick, galvanized steel to ASTM A 653M.

.3 Gasket: extruded neoprene, field replaceable, with 10 year warranty.

.4 Bearings: roller self lubricated and sealed.

.5 Operator: compatible with damper, linear stroke operator, spring loaded actuator, zinc-aluminum foundry alloy casting cam follower.

.6 Performance:

.1 Leakage: in closed position to be less than 2 % of rated air flow at 500 Pa pressure differential across damper.

.2 Pressure drop: at full open position to be less than 25 Pa differential across damper at 10 m/s.

2.3 BACK DRAFT DAMPERS

.1 Automatic gravity operated, multi leaf, aluminum or steel construction with nylon bearings, centre pivoted, spring assisted or counterweighted.

2.4 RELIEF DAMPERS

.1 Automatic multi-leaf steel or aluminum dampers with ball bearing centre pivoted and counter-weights set to open as indicated.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install where indicated.

.2 Install in accordance with recommendations of SMACNA and manufacturer's instructions.

.3 Seal multiple damper modules with silicon sealant.

.4 Install access door adjacent to each damper. See Section 23 33 00 – Air Duct Accessories.

.5 Ensure dampers are observable and accessible.

3.2 CLEANING

.1 Proceed in accordance with Section 01 74 00 - Cleaning.

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

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Fans, motors, accessories, and hardware for commercial use.

1.2 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures

.2 Section 01 35 29.06 – Health and Safety Requirements.

.3 Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

.4 Section 01 78 00 – Closeout Submittals

.5 Section 23 05 13 – Common Motor Requirements for HVAC Equipment.

.6 Section 23 05 48 – Vibration and Seismic Control for HVAC Piping and Equipment.

.7 Section 23 33 00 – Air Duct Accessories.

1.3 REFERENCES

.1 American National Standards Institute/Air Movement and Control Association (ANSI/AMCA)

.1 ANSI/AMCA Standard 99, Standards Handbook.

.2 ANSI/AMCA Standard 300, Reverberant Room Method for Sound Testing of Fans.

.3 ANSI/AMCA Standard 301, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

.2 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)

.1 ANSI/AMCA 210, Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.

.3 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

.1 AHSRAE 51, Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Safety Data Sheets (SDS).

.5 National Electrical Manufacturers Association (NEMA)

.1 NEMA MG 1 Motors and Generators

.2 NEMA ICS 7.1 Safety Standard for Construction and Guide for Selection, Installation and Operation of Adjustable Drive Systems.

.6 The Master Painters Institute (MPI)

.1 Architectural Painting Specification Manual, MPI #18, Primer, Zinc Rich, Organic.

1.4 SYSTEM DESCRIPTION

.1 Performance Requirements:

.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards in force.

.2 Capacity: flow rate, total static pressure, bhp 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 AMCA 99.

.4 Sound ratings: comply with AMCA 301, tested to AMCA 300. Supply unit with AMCA certified sound rating seal.

.5 Performance ratings: based on tests performed in accordance with ANSI/AMCA 210. Supply unit with AMCA certified rating seal, except for propeller fans smaller than 300 mm diameter.

1.5 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Safety Data Sheets (SDS) in accordance with Section 01 33 00 - Submittal Procedures.

.2 Shop Drawings:

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

.3 Provide:

.1 Fan performance curves showing point of operation, BHP kW and efficiency.

.2 Sound rating data at point of operation.

.3 Dimensional data.

.4 Installation procedures.

.4 Indicate:

.1 Motors, sheaves, bearings, shaft details

.2 Minimum performance achievable with variable speed controllers and variable inlet vanes as appropriate.

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

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

.6 Closeout Submittals:

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

1.6 QUALITY ASSURANCE

.1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.7 MAINTENANCE

.1 Extra Materials:

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.1 Spare parts to include:

.1 Matched sets of belts.

.2 Furnish list of individual manufacturer's recommended spare parts for equipment, include:

.1 Bearings and seals.

.2 Belts

.3 Addresses of suppliers.

.4 List of specialized tools necessary for adjusting, repairing or replacing.

1.8 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.

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

.2 Waste Management and Disposal:

.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 PRODUCTS

2.1 FANS GENERAL

.1 Capacity: flow rate, static pressure, bhp, efficiency, revolutions per minute, power, model, size, sound power data and as indicated on schedule.

.2 Fans: statically and dynamically balanced, constructed in conformity with AMCA 99.

.3 Sound ratings: comply with AMCA 301, tested to AMCA 300. Unit shall bear AMCA certified sound rating seal.

.4 Performance ratings: based on tests performed in accordance with ANSI/AMCA 210, and ANSI/ASHRAE 51. Unit shall bear AMCA certified rating seal, except for propeller fans smaller than 300 mm diameter.

.5 Motors:

.1 Open drip proof outside of air stream, TEFC when in air stream, explosion proof as indicated in accordance with NEMA MG1.

.2 In accordance with Section 23 05 13 – Common Motor Requirements for HVAC Equipment supplemented as specified herein.

.3 For use with variable speed controllers where specified.

.4 Sizes as specified.

.5 Two speed with two windings and speeds of approximately 1200 or 900 r/min low and 1800 r/min high as indicated.

.6 Two speeds with split winding, constant horsepower or constant or variable torque as specified and speeds as indicated.

.6 Accessories and hardware: matched sets of V-belt drives, adjustable slide rail motor bases, belt guards, coupling guards, fan inlet and/or outlet safety screens as indicated and as specified in Section 23 05 13 – Common Motor Requirements for HVAC Equipment, inlet or outlet dampers and vanes and as indicated.

.7 Factory primed before assembly in colour standard to manufacturer.

.8 Scroll casing drains: as indicated.

.9 Finish on fume hood exhaust fans: heresite coated

.10 Bearing lubrication systems plus extension lubrication tubes where bearings are not easily accessible.

.11 Vibration isolation: to Section 23 05 48 - Vibration and Seismic Control for HVAC Piping and Equipment.

.12 Flexible connections: to Section 23 33 00 – Air Duct Accessories.

2.2 CENTRIFUGAL FANS

.1 Fan wheels:

.1 Welded steel or aluminum construction.

.2 Maximum operating speed of centrifugal fans not more than 40 % of first critical speed.

.3 Air foil or backward inclined blades, as indicated.

.2 Bearings: air handling quality, heavy duty, split pillow-block, flange mounted grease lubricated ball or roller self aligning type with oil retaining, dust excluding seals and a certified minimum rated life to ABMA L10 of 100,000 hours. Shaft seals on laboratory fume hood and biological safety cabinet exhaust fans:

.1 Single disc or stuffing box seals.

.3 Housings:

.1 Volute with inlet cones: fabricated steel for wheels 300 mm or greater, cast iron, or 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 latched airtight access doors with handles.

.4 Spark resistant construction Type B minimum where indicated.

.4 Variable volume control devices:

.1 Mounted by fan manufacturer.

.2 Adjustable inlet vanes: operated from a centre mechanism linked to each damper vane. Support each vane at ends in bronze bearings. On DWDI fans interconnect vanes to operate in unison. Provide locking devices for manual operation.

.3 Variable Speed Drives: to NEMA ICS 7.1.

2.3 CABINET FANS - GENERAL PURPOSE

.1 Fan characteristics and construction: as centrifugal fans.

.2 Cabinet hung single or multiple wheels with DWDI centrifugal fans in factory fabricated casing complete with vibration isolators and seismic control measures, motor, direct drive or V-belt drive and guard outside casing.

.3 Fabricate casing of zinc coated or phosphate treated steel reinforced and braced for rigidity. Provide removable panels for access to interior. Uncoated, steel parts shall be

painted over with corrosion resistant paint to MPI #18. Finish inside and out, over prime coat, with rust resistant enamel to Section 09 91 13 – Exterior Painting. Internally line cabinet with 12-25 mm thick rigid acoustic insulation, pinned and cemented, complete with metal nosings on all exposed edges.

2.4 IN-LINE CENTRIFUGAL FANS

.1 Characteristics and construction: as for centrifugal fan wheels, with axial flow construction and direct or belt drive as indicated.

.2 Provide AMCA arrangements 1 or 9 as indicated with stiffened flanges, smooth rounded inlets, and stationary guide vanes.

PART 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 FAN INSTALLATION

.1 Install fans as indicated, complete with resilient mountings specified in Section 23 05 48 - Vibration and Seismic Control for HVAC and Piping Equipment, 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 CLEANING

.1 Proceed in accordance with Section 01 74 00 - Cleaning.

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

3.4 COMMISSIONING

.1 Commissioning in accordance with Section 01 91 13.13 – Commissioning (Cx) Requirements.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Mechanical louvers; intakes; vents; and reinforcement and bracing for air vents, intakes and gooseneck hoods.

.2 General

.1 louver will be installed in the underside of a slightly sloped soffit.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

1.3 REFERENCES

.1 Air Movement and Control Association (AMCA)

.1 AMCA 540, Test Method for Louvres Impacted by Wind Borne Debris.

.2 AMCA 550, Test Method for High Velocity Wind Driven Rain Resistant Louvres.

.2 American National Standards Institute (ANSI)/ National Fire Protection Association (NFPA)

.1 ANSI/NFPA 96, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

.3 American Society for Testing and Materials International (ASTM)

.1 ASTM E 90, Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Safety Data Sheets (SDS).

.5 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

.6 Society of Automotive Engineers (SAE)

1.4 SYSTEM DESCRIPTION

.1 Performance Requirements:

.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

1.5 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Safety Data Sheets (SDS) in accordance with Section 01 33 00 - Submittal Procedures.

.2 Indicate following:

.1 Pressure drop.

.2 Face area.

.3 Free area.

.4 Dimensions

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

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

.3 Test Reports:

.1 Submit certified data from independent laboratory substantiating acoustic and aerodynamic performance to ASTM E 90.

1.6 QUALITY ASSURANCE

.1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.

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

.2 Waste Management and Disposal:

.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 PRODUCTS

2.1 FIXED LOUVRES – ALUMINUM

.1 louver will be installed in the underside of a slightly sloped soffit.

.2 Construction: welded with exposed joints ground flush and smooth.

.3 Material: extruded aluminum alloy 6063-T5.

.4 Blade: drainable, stormproof pattern with centre watershed in blade, reinforcing bosses and maximum blade length of 1500 mm.

.5 Frame, head, sill and jamb: 100 mm deep one piece extruded aluminum, minimum 3 mm thick with approved caulking slot, integral to unit. Flanged frame or flush frame as indicated.

.6 Mullions: at 1500 mm maximum centres.

.7 Fastenings: stainless steel with nuts and resilient neoprene washers between aluminum and head of bolt, or between nut, ss washer and aluminum body.

.8 Screen: 12 mm on exhaust and intake mesh, 2.0 mm diameter wire aluminum or galvanized birdscreen on inside face of louvres in formed U-frame.

.9 Finish: Duranar (AAMA 2605) finish + stainless steel fasteners,Colour: to Owner’s approval.

PART 3 EXECUTION

3.1 MANUFACTURER’S INSTRUCTIONS

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

3.2 INSTALLATION

.1 In accordance with manufacturer's and SMACNA recommendations.

.2 Reinforce and brace as indicated.

.3 Anchor securely into opening. Seal with caulking around to ensure weather tightness.

3.3 CLEANING

.1 Proceed in accordance with Section 01 74 00 - Cleaning.

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

END OF SECTION

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

.3 Section 01 78 00 – Closeout Submittals.

.4 Section 01 91 13.13 – Commissioning (Cx) Requirements.

.5 Section 09 91 23 – Interior Painting.

.6 Section 22 07 16 – Plumbing Equipment Insulation.

.7 Section 23 05 13 – Common Motor Requirements for HVAC Equipment.

.8 Section 23 05 48 – Vibration and Seismic Control for HVAC and Piping Equipment.

.9 Section 23 33 00 – Air Duct Accessories.

.10 Section 23 33 15 – Dampers - Operating.

.11 Section 23 34 00 – HVAC Fans.

.12 Section 23 40 00 – HVAC Air Cleaning Devices.

.13 Section 23 05 13 – Common Motor Requirements for HVAC Equipment.

1.2 REFERENCES

.1 American National Standards Institute / National Fire Prevention Association (ANSI/NFPA)

.1 ANSI/NFPA-90A, Standard for the Installation of Air Conditioning and Ventilating Systems.

.2 Sheet Metal and Air-Conditioning Contractors' National Association (SMACNA).

.3 Canadian Standards Association (CSA)

.1 CSA B52 Mechanical Refrigeration Code

.4 American Bearing Manufacturer’s Association (ABMA)

.1 ANSI/ABMA 9 Load Ratings and Fatique Life for Ball Bearings

.2 ANSI/ABMA 11 Load Ratings and Fatique Life for Roller Bearings.

.5 Air Movement and Control Association (AMCA)

.1 AMCA 204, Standard Balance Quality and Vibration Levels for Fans.

.2 AMCA 210, Laboratory Method of Testing Fans for Aerodynamic Performance Rating (ASHRAE)

.3 AMCA 300, Reverberaut Room Method for Sound Testing of Fans.

.6 American Society of Heating Refrigeration and Air-Conditioning Engineers (ASHRAE).

.1 ASHRAE 68, Laboratory Method of Testing to Determine the Sound Power in a Duct.

.2 ANSI/ASHRAE 90.1, (I-P) Energy Standard for Buildings Except Low-Rise Residential Buildings.

.3 ANSI/ASHRAE 52.2, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.

.7 Air-Conditioning, Heating and Refrigeration (AHRI)

.1 ARI 430 Central Station Air Handling Units

.2 ARI 260 Sound Rating of Ducted Air Moving and Conditioning Equipment

.3 ARI 400 Forced Circulation Air-Cooling and Air Heating Coils.

.8 National Electrical Manufacturer's Association (NEMA)

.1 NEMA MG 1 Motors and Generators

.2 NEMA ICS 7-1 Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable Speed Drive Systems.

.9 Provincial Boiler Pressure Vessel and Compressed Gas Regulations.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

.2 Indicate following:

.1 Construction specifications, dimensions, weights, fans, motors, vibration isolation, coils, capacities, curves, filter housings, filters, mixing boxes, dampers. Controls, actuators, accessories installation procedures, and control wiring diagrams.

1.4 CLOSEOUT SUBMITTALS

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

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal, paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Divert unused metal and wiring materials from landfill to metal recycling facility as approved by Owner.

.5 Divert unused paint material from landfill to official hazardous material collection site as approved by Owner.

.6 Do not dispose of unused paint materials into sewer systems, into lakes, streams, onto ground or in other locations where it will pose health or environmental hazard.

1.6 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 such as bearings and seals, and addresses of suppliers, together with list of specialized tools necessary for adjusting, repairing or replacing, for placement into operating manual.

.3 One set of filters for start up, one set for commissioning, one spare set of filters for each unit.

1.7 TRAINING

.1 Provide training in accordance with Section 01 79 00.13 – Demonstration and Training for Building Commissioning.

PART 2 PRODUCTS

2.1 GENERAL

.1 Factory assembled components to form units supplying air at design conditions as indicated.

2.2 MANUFACTURED ITEMS

.1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards in force.

2.3 FANS

.1 To Section 23 34 00 - HVAC Fans.

.2 Fans shall be modular single-inlet centrifugal plenum type, free-standing without scroll housings, with airfoil or backward-inclined blades. Fans may be single width single inlet (SWSI) or as required by capacity. Fans and shafts shall be dynamically balanced for fixed or variable speed operation prior to installation, and the complete fan assembly dynamically balanced at the factory after installation within the air-handling unit. Fans shall be mounted on accurately ground and finished steel shafts. Fan wheels and structural components shall be provided with a rust-resistant enamel coating..

.3 Bearings shall be air handling quality, heavy duty, grease lubricated, ball or roller type. Fan bearings to be sealed against dust and dirt and precision self-aligning ball or roller type. Bearing life shall be L-10 rated at not less than 100,000 hours minimum as defined by ABMA 9 and ABMA 11. Bearings permanently lubricated or lubricated type with lubrication fittings readily accessible at the drive side of the unit. Bearings supported by structural shapes, or die formed sheet structural members, or support plates securely attached to the unit casing. Bearings may not be fastened directly to the unit sheet metal casing.

.4 Unit fan or fans selected to produce the required capacity at the fan static pressure. Sound power level as indicated. The sound power level values obtained according to AMCA 300 or ASHRAE 68.

.5 Motors controlled by variable frequency drives (VFD's) suitable for this application, and be inverter duty rated to NEMA MG1 Part 31 and NEMA ICS 7.1. All motors to be TEFC type, NEMA type B with 1.15 service factor at 40^{o} C.

2.4 CASING

.1 General.

.1 Factory manufactured galvanized or phosphate treated steel casing minimum thickness of 1.3 mm thick steel outer casing reinforced and braced for rigidity and flanged for bolted sub- assemblies, to withstand a pressure differential as indicated.

.2 Provide walk-in access doors to allow access to internal parts and component removal.

.1 Access doors: insulated sandwich panel construction of same material and thickness as casing, 600 mm wide full height of casing and complete

with 3 hinges or piano hinges, two-way latches, neoprene gaskets and. Hinge doors to open against air pressure complete with hold open devices.

.3 Paint over steel, where steel is not galvanized, or where galvanized steel sheet is cut, with corrosion resistant paint to CGSB 1.181.

.1 Finish inside and out, over prime coat, with enamel paint to Section 09 91 13 - Exterior Painting.

.4 Internally insulate top, bottom and sides of casing with 50 mm thick, 72 kg/m^3 density, neoprene coated rigid acoustic duct liner with metal nosings at edges, pinned and cement in place. Cover insulation with 1.0 mm thick type 316 stainless steel solid liner.

.5 Weatherproof sheet metal casings:

.1 Finish outside with rust resistant enamel to Section 09 91 13 – Exterior Painting.

.3 Insulation: K= 0.0337 W/m-^{o}C @ 24 ^{o}C, 50 mm. See Section 23 07 16 HVAC Equipment Insulation

.6 Openings and bolted sections gasketted.

.7 Provide vapour tight marine light fixtures with fluorescent lamps complete with gaskets and cast aluminum guards in each section. Conduit and Wiring to Division 26.

.8 Floor panels minimum 2.8 mm thick, stainless steel Type 316.

.9 Provide steel channel around perimeter unit with intermediate supports and minimum of four lifting lugs.

2.5 COILS

.1 General:

.1 Cleanable tube type: headers and straight tubes.

.2 Plate fin type: tubes mechanically bonded to fins. Spiral wound fin type: mechanically bonded to tubes.

.3 Non-ferrous tubes and headers: brazed assembly.

.4 Maximum tube length: 3.6 m unless specified otherwise.

.5 Factory tested with air under water.

.6 Canadian Registration Numbers (CRN)

.7 Capacities: See Schedule

.2 Ratings: ARI Certified. Submit with shop drawings actual cooling and heating fluid entering and leaving conditions for stated air side requirements.

.1 Unless otherwise indicated, preheat coils rated for 3.5 m/s.

.2 Water velocity: 1.2 m/s maximum. Under 0.6 m/s, turbulators may be used if manufacturer's standard practice.

.3 Coil casings:

.1 Mounting: designed for bolting to other sections.

.2 Copper at spray washers as indicated: 1.6 mm thick cornice temper copper.

.3 Tube supports: allow for expansion and contraction.

.4 Supports: steel channel or double angle frames or other approved support. Provide brass supports for copper coils.

.5 Blank-off plates: of similar material as casing to prevent air bypass. Seal openings where pipes pass through casing using methods recommended by SMACNA.

.4 Steam coils: single tube type.

.1 Tubes: copper, brass or steel.

.2 Fins: aluminum.

.3 Headers: cast iron, steel or cast brass.

.4 Pressure tests: 1.7 MPa.

.5 Hot water coils: cleanable fins.

.1 Tubes: copper, brass or steel.

.2 Fins: aluminum plate or spiral wound.

.3 Headers: Stainless Steel

.4 Pressure tests: 1.7 MPa.

.6 Special Coatings

.1 Refer to AHU schedule

2.6 DRAIN PANS

.1 Construction: 316 stainless steel. Rounded corners.

.2 Insulation: extruded foam type, minimum 13 mm thick.

.3 Drain connection: in bottom at low point.

.4 Installation: slope without sag minimum 1% to ensure no standing water at any time or at any point.

.5 Dimensions: minimum 75 mm from upstream face of coil to 150 mm beyond downstream face of coil or eliminator and to include all return bends and headers.

2.7 MIXING BOX SECTION

.1 Provide as indicated.

.2 Material: to match casing.

.3 Design: provide internal baffles and other devices, as required, to produce mixed air temperature to within plus or minus 3 ^{o}C of design across face of outlet.

.4 Factory manufactured assembly to include frame, dampers, operating linkages, drive shafts of minimum 12 mm diameter carbon steel and access door on each side.

.5 Dampers for mixing boxes: to Section 23 33 15- Dampers - Operating. Actuators by EMCS Contractor.

.6 Blender mixing box:

.1 General: single unit consisting of dampers, blender, mixing section, with provision for floor/ceiling mounting.

.2 Dampers: parallel blade, low leakage, proportioning type. Blades of 1.6 mm thick steel, 150 mm maximum wide, locked to steel rods in rustproof bushings.

.1 Leakage: not more than 50 L/s.m^2 at 750 Pa.

.2 Seals: Neoprene on damper edges, top, bottom, sides of framing.

2.8 FILTER BOX

.1 Material to match casing complete with filter arrangement as indicated using disposable type filters. Provide access to filter through hinged door.

.2 Filters: As indicated on schedule.

.3 Provide blank off plates to ensure zero bypass around filters.

.4 Frames shall be fabricated from minimum 1.6 mm stainless steel. Each holding frame shall be equipped with suitable filter holding devices. Holding frame seats shall be gasketted. All joints shall be airtight.

2.9 VIBRATION ISOLATION

.1 Flexible connections to Section 23 33 00 – Air Duct Accessories.

.2 Vibration isolators on each fan section to Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment.

.3 Wheels shall be dynamically balanced to balance quality grade G6.3 per AMCA 204. Each assembled fan shall be test ran at the factory at the specified RPM. Vibration signatures shall be taken on each fan bearing in the horizontal, vertical and axial directions. The maximum allowable fan vibration level shall be 5.1 mm/s for a BU-3 fan application category, filter in, at the fan RPM when the fan is flexibly mounted.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Fabricate to provide smooth air flow through all components. Limit air leakage to 1 % of rated air flow at 2.5 kPa suction pressure.

.2 Apply sealer into all seams prior to assembly. Secure toe angles continuous along entire length of assembly.

.3 UNIT SHALL BE FIELD ASSEMBLED ON SITE IN PIECES SMALL ENOUGH TO BE BROUGHT IN THROUGH EXISTING DOOR WAYS.

.4 DOORWAYS TO GAIN ACCESS TO GROUND LEVEL MECHANICAL ROOM ARE APPROXIMATELY 863MM WIDE, CONFIRM ON SITE. CONTRACTOR TO MAKE PROVISIONS TO ENSURE ALL NEW MATERIALS CAN BE TRANSPORTED INTO SPACE THROUGH EXISTING DOOR SPACE.

.5 Leak test after assembly at operating pressures.

3.2 COMMISSIONING

.1 Manufacturer's representative to provide one day on site per unit for startup and one day for commissioning in two separate visits to Section 01 91 13.13 – Commissioning (Cx) Requirements.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

.1 Section Includes.

.1 Methods and procedures for start-up, verification and commissioning, for building Energy Monitoring and Control System (EMCS) and includes:

.1 Start-up testing and verification of systems

.2 Check-out demonstration or proper operation of components.

.3 On-site operational tests

1.2 RELATED SECTIONS

.1 The contractor is to ensure that all related work is co-ordinated among all specification sections, as well as between all Divisions, and that the tender price includes all related work. The referenced sections below are for guidance only and are not necessarily a complete list of related sections.

.2 Section 01 33 00 - Submittal Procedures.

.3 Section 01 78 00 - Closeout Submittals.

.4 Section 01 79 00.13 – Demonstration and Training for Building Commissioning.

.5 Section 01 91 13.13 - Commissioning (Cx) Requirements.

.6 Section 25 05 01 - EMCS: General Requirements.

1.3 DEFINITIONS

.1 For additional acronyms and definitions refer to Section 25 05 01 - EMCS: General Requirements.

.2 AEL (Average Effectiveness Level): ratio between total test period less any system downtime accumulated within that period and test period.

.3 Downtime: results whenever EMCS is unable to fulfill required functions due to malfunction of equipment defined under responsibility of EMCS contractor. Downtime is measured by duration, in time, between time that Contractor is notified of failure and time system is restored to proper operating condition. Downtime not to include following:

.1 Outage of main power supply in excess of back-up power sources, provided that:

.1 Automatic initiation of back-up was accomplished.

.2 Automatic shut-down and re-start of components was as specified.

.2 Failure of communications link, provided that:

.1 Controller automatically and correctly operated in stand-alone mode.

.2 Failure was not due to failure of any specified EMCS equipment.

.3 Functional failure resulting from individual sensor inputs or output devices, provided that:

.1 System recorded said fault.

.2 Equipment defaulted to fail-safe mode.

.3 AEL of total of all input sensors and output devices is at least 99 % during test period.

1.4 DESIGN REQUIREMENTS

.1 Confirm with Owner that Design Criteria and Design Intents are still applicable.

.2 Commissioning personnel to be fully aware of and qualified to interpret Design Criteria and Design Intents.

1.5 SUBMITTALS

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

.2 Final Report: submit report to Owner.

.1 Include measurements, final settings and certified test results.

.2 Bear signature of commissioning technician and supervisor

.3 Report format to be approved by Owner before commissioning is started.

.4 Revise "as-built" documentation, commissioning reports to reflect changes, adjustments and modifications to EMCS as set during commissioning and submit to Owner in accordance with Section 01 78 00 - Closeout Submittals.

.5 Recommend additional changes and/or modifications deemed advisable in order to improve performance, environmental conditions or energy consumption.

1.6 CLOSEOUT SUBMITTALS

.1 Provide documentation, O&M Manuals, and training materials of O&M personnel for review by Owner before interim acceptance in accordance with Section 01 78 00 - Closeout Submittals and Section 25 05 03 – EMCS: Project Record Documents.

1.7 COMMISSIONING

.1 Do commissioning in accordance with Section 01 91 13.13 – General Commissioning (Cx) Requirements.

.2 Carry out commissioning under direction of Owner and in presence of Owner and Commissioning Co-ordinator.

.3 Inform, and obtain approval from, Owner in writing at least 14 days prior to commissioning or each test. Indicate:

.1 Location and part of system to be tested or commissioned.

.2 Testing/commissioning procedures, anticipated results.

.3 Names of testing/commissioning personnel.

.4 Correct deficiencies, re-test in presence of Owner until satisfactory performance is obtained.

.5 Acceptance of tests will not relieve Contractor from responsibility for ensuring that complete systems meet every requirement of Contract.

.6 Load system with project software. Install software for access to EMCS via dial up modem at Owner's designated site and at Transportation and Works Office in St. John's for use during commissioning and for their use afterwards. Where high speed internet is available, use web browser software, compatible with Windows Vista with access via Internet Explorer (latest edition).

.7 Perform tests as required.

1.8 COMPLETION OF COMMISSIONING

.1 Commissioning to be considered as satisfactorily completed when objectives of commissioning have been achieved and reviewed by Owner and Commissioning Co-ordinator.

1.9 ISSUANCE OF FINAL CERTIFICATE OF COMPLETION

.1 Final Certificate of Completion will not be issued until receipt of written approval indicating successful completion of specified commissioning activities including receipt of commissioning documentation.

PART 2 PRODUCTS

2.1 EQUIPMENT

.1 Provide sufficient instrumentation to verify and commission the installed system. Provide two-way radios.

.2 Instrumentation accuracy tolerances: higher order of magnitude than equipment or system being tested.

.3 Independent testing laboratory to certify test equipment as accurate to within approved tolerances no more than 2 months prior to tests.

.4 Locations to be approved, readily accessible and readable.

.5 Application: to conform to normal industry standards.

PART 3 EXECUTION

3.1 PROCEDURES

.1 Test each system independently and then in unison with other related systems.

.2 Commission each system using procedures prescribed by the Commissioning Co-ordinator and/or Owner.

.3 Commission integrated systems using procedures prescribed by Commissioning Co-ordinator and/or Owner.

.4 Debug system software.

.5 Optimize operation and performance of systems by fine-tuning PID values and modifying CDLs as required.

.6 Test full scale emergency evacuation and life safety procedures including operation and integrity of smoke management systems under normal and emergency power conditions as applicable.

3.2 FIELD QUALITY CONTROL

.1 Pre-Installation Testing.

.1 General: consists of field tests of equipment just prior to installation.

.2 Testing may be on site or at Contractor's premises as approved by Owner.

.3 Configure major components to be tested in same architecture as designed system. Include all required network and control components.

.4 Equip each Building Controller with sensor and controlled device of each type (AI, AO, DI, DO).

.5 Additional instruments to include:

.1 DP transmitters.

.2 VAV supply duct SP transmitters.

.3 DP switches used for dirty filter indication and fan status.

.6 In addition to test equipment, provide inclined manometer, digital micro-manometer, milli-amp meter, source of air pressure infinitely adjustable between 0 and 500 Pa, to hold steady at any setting and with direct output to milli-amp meter at source.

.7 After setting, test zero and span in 10 % increments through entire range while both increasing and decreasing pressure.

.8 Owner to mark instruments tracking within 0.5 % in both directions as "approved for installation".

.9 Transmitters above 0.5 % error will be rejected.

.10 DP switches to open and close within 2% of setpoint.

.2 Completion Testing.

.1 General: test after installation of each part of system and after completion of mechanical and electrical hook-ups, to verify correct installation and functioning.

.2 Include following activities:

.1 Test and calibrate field hardware including stand-alone capability of each controller.

.2 Verify each A-to-D convertor.

.3 Test and calibrate each AI using calibrated digital instruments.

.4 Test each DI to ensure proper settings and switching contacts.

.5 Test each DO to ensure proper operation and lag time.

.6 Test each AO to ensure proper operation of controlled devices. Verify tight closure and signals.

.7 Test operating software.

.8 Test application software and provide samples of logs and commands.

.9 Verify each CDL including energy optimization programs.

.10 Debug software.

.11 Blow out flow measuring and static pressure stations with high pressure air at 700 kPa.

.12 Provide point verification list in table format including point identifier, point identifier expansion, point type and address, low and high limits and Engineering units. This document will be used in final startup testing.

.3 Final Startup Testing: Upon satisfactory completion of tests, perform point-by-point test of entire system under direction of Owner and Commissioning Co-ordinator and provide:

.1 2 technical personnel capable of re-calibrating field hardware and modifying software.

.2 Detailed daily schedule showing items to be tested and personnel available.

.3 Owner's acceptance signature to be on executive and applications programs.

.4 Commissioning to commence during final startup testing.

.5 O&M personnel to assist in commissioning procedures as part of training.

.6 Commissioning to be supervised by qualified supervisory personnel and Owner.

.7 Commission systems considered as life safety systems before affected parts of the facility are occupied.

.8 Operate systems as long as necessary to commission entire project.

.9 Monitor progress and keep detailed records of activities and results.

.4 Final Operational Testing: to demonstrate that EMCS functions in accordance with contract requirements.

.1 Prior to beginning of 30 day test demonstrate that operating parameters (setpoints, alarm limits, operating control software, sequences of operation, trends, graphics and CDL's) have been implemented to ensure proper operation and operator notification in event of off-normal operation.

.1 Repetitive alarm conditions to be resolved to minimize reporting of nuisance conditions.

.2 Test to last at least 30 consecutive 24 hour days.

.3 Tests to include:

.1 Demonstration of correct operation of monitored and controlled points.

.2 Operation and capabilities of sequences, reports, special control algorithms, diagnostics, software.

.4 System will be accepted when:

.1 EMCS equipment operates to meet overall performance requirements. Downtime as defined in this Section must not exceed allowable time calculated for this site.

.2 Requirements of Contract have been met.

.5 In event of failure to attain specified AEL during test period, extend test period on day-to-day basis until specified AEL is attained for test period.

.6 Correct defects when they occur and before resuming tests.

.5 Commissioning Co-ordinator and/or Owner to verify reported results.

3.3 ADJUSTING

.1 Final adjusting: upon completion of commissioning as reviewed by Owner set and lock devices in final position and permanently mark settings.

3.4 DEMONSTRATION

.1 Demonstrate to Commissioning Manager and/or Owner operation of systems including sequence of operations in regular and emergency modes, under normal and emergency conditions, start-up, shut-down interlocks and lock-outs in accordance with Section 01 91 13.13 –Commissioning (Cx) Requirements.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

.1 Section Includes.

.1 Requirements and procedures for training program, instructors and training materials, for building Energy Monitoring and Control System (EMCS) Work.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 25 05 01 - EMCS: General Requirements.

1.3 DEFINITIONS

.1 CDL - Control Description Logic.

.2 For additional acronyms and definitions refer to Section 25 05 01 - EMCS: General Requirements

1.4 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures and supplemented and modified by requirements of this Section.

.2 Submit training proposal complete with hour-by-hour schedule including brief overview of content of each segment to Owner 30 days prior to anticipated date of beginning of training.

.1 List name of trainer, and type of visual and audio aids to be used.

.2 Show co-ordinated interface with other EMCS mechanical and electrical training programs.

.3 Submit reports within one week after completion of Phase 1 and Phase 2 training program that training has been satisfactorily completed.

1.5 QUALITY ASSURANCE

.1 Provide competent instructors thoroughly familiar with aspects of EMCS installed in facility.

.2 Owner reserves right to approve instructors.

1.6 INSTRUCTIONS

.1 Provide instruction to designated personnel in adjustment, operation, maintenance and pertinent safety requirements of EMCS installed.

.2 Training to be project-specific.

1.7 TIME FOR INSTRUCTION

.1 Number of days of instruction to be as specified in this section (1 day = 7 hours including two 15 minute breaks and excluding lunch time).

1.8 TRAINING MATERIALS

.1 Provide equipment, visual and audio aids, and materials for classroom training.

.2 Supply manual for each trainee, describing in detail data included in each training program.

.1 Review contents of manual in detail to explain aspects of operation and maintenance (O&M).

1.9 TRAINING PROGRAM

.1 To be in 2 phases over 6 month period.

.2 Phase 1: 2 day program to begin before 30 day test period at time mutually agreeable to Contractor, Owner and Commissioning Co-ordinator.

.1 Train O&M personnel in functional operations and procedures to be employed for system operation.
.2 Supplement with on-the-job training during 30 day test period.
.3 Include overview of system architecture, communications, operation of computer and peripherals, report generation.
.4 Include detailed training on operator interface functions for control of mechanical systems, CDL's for each system, and elementary preventive maintenance.
.5 Introduction to Direct Digital Controls and BACnet protocol.
.6 Identification of Control Components.
.7 Review of DDC Network Diagram for building.
.8 Review of shop drawings for building.
.9 Detailed discussion of sequences of operation
.10 Walk through of mechanical systems.

.3 Phase 2: 5 day program to begin 8 weeks after acceptance for operators, equipment maintenance personnel and programmers.

.1 Provide multiple instructors on pre-arranged schedule. Include at least

.1 Operator training: provide operating personnel, maintenance personnel and programmers with condensed version of Phase 1 training.

.2 Equipment maintenance training: provide personnel with 2 days training within a 5 day period in maintenance of EMCS components, maintenance and calibration of sensors and controls.

.3 Programmers: provide personnel with 2 days training within a 5 day period in following subjects in approximate percentages of total course shown:

.1 Software and architecture: 10%

.2 Application programs: 15%

.3 Controller programming: 50%

.4 Trouble shooting and debugging:10%

.5 Colour graphic generation: 15%

.6 Display and interpret summaries

.7 Command points

.8 Modify points and point groups

.9 Define trend logs

.10 Schedule and print reports

1.10 ADDITIONAL TRAINING

.1 List courses offered by name, duration and approximate cost per person per week. Note courses recommended for training supervisory personnel.

1.11 MONITORING OF TRAINING

.1 Owner to monitor training program and may modify schedule and content.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 General requirements for building Energy Monitoring and Control System (EMCS) that are common to NMS EMCS Sections.

1.2 RELATED SECTIONS

.1 The contractor is to ensure that all related work is co-ordinated among all specification sections, as well as between other Divisions, and that the tender price includes all related work. The referenced sections below are for guidance only and are not necessarily a complete list of related sections.

.2 Section 01 33 00 – Submittal Procedures.

.3 Section 01 35 29.06 – Health and Safety Requirements.

.4 Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

.5 Section 01 91 13.13 – Commissioning (Cx) Requirements.

.6 Section 09 91 23 - Interior Painting.

.7 Section 25 01 11 - EMCS: Start-up, Verification and Commissioning.

.8 Section 25 01 12 - EMCS: Training.

.9 Section 25 05 02 - EMCS: Submittals and Review Process.

.10 Section 25 05 03 - EMCS: Project Record Documents.

.11 Section 25 05 54 - EMCS: Identification.

.12 Section 25 05 60 - EMCS: Field Installation.

.13 Section 25 08 20 - EMCS: Warranty and Maintenance.

.14 Section 25 10 01 - EMCS: Local Area Network (LAN).

.15 Section 25 10 02 - EMCS: Operator Work Station (OWS).

.16 Section 25 30 01 - EMCS: Building Controllers

.17 Section 25 30 02 - EMCS: Field Control Devices.

.18 Section 25 90 01 - EMCS: Site Requirements, Applications and Systems Sequences of Operation.

1.3 REFERENCES

.1 American National Standards Institute (ANSI)

.1 ANSI/ISA 5.5, Graphic Symbols for Process Displays.

.2 American National Standards Institute (ANSI)/ Institute of Electrical and Electronics Engineers (IEEE).

.1 ANSI/IEEE 260.1, American National Standard Letter Symbols Units of Measurement (SI Units, Customary Inch-Pound Units, and Certain Other Units).

.3 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).

.1 ASHRAE STD 135, BACNET - Data Communication Protocol for Building Automation and Control Network.

.4 Canadian Standards Association (CSA International).

.1 CAN/CSA-Z234.1, Canadian Metric Practice Guide.

.5 Consumer Electronics Association (CEA).

.1 CEA-709.1-B, Control Network Protocol Specification.

.6 Department of Justice Canada (Jus).

.1 Canadian Environmental Assessment Act (CEAA).
.2 Canadian Environmental Protection Act (CEPA).

.7 Health Canada/Workplace Hazardous Materials Information System (WHMIS).

.1 Safety Data Sheets (SDS).

.8 Transport Canada (TC).

.1 Transportation of Dangerous Goods Act (TDGA).

.9 National Electrical Manufacturers Association (NEMA)

1.4 ACRONYMS, ABBREVIATIONS AND DEFINITIONS

.1 Acronyms used in EMCS.

.1 AEL - Average Effectiveness Level
.2 AI - Analog Input
.3 AO - Analog Output
.4 BACnet - Building Automation and Control Network
.5 BC(s) - Building Controller(s)
.6 BECC - Building Environmental Control Centre
.7 CAB - Canadian Automated Building (CAB) Protocol
.8 CAD - Computer Aided Design
.9 CDL - Control Description Logic
.10 CDS - Control Design Schematic
.11 COSV - Change of State or Value
.12 CPU - Central Processing Unit
.13 DI - Digital Input
.14 DO - Digital Output
.15 DP - Differential Pressure
.16 ECU - Equipment Control Unit
.17 EMCS - Energy Monitoring and Control System
.18 HVAC - Heating, Ventilation, Air Conditioning
.19 IDE - Interface Device Equipment
.20 I/O - Input/Output
.21 ISA - Industry Standard Architecture
.22 LAN - Local Area Network
.23 LCU - Local Control Unit
.24 MCU - Master Control Unit
.25 NC - Normally Closed
.26 NO - Normally Open
.27 OS - Operating System
.28 O&M - Operation and Maintenance
.29 OWS - Operator Work Station
.30 PC - Personal Computer
.31 PCI - Peripheral Control Interface
.32 PCMCIA - Personal Computer Micro-Card Interface Adapter
.33 PID - Proportional, Integral and Derivative.
.34 RAM - Random Access Memory

.35 ROM - Read Only Memory

.36 SP - Static Pressure

.37 TCU - Terminal Control Unit

.38 USB - Universal Serial Bus

.39 UPS - Uninterruptible Power Supply

.40 WAN- Wide Area Network

1.5 DEFINITIONS

.1 Point: may be logical or physical.

.1 Logical points: values calculated by system such as setpoints, totals, counts, derived corrections and may include, but not limited to result of and statements in CDL's.

.2 Physical points: inputs or outputs which have hardware wired to controllers which are measuring physical properties, or providing status conditions of contacts or relays which provide interaction which related equipment (stop, start) and value or damper actuators.

.2 Point Name: composed of two parts, point identifier and point expansion.

.1 Point identifier: comprised of three descriptors, "area" descriptor, "system" descriptor and "point" descriptor, for which database to provide 25 character field for each point identifier. "System" is system that point is located on.

.1 Area descriptor: building or part of building where point is located.

.2 System descriptor: system that point is located on.

.3 Point descriptor: physical logical point description. For point identifier "area", "system" and "point" will be shortforms or acronyms. Database must provide 25 character field for each point identifier.

.2 Point expansion: comprised of three fields, one for each descriptor. Expanded form of shortform or acronym used in "area", "system", and "point" descriptors is placed into appropriate point expansion field. Database must provide 32 character field for each point expansion.

.3 Bilingual systems to include additional point identifier expansion fields of equal capacity for each point name for second language.

.1 System to support use of numbers and readable characters including blanks, periods or underscores to enhance user readability for each of the above strings.

.3 Point Object Type: points fall into following object types:

.1 AI (analog input)

.2 AO (analog output)

.3 DI (digital input)

.4 DO (digital output)

.5 Pulse inputs

.4 Symbols and engineering unit abbreviations utilized in displays: to ANSI/ISA S5.5.

.1 Printouts: to ANSI/IEEE 260.1.

.2 Refer also to Section 25 05 54 - EMCS: Identification.

1.6 SYSTEM DESCRIPTION

.1 Refer to control schematics, sequences of operation and related Divisions of specifications for system architecture.

.2 Work covered by sections referred to above consists of fully operational EMCS, including, but not limited to, following:

.1 Building Controllers.

.2 Control devices as listed in I/O point summaries and/or shown on the control drawings.

.3 OWS

.4 Data communications equipment necessary to affect EMCS data transmission system.

.5 Field control devices.

.6 Software/Hardware complete with full documentation.

.7 Complete operating and maintenance manuals.

.8 Training of personnel.

.9 Acceptance tests, technical support during commissioning, full documentation.

.10 Wiring interface co-ordination of equipment supplied by others.

.11 Miscellaneous work as specified in these sections and as indicated.

.3 Design Requirements:

.1 Design and provide conduit and wiring linking elements of system.

.2 Supply sufficient programmable controllers of types to meet project requirements. Quantity and points contents as reviewed prior to installation.

.3 Location of controllers as reviewed by Owner prior to installation.

.4 Provide utility and emergency power to EMCS.

.5 Metric references: in accordance with CAN/CSA Z234.1.

.4 Language Operating Requirements:

.1 Provide English interface to system through operator selectable access codes.

.2 Use non-linguistic symbols for displays on graphic terminals wherever possible. Other information to be in English.

.3 Operating system executive: provide primary hardware-to-software interface

specified as part of hardware purchase with associated documentation to be in English.

.4 System manager software: include in English system definition point database, additions, deletions or modifications, control loop statements, use of high level programming languages, report generator utility and other OS utilities used for maintaining optimal operating efficiency.

.5 Include, in English:

.1 Input and output commands and messages from operator-initiated functions and field related changes and alarms as defined in CDL's or assigned limits (i.e. commands relating to day-to-day operating functions and not related to system modifications, additions, or logic re-definements).

.2 Graphic "display" functions, point commands to turn systems on or off, manually override automatic control of specified hardware points. To be in English at specified OWS. Point name expansions in English.

.3 Reporting function such as trend log, trend graphics, alarm report logs, energy report logs, maintenance generated logs.

.6 The network design to be a fully distributed network, with each primary system having its own locally mounted dedicated controller. Any failure in the network shall not in any way affect the control of these primary systems. Connecting hardware points from one system to more than one controller is not acceptable. Any points associated with a system are to be connected to one dedicated controller. Each dedicated controller to have a locally mounted control and display device to allow the operator to view and adjust any point on the controller.

.7 All wiring associated with the EMCS communication network as well as all control wiring and conduit associated with the EMCS at 50 volts or less. Wire and conduit above 50 volts by Electrical Division.

.8 BACnet compliance: full compliance to the BACnet standard (ANSA/ASHRAE) 135, BACnet – A Data communication Protocol for Building Automation and Control Networks is mandatory. Down to the field device level, the EMCS system must meet BACnet standards for system architecture and administration, and use open communication protocols and user friendly programming and graphics. Install the EMCS installed to communicate at the supervisory layer to the WAN using the BACnet TCP/IP protocol implemented on Ethernet.

.9 The EMCS system for this facility to be accessible by designated personnel via the WAN for monitoring and programming purposes. The EMCS contractor to provide all the required hardware, software, gateways, etc. needed to permit connection of the EMCS to the WAN. This shall include all hardware, software, programming, start-up and commissioning required. The contractor to supply and install all the required hardware and software on the WAN file server to allow for this remote operation monitoring and programming to take place. The contractor to supply and install all the required hardware and software on the operator workstation(s) located in the Owner’s facilities management

department. In addition, a remote dial in access directly to the system shall be provided.

1.7 SUBMITTALS

.1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures and 25 05 02 - EMCS: Submittals and Review Process.

.2 Submit for review:

.1 Equipment list and systems manufacturers within ten (10) working days after award of contract.

.3 Quality Control:

.1 Provide equipment and material from manufacturer's regular production, CSA certified, manufactured to standard quoted plus additional specified requirements.

.2 Where CSA certified equipment is not available submit such equipment to inspection authorities for special inspection and approval before delivery to site.

.3 Submit proof of compliance to specified standards with shop drawings and product data in accordance with Section 25 05 02 – EMCS: Submittals and Review Process. Label or listing of specified organization is acceptable evidence.

.4 In lieu of such evidence, submit certificate from testing organization, approved by third party Engineer registered in Canada, certifying that item was tested in accordance with their test methods and that item conforms to their standard/code.

.5 For materials whose compliance with organizational standards/codes/ specifications is not regulated by organization using its own listing or label as proof of compliance, furnish certificate stating that material complies with applicable referenced standard or specification.

.6 Permits and fees: in accordance with general conditions of contract.

.7 Existing devices intended for re-use: submit test report.

1.8 QUALITY ASSURANCE

.1 Have local office for at least 5 years staffed by factory trained personnel capable of installing and providing instruction, routine maintenance and emergency service on systems.

.2 Provide record of successful previous installations submitting tender showing experience with similar installations utilizing computer-based systems.

.3 Have access to local supplies of essential parts and provide 7 year guarantee of availability of spare parts after obsolescence.

.4 Ensure factory qualified supervisory personnel continuously direct and monitor work and attend site meetings.

.5 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

.6 Be able to provide factory trained personnel on site within two (2) working days notice or provide instructions on maintenance and emergency service on system.

.7 BACnet devices to bear BACnet testing laboratories BTL mark and listed on BACnet manufacturers association web site.

1.9 DELIVERY, STORAGE AND HANDLING

.1 Material Delivery Schedule: provide Owner with “Materials Delivery Schedule” within 2 weeks after award of contract.

.2 Waste Management and Disposal:

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Separate for reuse and recycling and place in designated containers Steel, Metal, Plastic waste in accordance with Waste Management Plan.

.5 Place materials defined as hazardous or toxic in designated containers.

.6 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional, Municipal, and Provincial regulations.

.7 Label location of salvaged material's storage areas and provide barriers and security devices.

.8 Ensure emptied containers are sealed and stored safely.

.9 Divert unused metal materials from landfill to metal recycling facility as approved by Owner.

.10 Fold up metal and plastic banding, flatten and place in designated area for recycling

1.10 EXISTING CONDITIONS - CONTROL COMPONENTS

.1 Utilize existing control wiring and piping as indicated.

.2 Re-use field control devices that are usable in their original configuration provided that they conform to applicable codes, standards and specifications.

.1 Do not modify original design of existing devices without written permission from Owner.

.2 Provide for new, properly designed device where re-usability of components is

uncertain.

.3 Inspect and test existing devices intended for re-use within 30 days of award of contract, and prior to installation of new devices.

.1 Furnish test report to Owner within 40 days of award of contract listing each component to be re-used and indicating whether it is in good order or requires repair by Owner.

.2 Failure to produce test report will constitute acceptance of existing devices by owner.

.4 Non-functioning items:

.1 Provide with report specification sheets or written functional requirements to support findings.

.2 Owner will repair or replace existing items judged defective yet deemed necessary for EMCS.

.5 Submit written request for permission to disconnect controls and to obtain equipment downtime before proceeding with Work.

.6 Assume responsibility for existing controls to be incorporated into EMCS after written receipt of approval from Owner.

.1 Be responsible for items repaired or replaced by Owner.

.2 Be responsible for repair costs due to negligence or abuse of equipment repaired or replaced by Owner.

.3 Responsibility for existing devices terminates upon final acceptance of EMCS or applicable portions of EMCS as approved by Owner.

.7 Remove existing controls not re-used or not required. Place in approved storage for disposition as directed

PART 2 PRODUCTS

2.1 ACCEPTABLE SYSTEMS, MANUFACTURERS

.1 Proposed system to have communication capability utilizing BACnet Protocol.

.2 Panel to be NEMA rated to suit environmental requirements.

.3 Panels to have hinged doors equipped with standard keyed-alike cabinet locks, keyed to same key.

.4 Wiring within panels to be contained within properly sized rigid PVC slotted wall wire duct. All wiring within the wire duct to be concealed with a non-slip cover.

.5 Terminations for the connection of power wiring, communication wiring and field mounted

devices to be at properly identified terminal blocks mounted within the control panel.

.6 All control panels to be provided with an internally mounted 120 volt duplex power receptacle.

.7 All control panels to be identified with permanently mounted Lamecoid tags to identify the control panel and the systems served by the control panel. Submit schedule of labels with shop drawing submission.

.8 Provide low voltage transformers in panels or elsewhere as required.

.9 Provide adaptors between metric and imperial components.

PART 3 EXECUTION

3.1 MANUFACTURER'S RECOMMENDATIONS

.1 Installation to be to manufacturer's recommendations. Provide printed copies of recommendations with shop drawings or product data.

3.2 PAINTING

.1 Painting to be in accordance with NEMA, supplemented as follows:

.2 Clean and touch up marred or scratched surfaces of factory finished equipment to match original finish.

.3 Restore to new condition, finished surfaces which have been damaged too extensively to be primed and touched up to make good.

.4 Clean and prime exposed hangers, racks, fastenings, and other support components.

.5 Paint all unfinished equipment installed indoors to NEMA.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

.1 Section Includes.

.1 Methods and procedures for shop drawings submittals, preliminary and detailed review process include review meetings for building Energy Monitoring and Control System (EMCS).

1.2 RELATED SECTIONS

.1 The contractor is to ensure that all related work is co-ordinated among all specification sections as well as between all Divisions, and that the tender price includes all related work. The referenced sections below are for guidance only and are not necessarily a complete list of related sections.

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 25 01 11 - EMCS: Start-up, Verification and Commissioning.

.3 Section 25 05 01 - EMCS: General Requirements.

1.3 DEFINITIONS

.1 Acronyms and definitions: refer to Section 25 05 01 - EMCS: General Requirements.

1.4 DESIGN REQUIREMENTS

.1 Preliminary Design Review: to contain following contractor and systems information.

.1 Location of local office.
.2 Description and location of installing and servicing technical staff.
.3 Location and qualifications of programming design and programming support staff.
.4 List of spare parts.
.5 Location of spare parts stock.
.6 Names of sub-contractors and site-specific key personnel.
.7 Sketch of site-specific system architecture.
.8 Specification sheets for each item including memory provided, programming language, speed, type of data transmission.
.9 Descriptive brochures.
.10 Sample CDL and graphics (systems schematics).
.11 Response time for each type of command and report.
.12 Item-by-item statement of compliance.
.13 Proof of demonstrated ability of system to communicate utilizing BACnet protocol.

1.5 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures and coordinate with requirements in this Section.

.2 Submit preliminary design document within 30 working days after contract award for review by Owner.

.3 Shop Drawings to consist of 3 hard copies and 1 soft copy of design documents, shop drawings, product data and software.

.4 Hard copy to be completely indexed and coordinated package to assure compliance with contract requirements and arranged in same sequence as specification and cross-referenced to specification section and paragraph number.

.5 Soft copy to be in AutoCAD - latest version and Microsoft Word latest version format, or PDF structured using menu format for easy loading and retrieval on OWS.

.6 Submittals shall consist of:

.1 Data sheets of all products.
.2 Wiring and piping interconnection diagrams including panel and device power, and sources.
.3 List of materials of all proposed devices and equipment.
.4 Software documentation:
.5 Sequence of operation, in text form.
.6 Application programs.
.7 Point Schedules
.8 Controls schematics and system diagrams.
.9 Project installation schedule.
.10 Names of subtrades working for EMCS contractor.
.11 Mounting support details for components installed in airflow, waterflow and steam systems.

.7 Submit shop drawings in a package which contains the various schedules and drawings which completely describe the control system installed. At a minimum the shop drawing package to contain the following items described in Section 1.4.8 to 1.4.28 as follows:

.8 Network drawing showing the network connection of all network control units, programmable control units, terminal control units and operator workstations to indicate the location of each of these elements.

.9 Schematic control diagram for each system being controlled. Where there are typical systems a drawing to be provided for each system. This drawing to be on a AB size sheet (11 x 17) and shall include a title block which includes as a minimum the drawing title,

drawing number, project title, contractor's name, contractor's address, contractor's phone and fax numbers, contractor's project number and a section to provide a record for revision information.

.10 The schematic control diagram to include a bill of materials which provides a list of all part numbers and descriptions for the control components on the drawing list to include field equipment as well as panel mounted components.

.11 The schematic control diagram to include a complete wiring diagram for all electrical connections, including motor starters, heating coils, coiling coils etc.

.12 The schematic control diagram to include a layout of the control panels for each system. This layout to show the mounting of all panel equipment, including transformers, power supplies, controllers, transducers, sensors, relays, contactors and any other panel mounted equipment.

.13 The contractor to include with the shop drawing submittal drawings, showing all wiring details for the connections of sensors, transducers, relays and contactors these details to show terminal numbers and be referenced to the appropriate schedules and drawings.

.14 The contractor to supply with the shop drawing package a complete point schedule to show every point connected to the system. This schedule to be in tabular format and provide the point identification, point type, wire tag, termination details reference, referenced drawings, device mounting location and device code numbers.

.15 The point schedule to provide at a minimum the following information on the software attributes of the point:

.1 Tag name – ex. EPT-1
.2 Point type – ex. AO-3
.3 System name – ex. A/C-1
.4 Object name – H-VLV.
.5 Expanded ID- Heating control valve
.6 Units of measurement - %.

.16 The point schedule to provide at a minimum the following information on the digital controller to which the point is connected:

.1 Controller type – ex. Unitary controller
.2 Controller address ex. 256.
.3 Cable destination – the termination at the controller, ex. AO-1.
.4 Terminal numbers – the termination at the controller.

.17 The point schedule to provide at minimum the following information on the control panel:

.1 Panel identification

.2 Panel location

.3 Reference drawing

.18 The point schedule to provide at a minimum the following information on any intermediate device which may be associated with the point:

.1 Type of wiring or tubing used

.2 Device part number

.3 Location of the device.

.4 Reference details.

.19 The point schedule to provide at a minimum the following information on any field device which may be associated with the point;

.1 Type of wiring or tubing used

.2 Device part number

.3 Location of the devices

.4 Reference details

.20 The contractor to supply with the shop drawing package a complete room schedule, to show the equipment associated with the room controls. Schedule to be in tabular format and provide the room number and location, terminal unit number, part numbers for the terminal unit controller, sensors and actuators. Included on this schedule terminal unit type, size, minimum flow and maximum flow.

.21 Sequence of operation for each system controlled. Sequence to be in complete conformance with the sequence of operations included with this specification. Any changes require the approval of the Owner in writing. Sequence to include all modes of operation including fail safe, emergency and fire modes.

.22 Valve schedule including design flow, CV, size, type, actuator, pressure drop and maximum shut off pressure differential for each control valve.

.23 Damper schedule including design air flow, size, type actuator and torque requirements for each control damper.

.24 Provide one permanent, not fading, as built copy of each control drawing, enclosed by an aluminium frame with glass cover, or sealed by plastic laminate in rigid metal bound frame. To be installed at each respective control panel location.

.25 Catalogue cut sheets of all equipment used. This includes, but is not limited to DDC panels, peripherals, sensors, actuators, dampers, control air system components, etc.

.26 Range and scale information for all transmitters and sensors. This sheet to clearly indicate one device and any applicable options. Where more than one device to be used is on a single sheet, submit two sheets, individually marked.

.27 Hardware data sheets for all operator workstations, local access panels, and portable operator terminals.

.28 Software manuals for all applications programs to be provided as a part of the operator workstations, portable operator terminals, programming devices, and so forth for

1.6 PRELIMINARY SHOP DRAWING REVIEW

.1 Submit preliminary shop drawings within 30 working days of award of contract and include following:

.1 Specification sheets for each item. To include manufacturer's descriptive literature, manufacturer's installation recommendations, specifications, drawings, diagrams, performance and characteristic curves, catalogue cuts, manufacturer's name, trade name, catalogue or model number, nameplate data, size, layout, dimensions, capacity, other data to establish compliance.

.2 Detailed system architecture showing all points associated with each controller including, signal levels, pressures where new EMCS ties into existing control equipment.

.3 Spare point capacity of each controller by number and type.

.4 Controller locations.

.5 Auxiliary control cabinet locations.

.6 Single line diagrams showing cable routings, conduit sizes, spare conduit capacity between control centre, field controllers and systems being controlled.

.7 Valves: complete schedule listing including following information: designation, service, manufacturer, model, point ID, design flow rate, design pressure drop, required Cv, Valve size, actual Cv, spring range, pilot range, required torque, actual torque and close off pressure (required and actual).

.8 Dampers: sketches showing module assembly, interconnecting hardware, operator locations, operator spring range, pilot range, required torque, actual torque.

.9 Flow measuring stations: complete schedule listing designation, service, point ID, manufacturer, model, size, velocity at design flow rate, manufacturer, model and range of velocity transmitter.

.10 Compressor schematic and sizing data.

1.7 DETAIL SHOP DRAWING REVIEW

.1 Submit detailed shop drawings within 60 working days after award of contract and before start of installation and include following:

.1 Corrected and updated versions (hard copy only) of submissions made during preliminary review.

.2 Wiring diagrams.

.3 Piping diagrams and hook-ups.

.4 Interface wiring diagrams showing termination connections and signal levels for equipment to be supplied by others.

.5 Shop drawings for each input/output point, sensors, transmitters, showing information associated with each particular point including:

.1 Sensing element type and location.

.2 Transmitter type and range.

.3 Associated field wiring schematics, schedules and terminations.

.4 Pneumatic schematics and schedules.

.5 Complete Point Name Lists.

.6 Setpoints, curves or graphs and alarm limits (high and low, 3 types critical, cautionary and maintenance), signal range.

.7 Software and programming details associated with each point.

.8 Manufacturer's recommended installation instructions and procedures.

.9 Input and output signal levels or pressures where new systems ties into existing control equipment.

.6 Control schematics, narrative description, CDL's fully showing and describing automatic and manual procedure required to achieve proper operation of project, including under complete failure of EMCS.

.7 Graphic system schematic displays of air and water systems with point identifiers and textual description of system, and typical floor plans as specified.

.8 Complete system CDL's including companion English language explanations on same sheet but with different font and italics. CDL's to contain specified energy optimization programs.

.9 Listing of and example of specified reports.

.10 Listing of time of day schedules.

.11 Mark up to-scale construction drawing to detail control room showing location of equipment and operator work space.

.12 Type and size of memory with statement of spare memory capacity.

.13 Full description of software programs provided.

.14 Sample of "Operating Instructions Manual" to be used for training purposes.

.15 Outline of proposed start-up and verification procedures. Refer to Section 25 01 11 – EMCS: Start-up, Verification and Commissioning.

1.8 QUALITY ASSURANCE

.1 Preliminary Design Review Meeting: Convene meeting within 45 working days of award of contract to:

.1 Undertake functional review of preliminary design documents, resolve inconsistencies.

.2 Resolve conflicts between contract document requirements and actual items (e.g.: points list inconsistencies).

.3 Review interface requirements of materials supplied by others.

.4 Review "Sequence of Operations".

.2 Contractor's factory trained programmer to attend meeting.

.3 Owner retains right to revise sequence or subsequent CDL prior to software finalization without cost to Owner.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

.1 Section Includes.

.1 Requirements and procedures for final control diagrams and operation and maintenance (O&M) manual, for building Energy Monitoring and Control System (EMCS) Work.

1.2 RELATED SECTIONS

.1 Section 01 78 00 - Closeout Submittals.

.2 Section 25 01 11 - EMCS: Start-up, Verification and Commissioning.

.3 Section 25 05 01 - EMCS: General Requirements.

.4 Section 25 05 02 - EMCS: Submittals and Review Process.

1.3 DEFINITIONS

.1 BECC - Building Environmental Control Centre.

.2 OWS - Operator Work Station.

.3 For additional acryonyms and definitions refer to Section 25 05 01 - EMCS: General Requirements

1.4 SUBMITTALS

.1 Submittals in accordance with Section 01 78 00 - Closeout Procedures, supplemented and modified by requirements of this Section.

.2 Submit Record Documents, As-built drawings, Operation and Maintenance Manual to Owner in English.

.3 Provide soft copies and hard copies in hard-back, 50 mm 3 ring, D-ring binders.

.1 Binders to be 2/3 maximum full.

.2 Provide index to full volume in each binder.

.3 Identify contents of each manual on cover and spine.

.4 Provide Table of Contents in each manual.

.5 Assemble each manual to conform to Table of Contents with tab sheets placed before instructions covering subject.

1.5 AS-BUILTS

.1 Provide 1 copy of detailed shop drawings generated in Section 25 05 02 - EMCS: Submittals and Review Process and include:

.1 Changes to contract documents as well as addenda and contract extras.

.2 Changes to interface wiring.

.3 Routing of conduit, wiring and control air lines associated with EMCS installation.

.4 Locations of obscure devices to be indicated on drawings.

.5 Listing of alarm messages.

.6 Panel/circuit breaker number for sources of normal/emergency power.

.7 Names, addresses, telephone numbers of each sub-contractor having installed equipment, local representative for each item of equipment, each system.

.8 Test procedures and reports: provide records of start-up procedures, test procedures, checkout tests and final commissioning reports as specified in Section 25 01 11 - EMCS: Start-up, Verification and Commissioning.

.9 Basic system design and full documentation on system configuration.

.2 Submit for final review by Owner.

.3 Provide before acceptance 4 hard and 1 soft copy incorporating changes made during final review.

1.6 O&M MANUALS

.1 Custom design O&M Manuals (both hard and soft copy) to contain material pertinent to this project only, and to provide full and complete coverage of subjects referred to in this Section.

.2 Provide 2 complete sets of hard and soft copies prior to system or equipment tests.

.3 Include complete coverage in concise language, readily understood by operating personnel using common terminology of functional and operational requirements of system. Do not presume knowledge of computers, electronics or in-depth control theory.

.4 Functional description to include:

.1 Functional description of theory of operation.

.2 Design philosophy.

.3 Specific functions of design philosophy and system.

.4 Full details of data communications, including data types and formats, data processing and disposition data link components, interfaces and operator tests or self-test of data link integrity.

.5 Explicit description of hardware and software functions, interfaces and requirements for components in functions and operating modes.

.6 Description of person-machine interactions required to supplement system description, known or established constraints on system operation, operating procedures currently implemented or planned for implementation in automatic mode.

.5 System operation to include:

.1 Complete step-by-step procedures for operation of system including required actions at each OWS.

.2 Operation of computer peripherals, input and output formats.

.3 Emergency, alarm and failure recovery.

.4 Step-by-step instructions for start-up, back-up equipment operation, execution of systems functions and operating modes, including key strokes for each command so that operator need only refer to these pages for keystroke entries required to call up display or to input command.

.6 Software to include:

.1 Documentation of theory, design, interface requirements, functions, including test and verification procedures.

.2 Detailed descriptions of program requirements and capabilities.

.3 Data necessary to permit modification, relocation, reprogramming and to permit new and existing software modules to respond to changing system functional requirements without disrupting normal operation.

.4 Software modules, fully annotated source code listings, error free object code files ready for loading via peripheral device

.5 Complete program cross reference plus linking requirements, data exchange requirements, necessary subroutine lists, data file requirements, other information necessary for proper loading, integration, interfacing, program execution.

.6 Software for each Controller and single section referencing Controller common parameters and functions.

.7 Maintenance: document maintenance procedures including inspection, periodic preventive maintenance, fault diagnosis, repair or replacement of defective components, including calibration, maintenance, repair of sensors, transmitters, transducers, controller and interface firmware, plus diagnostics and repair/replacement of system hardware.

.8 System configuration document:

.1 Provisions and procedures for planning, implementing and recording hardware and software modifications required during operating lifetime of system.

.2 Information to ensure co-ordination of hardware and software changes, data link or message format/content changes, sensor or control changes in event that system modifications are required.

.9 Programmer control panel documentation: provide where panels are independently interfaced with BECC, including interfacing schematics, signal identification, timing diagrams, fully commented source listing of applicable driver/handler.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

.1 Section Includes.

.1 Requirements and procedures for identification of devices, sensors, wiring, tubing, conduit and equipment, for building Energy Monitoring and Control System (EMCS) Work and nameplates, materials, colours and lettering sizes.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 25 05 01 - EMCS: General Requirements.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CSA C22.1, The Canadian Electrical Code, Part I, Safety Standard for Electrical Installations.

1.4 DEFINITIONS

.1 For acronyms and definitions refer to Section 25 05 01 - EMCS: General Requirements.

1.5 SYSTEM DESCRIPTION

.1 Language Operating Requirements: provide identification for control items in English.

1.6 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures and Section 25 05 02 – EMCS: Submittals and Review Process supplemented and modified by requirements of this Section.

.2 Submit to Owner for approval samples of nameplates, identification tags and list of proposed wording.

PART 2 PRODUCTS

2.1 NAMEPLATES FOR PANELS

.1 Identify by plastic laminate, 3 mm thick melamine, matt white finish, black core, square corners, lettering accurately aligned and engraved into core, mechanically attached with self-tapping screws.

.2 Sizes: 25 x 67 mm minimum.

.3 Lettering: minimum 7 mm high, black.

.4 Inscriptions: machine engraved to identify function.

2.2 NAMEPLATES FOR FIELD DEVICES

.1 Identify by plastic encased cards attached by plastic tie.

.2 Sizes: 50 x 100 mm minimum.

.3 Lettering: minimum 5 mm high produced from laser printer in black.

.4 Data to include: point name and point address, make, model number.

.5 Companion cabinet: identify interior components using plastic enclosed cards with point name and point address.

2.3 NAMEPLATES FOR ROOM SENSORS

.1 Identify by stick-on labels using point identifier.

.2 Location: as directed by Owner.

.3 Letter size: to suit, clearly legible.

2.4 WARNING SIGNS

.1 Equipment including motors, starters under remote automatic control: supply and install orange coloured signs warning of automatic starting under control of EMCS.

.2 Sign to read: "Caution: This equipment is under automatic remote control of EMCS" as reviewed by Owner.

2.5 WIRING

.1 Supply and install numbered tape markings on wiring at panels, junction boxes, splitters, cabinets and outlet boxes.

.2 Colour coding: to CSA C22.1. Use colour coded wiring in communications cables, matched throughout system.

.3 Power wiring: identify circuit breaker panel/circuit breaker number inside each EMCS panel.

2.6 PNEUMATIC TUBING

.1 Numbered tape markings on tubing to provide uninterrupted tracing capability.

2.7 CONDUIT

.1 Colour code EMCS conduit.

.2 Pre-paint box covers and conduit fittings.

.3 Coding: use fluorescent orange paint and confirm colour with Owner during "Preliminary Design Review".

PART 3 EXECUTION

3.1 NAMEPLATES AND LABELS

.1 Ensure that manufacturer's nameplates, CSA labels and identification nameplates are visible and legible at all times.

3.2 EXISTING PANELS

.1 Correct existing nameplates and legends to reflect changes made during work.

END OF SECTION

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 11 00 – Summary of Work.

.2 Section 01 73 00 – Execution Requirements.

.3 Section 07 84 00 – Firestopping.

.4 Section 21 05 01 – Common Work Results for Mechanical.

.5 Section 21 07 19 – Thermal Insulation of Piping.

.6 Section 22 13 16.13 – Sanitary Waste and Vent Piping – Cast Iron and Copper.

.7 Section 23 05 15 - Common Installation Requirements for HVAC Pipework.

.8 Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment.

.9 Section 23 07 13 – Duct Insulation.

.10 Section 23 21 13.02 – Hydronic Systems: Steel.

.11 Section 23 23 00 – Copper Tubing and Fittings Refrigerant.

.12 Section 25 05 01 – EMCS: General Requirements.

.13 Section 26 05 00 – Common Work Results-Electrical.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)

.1 ANSI/ASME B16.22, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

.2 ANSI C2, National Electrical Safety Code.

.3 ANSI/NFPA 70, National Electrical Code.

.2 Canadian Standards Association (CSA)

.1 CSA C22.1, Canadian Electrical Code, Part 1.

.2 CAN/CSA C22.3 No.1, Overhead Systems.

.3 CSA C22.3 No. 7, Underground Systems.

1.3 SYSTEM DESCRIPTION

.1 Electrical:

.1 Provide power wiring from emergency power panels where emergency power is provided to EMCS field panels. If no emergency power provided, install UPS Device. Circuits to be for exclusive use of EMCS equipment. Panel breakers to be identified on panel legends tagged and locks applied to breaker switches.

.2 Hard wiring between field control devices and EMCS field panels.

.3 Communication wiring between EMCS field panels and OWS's including main control centre BECC.

.4 Modify existing starters to provide for EMCS as indicated in I/O Summaries and as indicated.

.5 Refer to wiring diagrams included as part of flow diagrams. Trace existing control wiring installation and provide updated wiring schematics including additions and/or deletions to control circuits for approval by Owner before commencing work.

.6 All control wiring 50 V and less for equipment supplied by Division 25 will be the responsibility of Division 25- Integrated Automation Contractor. Conduit and wire associated with this is the responsibility of Division 25.

.2 Mechanical:

.1 Pipe taps required for EMCS equipment will be supplied and installed by Mechanical Division.

.2 Wells and control valves shall be supplied by EMCS Contractor and installed by Mechanical.

.3 Installation of air flow stations, dampers, and other devices requiring sheet metal trades to be mounted by Mechanical. Costs to be carried by designated trade.

.3 Structural:

.1 Special steelwork as required for installation of work.

1.4 PERSONNEL QUALIFICATIONS

.1 Qualified factory trained supervisory personnel to:

.1 Continuously direct and monitor all work.

.2 Attend site meetings.

1.5 EXISTING CONDITIONS

.1 Cutting and Patching: refer to Section 01 73 00 – Execution Requirements supplemented as specified herein.

.2 Repair all surfaces damaged during execution of work.

.3 Turn over to Owner existing materials removed from work not identified for re-use.

PART 2 PRODUCTS

2.1 PIPING

.1 Domestic H&CWS: refer to Section 22 11 18-Domestic Water Piping Copper and Section 22 11 18.01 – Domestic Water Piping Plastic.

.2 Sanitary, storm water: refer to Section 22 13 16.13 – Sanitary Waste and Vent Piping – Cast Iron and Copper, and Section 22 13 16.16 – Sanitary Waste and Vent Piping – Plastic.

.3 Hot water heating, chilled water: refer to Section 23 21 13.02 – Hydronic Systems: Steel and Section 23 20 12 Pressure Piping – Plastic.

.4 Condenser water: refer to Section 23 21 13 02– Hydronic Systems: Steel.

.5 Refrigeration: refer to Section 23 23 00 - Refrigerant Piping.

.6 Sleeves, escutcheons: refer to Section 23 05 15 - Common Installation Requirements for HVAC Pipework.

.7 Hangers and supports: refer to Section 23 05 29– Hangers and Supports for HVAC Piping and Equipment.

.8 Insulation: refer to Section 21 07 19 – Thermal Insulation for Piping and 23 07 13 – Thermal Insulation for Ducting.

2.2 SPECIAL SUPPORTS

.1 Structural grade steel, primed and painted after construction and before installation.

2.3 WIRING

.1 As per requirements of Electrical Divisions.

.2 For 50V and above copper conductor with chemically cross-linked thermosetting polyethylene insulation rated RW90 and 600V. Colour code to CSA 22.1.

.3 For wiring under 50 volts use FT6 rated wiring where wiring is not run in conduit. All other cases use FT4 wiring.

.4 Sizes:

.1 120V Power supply: to match or exceed breaker, size #12 minimum.

.2 Wiring for safeties/interlocks for starters, motor control centres, to be stranded, #14 minimum.

.3 Field wiring to digital device: #18AWG or 20AWG stranded twisted pair.

.4 Analog input and output: shielded #18 minimum solid copper or #20 minimum stranded twisted pair. Wiring must be continuous without joints.

.5 More than 4 conductors: #22 minimum solid copper.

.5 Terminations:

.1 Terminate wires with screw terminal type connectors suitable for wire size, and number of terminations.

2.4 CONDUIT

.1 As per requirements of Electrical Division.

.2 Electrical metallic tubing to CSA C22.2 No. 03. Flexible and liquid tight flexible metal conduit to CSA C22.2 No.56. Rigid steel threaded conduit to CSA C22.2 No. 45.

.3 Junction and pull boxes: welded steel.

.1 Surface mounting cast FS: screw-on flat covers.

.2 Flush mounting: covers with 25 mm minimum extension all round.

.4 Cabinets: sheet steel, for surface mounting, with hinged door, latch lock, 2 keys, complete with perforated metal mounting backboard. Panels to be keyed alike for similar functions and or entire contract as approved.

.5 Outlet boxes: 100 mm minimum, square.

.6 Conduit boxes, fittings:

.1 Bushings and connectors: with nylon insulated throats.

.2 With push pennies to prevent entry of foreign materials.

.7 Fittings for rigid conduit:

.1 Couplings and fittings: threaded type steel.

.2 Double locknuts and insulated bushings: use on sheet metal boxes.

.3 Use factory "ells" where 90 degree bends required for 25 mm and larger conduits.

.8 Fittings for thin wall conduit:

.1 Connectors and couplings: steel, set screw type.

2.5 WIRING DEVICES, COVER PLATES

.1 Conform to CSA.

.2 Receptacles:

.1 Duplex: CSA type 5-15R.

.2 Single: CSA type 5-15R.

.3 Cover plates and blank plates: finish to match other plates in area.

2.6 SUPPORTS FOR CONDUIT, FASTENINGS, EQUIPMENT

.1 Solid masonry, tile and plastic surfaces: lead anchors or nylon shields.

.1 Hollow masonry walls, suspended drywall ceilings: toggle bolts.

.2 Exposed conduits or cables:

.1 50 mm diameter and smaller: one-hole steel straps.

.2 Larger than 50 mm diameter: two-hole steel straps.

.3 Suspended support systems:

.1 Individual cable or conduit runs: support with 6 mm diameter threaded rods and support clips.

.2 Two or more suspended cables or conduits: support channels supported by 6 mm diameter threaded rod hangers.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install equipment, components so that manufacturer's and CSA labels are visible and legible after commissioning is complete.

3.2 PIPING

.1 Domestic H&CWS: refer to Section 22 11 18 –Domestic Water Piping Copper.

.2 Sanitary, storm water: refer to 22 13 16.13 – Sanitary Waste and Vent Piping – Cast Iron and Copper.

.3 Hot water heating, chilled water: refer to Section 23 21 13.02 – Hydronic Systems: Steel.

.4 Condenser water: refer to Section 23 21 13.02 – Hydronic Systems: Steel.

.5 Refrigeration: refer to Section 23 23 00 - Copper Tubing and Fittings Refrigerant.

.6 Insulation: refer to Section 21 07 19 – Thermal Insulation for Piping and 23 07 13 – Thermal Insulation for Ducting.

3.3 MECHANICAL PIPING

.1 Install piping in accordance with Section 23 05 15 - Common Installation Requirements for HVAC Pipework.

3.4 SUPPORTS

.1 Install special supports as required and as indicated.

3.5 ELECTRICAL GENERAL

.1 Do complete installation in accordance with requirements of:

.1 Electrical Divisions, this specification.

.2 CSA 22.1 Canadian Electrical Code, latest edition.

.3 ANSI/NFPA 70.

.4 ANSI C2.

.2 Fully enclose or properly guard electrical wiring, terminal blocks, high voltage (above 50 V) contacts and mark to prevent accidental injury.

.3 Do underground installation to CAN/CSA C22.3 No.7, except where otherwise specified.

.4 Conform to manufacturer's recommendations for storage, handling and installation.

.5 Check factory connections and joints. Tighten where necessary to ensure continuity.

.6 Install electrical equipment between 1000 and 2000 mm above finished floor wherever possible and adjacent to related equipment.

.7 Protect exposed live equipment such as panel, mains, outlet wiring during construction for personnel safety.

.8 Shield and mark live parts "LIVE 120 VOLTS" or other appropriate voltage.

.9 Install conduits, and sleeves prior to pouring of concrete.

.10 Holes through exterior wall and roofs: flash and make weatherproof.

.11 Make necessary arrangements for cutting of chases, drilling holes and other structural work required to install electrical conduit, cable, pull boxes, outlet boxes.

.12 Install cables, conduits and fittings which are to be embedded or plastered over, neatly and closely to building structure to minimize furring.

3.6 CONDUIT SYSTEM

.1 Communication wiring shall be installed in conduit. Provide complete conduit system to link Building Controllers to BECC. Conduit sizes to suit wiring requirements and to allow for future expansion capabilities specified for systems. Maximum conduit fills not to exceed 40%. Design drawings do not show conduit layout.

.2 Install conduits parallel or perpendicular to building lines, to conserve headroom and to minimize interference.

.3 Do not run exposed conduits in normally occupied spaces unless otherwise indicated or unless impossible to do otherwise. Obtain approval from Owner before starting such work. Provide complete conduit system to link field panels and devices with main control centre. Conduit size to match conductors plus future expansion capabilities as specified.

.4 Locate conduits at least 150 mm from parallel steam or hot water pipes and at least 50 mm at crossovers.

.5 Bend conduit so that diameter is reduced by less than 1/10th original diameter.

.6 Field thread on rigid conduit to be of sufficient length to draw conduits up tight.

.7 Limit conduit length between pull boxes to less than 30 m.

.8 Use conduit outlet boxes for conduit up to 32 mm diameter and pull boxes for larger sizes.

.9 Fastenings and supports for conduits, cables, and equipment:

.1 Provide metal brackets, frames, hangers, clamps and related types of support structures as indicated and as required to support cable and conduit runs.

.2 Provide adequate support for raceways and cables, sloped vertically to equipment.

.3 Use supports or equipment installed by other trades for conduit, cable and raceway supports only after written approval from Owner.

.10 Install polypropylene fish cord in empty conduits for future use.

.11 Where conduits become blocked, remove and replace blocked sections.

.12 Pass conduits through structural members only after receipt of Owner's written approval.

.13 Conduits may be run in flanged portion of structural steel.

.14 Group conduits wherever possible on suspended or surface channels.

.15 Pull boxes:

.1 Install in inconspicuous but accessible locations.

.2 Support boxes independently of connecting conduits.

.3 Fill boxes with paper or foam to prevent entry of construction material.

.4 Provide correct size of openings. Reducing washers not permitted.

.5 Mark location of pull boxes on record drawings.

.6 Identify AC power junction boxes, by panel and circuit breaker.

.16 Install terminal blocks or strips indicated in cabinets to Electrical Division.

.17 Install bonding conductor for 120 volt and above in conduit.

3.7 WIRING

.1 Install multiple wiring in ducts simultaneously.

.2 Do not pull spliced wiring inside conduits or ducts.

.3 Use CSA certified lubricants of type compatible with insulation to reduce pulling tension.

.4 Tests: use only qualified personnel. Demonstrate that:

.1 Circuits are continuous, free from shorts, unspecified grounds.

.2 Resistance to ground of all circuits is greater than 50 Megohms.

.5 Provide Owner with test results showing locations, circuits, results of tests.

.6 Remove insulation carefully from ends of conductors and install to manufacturer's recommendations. Accommodate all strands in lugs. Where insulation is stripped in excess, neatly tape so that only lug remains exposed.

.7 Wiring in main junction boxes and pull boxes to terminate on terminal blocks only, clearly and permanently identified. Junctions or splices not permitted for sensing or control signal covering wiring.

.8 Do not allow wiring to come into direct physical contact with compression screw.

.9 Install ALL strands of conductor in lugs of components. Strip insulation only to extent necessary for installation.

3.8 WIRING DEVICES, COVER PLATES

.1 Receptacles:

.1 Install vertically in gang type outlet box when more than one receptacle is required in one location.

.2 Cover plates:

.1 Install suitable common cover plate where wiring devices are grouped.

.2 Use flush type cover plates only on flush type outlet boxes.

3.9 STARTERS, CONTROL DEVICES

.1 Install and make control connections as indicated. Power connections above 50V by Electrical Division.

.2 Install correct over-current devices.

.3 Identify each control wire, terminal for external connections with permanent number marking identical to diagram.

.4 Performance Verification:

.1 Operate switches and controls to verify functioning.

.2 Perform start and stop sequences of contactors and relays.

.3 Check that interlock sequences, with other separate related starters, equipment and auxiliary control devices, operate as specified.

3.10 GROUNDING

.1 Install complete, permanent, continuous grounding system for equipment, including conductors, connectors and accessories.

.2 Install separate grounding conductors in conduit within building.

.3 Install ground wire in all PVC ducts and in tunnel conduit systems.

.4 Tests: perform ground continuity and resistance tests, using approved method appropriate to site conditions.

3.11 TESTS

.1 General:

.1 Perform following tests in addition to tests specified Section 25 08 20 - EMCS: Warranty and Maintenance.

.2 Give 14 days written notice of intention to test.

.3 Conduct in presence of Owner and authority having jurisdiction.

.4 Conceal work only after tests satisfactorily completed.

.5 Report results of tests to Owner in writing.

.6 Preliminary tests:

.1 Conduct as directed to verify compliance with specified requirements.

.2 Make needed changes, adjustments, replacements.

.3 Insulation resistance tests:

.1 Megger all circuits, feeders, equipment for 120 - 600V with 1000V instrument. Resistance to ground to be more than required by Code before energizing.

.2 Test insulation between conductors and ground, efficiency of grounding system to satisfaction of Owner and authority having jurisdiction.

3.12 IDENTIFICATION

.1 Refer to Section 25 05 54- EMCS: Identification.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

.1 Section Includes.

.1 Requirements and procedures for warranty and activities during warranty period and service contracts, for building Energy Monitoring and Control System (EMCS).

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 78 00 - Closeout Submittals.

.3 Section 25 05 01 - EMCS: General Requirements.

1.3 REFERENCES

.1 Canada Labour Code (R.S., c. L-2)/Part I - Industrial Relations.

.2 Canadian Standards Association (CSA)

.1 CSA Z204 – Guidelines for Managing Indoor Quality in Buildings

1.4 DEFINITIONS

.1 OWS - Operator Work Station.

.2 For additional acronyms and definitions refer to Section 25 05 01 - EMCS: General Requirements.

1.5 SUBMITTALS

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

.2 Submit detailed preventative maintenance schedule for system components to Owner.

.3 Submit detailed inspection reports Owner.

.4 Submit dated, maintenance task lists to Owner and include the following sensor and output point detail, as proof of system verification:

.1 Point name and location.
.2 Device type and range.
.3 Measured value.
.4 System displayed value.

.5 Calibration detail

.6 Indication if adjustment required,

.7 Other action taken or recommended.

.5 Submit network analysis report showing results with detailed recommendations to correct problems found.

.6 Records and logs: in accordance with Section 01 78 00 - Closeout Submittals.

.1 Maintain records and logs of each maintenance task on site.

.2 Organize cumulative records for each major component and for entire EMCS chronologically.

.3 Submit records to Owner, after inspection indicating that planned and systematic maintenance have been accomplished.

.7 Revise and submit to Owner in accordance with Section 01 78 00 - Closeout Submittals "As-built drawings" documentation and commissioning reports to reflect changes, adjustments and modifications to EMCS made during warranty period.

1.6 MAINTENANCE SERVICE DURING WARRANTY PERIOD

.1 Provide services, materials, and equipment to maintain EMCS for warranty period of one year after date of substantial completion. Provide detailed preventative maintenance schedule for system components as described in Submittal article.

.2 Emergency Service Calls:

.1 Initiate service calls when EMCS is not functioning correctly.

.2 Qualified control personnel to be available during warranty period to provide service to "CRITICAL" components whenever required at no extra cost.

.3 Furnish Owner with telephone number where service personnel may be reached at any time.

.4 Service personnel to be on site ready to service EMCS after receiving request for service.

.5 Perform work continuously until EMCS restored to reliable operating condition.

.3 Operation: foregoing and other servicing to provide proper sequencing of equipment and satisfactory operation of EMCS based on original design conditions and as recommended by manufacturer.

.4 Work requests: record each service call request, when received separately on approved form and include:

.1 Serial number identifying component involved.

.2 Location, date and time call received.

.3 Nature of trouble.

.4 Names of personnel assigned.

.5 Instructions of work to be done.

.6 Amount and nature of materials used.

.7 Time and date work started.

.8 Time and date of completion.

.5 Provide system modifications in writing.

.1 No system modification, including operating parameters and control settings, to be made without prior written approval of Owner.

1.7 SERVICE CONTRACTS

.1 Provide in-depth technical expertise and assistance to Owner and Commissioning Manager in preparation and implementation of service contracts and in-house preventive maintenance procedures. Service contracts duration is for the warranty period.

.2 Service Contracts to include:

.1 Annual verification of field points for operation and calibration.

.2 4 visits per year.

.3 2 responses to emergency calls during day, per year.

.4 2 responses to emergency calls during silent hours, per year.

.5 Silent hours defined as 1630 h – 0800 h and on weekends and statutory holidays.

.6 Complete inventory of installed system.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 FIELD QUALITY CONTROL

.1 Perform as minimum (3) three minor inspections and one major inspection (more often if required by manufacturer) per year. Provide detailed written report to Owner as described in Submittal article.

.2 Perform inspections during regular working hours, 0800 to 1630 h, Monday through Friday, excluding statutory holidays.

.3 Following inspections are minimum requirements and should not be interpreted to mean satisfactory performance:

.1 Perform calibrations using test equipment having traceable, certifiable accuracy at minimum 50% greater than accuracy of system displaying or logging value.

.2 Check and calibrate random sample of 10% field input/output devices in accordance with Canada Labour Code - Part I and CSA Z204.

.3 Provide dated, maintenance task lists, as proof of execution of complete system verification.

.4 Minor inspections to include, but not limited to:

.1 Perform visual, operational checks to BC's, peripheral equipment, interface equipment and other panels.

.2 Check equipment cooling fans as required.

.3 Visually check for mechanical faults, air leaks and proper pressure settings on pneumatic components.

.4 Review system performance with Operations Supervisor and/or Owner to discuss suggested or required changes.

.5 Major inspections to include, but not limited to:

.1 Minor inspection.

.2 Clean OWS(s) peripheral equipment, BC(s), interface and other panels, micro-processor interior and exterior surfaces.

.3 Check signal, voltage and system isolation of BC(s), peripherals, interface and other panels.

.4 Verify calibration/accuracy of each input and output device and recalibrate or replace as required (as per 3.1. 3.2).

.5 Provide mechanical adjustments, and necessary maintenance on printers.

.6 Run system software diagnostics as required.

.7 Install software and firmware enhancements to ensure components are operating at most current revision for maximum capability and reliability.

.1 Perform network analysis and provide report as described in Submittal article.

.6 Rectify deficiencies revealed by maintenance inspections and environmental checks.

.7 Continue system debugging and optimization.

.8 Testing/verification of occupancy and seasonal-sensitive systems to take place during four (4) consecutive seasons, after facility has been accepted, taken over and fully occupied.

.1 Test weather-sensitive systems twice: first at near winter design conditions and secondly under near summer design conditions.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 System requirements for Local Area Network (LAN) for Building Energy Monitoring and Control System (EMCS).

1.2 RELATED SECTIONS

.1 Section 25 05 01 – EMCS: General Requirements.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CSA T529, Telecommunications Cabling Systems in Commercial Buildings (Adopted ANSI/TIA/EIA-568-A with modifications.

.2 CSA T530, Commercial Building Standard for Telecommunications Pathways and Spaces (Adopted ANSI/TIA/EIA – 569-A with modifications.

.2 Institute of Electrical and Electronics Engineers (IEEE)/Standard for Information Technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements.

.1 IEEE Std 802.3TM, Part 3: Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications.

.3 Telecommunications Industries Association (TIA)/Electronic Industries Alliance (EIA).

.1 TIA/EIA-568, Commercial Building Telecommunications Cabling Standards Set, Part 1 General Requirements, Part 2 Balanced Twisted- Pair Cabling Components, Part 3 Optical Fiber Cabling Components Standard.

.2 TIA/EIA-569-A, Commercial Building Standard for Telecommunications Pathways and Spaces.

.4 Treasury Board Information Technology Standard (TBITS).

.1 TBITS 6.9, Profile for the Telecommunications Wiring System in Government Owned and Leased Buildings-Technical Specifications.

1.4 DEFINITIONS

.1 Acronyms and definitions: refer to Section 25 05 01 – EMCS: General Requirements.

1.5 SYSTEM DESCRIPTION

.1 Data communication network to link Operator Workstations and Master Control Units (MCU) in accordance with CSA T529, TIA/EIA-568, CSA T530 and TIA/EIA-569-A.

.1 Provide reliable and secure connectivity of adequate performance between different sections segments of network.

.2 Allow for future expansion of network, with selection of networking technology and communication protocols.

.2 Data communication network to included, but not limited to:

.1 EMCS-LAN.

.2 Modems.

.3 Network interface cards.

.4 Network management hardware and software.

.5 Network components necessary for complete network.

1.6 DESIGN REQUIREMENTS

.1 EMCS Local Area Network (EMCS-LAN).

.1 High Speed, high performance, local area network over MS/TP with MCUs and OWSs communicate with each other directly on peer to peer basis in accordance with IEEE 802.3/Ethernet Standard.

.2 EMCS-LAN to be: BACnet Protocol

.3 Each EMCS-LAN to be capable of supporting at least 50 devices.

.4 Support of combination of MCUs and OWSs directly connected to EMCS-LAN.

.5 High speed data transfer rates for alarm reporting, quick report generation from multiple controllers, upload/download information between network devices. Bit rate to be 10 Megabits per second minimum.

.6 Detection and accommodation of single or multiple failures of either OWSs, MCUs or network media. Operational equipment to continue to perform designated functions effectively in event of single or multiple failures.

.7 Commonly available, multiple sourced, networking components and protocols to allow system to co-exist with other networking applications including office automation.

.2 Dynamic Data Access.

.1 LAN to provide capabilities for OWSs, either network resident or connected remotely to access point status and application report data or execute control functions for other devices via LAN.

.2 Access to data to be based upon logical identification of building equipment.

.3 Network Medium.

.1 Network medium: twisted cable, shielded twisted cable, or fibre optic cable compatible with network protocol to be used within buildings. Fibre optic cable to be used between buildings.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

.1 Section Includes materials and installation for building automation controllers including:

.1 Master Control Unit (MCU).

.2 Local Control Unit (LCU)

.3 Equipment Control Unit (ECU).

.4 Terminal Control Unit (TCU).

1.2 RELATED SECTIONS

.1 Section 25 05 01 - EMCS: General Requirements.

.2 Section 25 05 02 - EMCS: Submittals and Review Process.

.3 Section 25 05 03 - EMCS: Project Records Documents.

.4 Section 25 30 02 - EMCS: Field Control Devices.

.5 Section 25 90 01 – EMCS: Site Requirements, Applications and Systems Sequences of Operation.

1.3 REFERENCES

.1 American Society of Heating, Refrigeration, and Air-Conditioning Engineers, Inc. (ASHRAE).

.1 ASHRAE, Applications Handbook, SI Edition.

.2 ASHRAE Standard 135 – BAC net – A Data Communications Protocol for Building Automation and Control Networks.

.3 ASHRAE Standard 135.1 Method of Test Conformance to BAC net.

.2 Canadian Standards Association (CSA)

.1 C22.2 No.205, Signal Equipment.

.3 Institute of Electrical and Electronics Engineers (IEEE)

.1 IEEE C37.90.1, Surge Withstand Capabilities Test for Protective Relays and Relays Systems.

1.4 DEFINITIONS

.1 Acronyms used in this section include: see Section 25 05 01 - EMCS: General Requirements.

1.5 SYSTEM DESCRIPTION

.1 General: Network of controllers comprising of MCU(‘s), LCU(‘s), ECU(‘s) or TCU(‘s) to be provided as indicated in System Architecture Diagram to support building systems and associated sequence(s) of operations as detailed in these specifications.

.1 Provide sufficient controllers to meet intents and requirements of this section.

.2 Controllers quantity, and point contents to be approved by Owner at time of preliminary design review.

.2 Controllers: stand-alone intelligent Control Units:

.1 Incorporate programmable microprocessor, non-volatile program memory, RAM, power supplies, as required to perform specified functions.

.2 Incorporate communication interface ports for communication LANs to exchange information with other Controllers.

.3 Capable of interfacing with operator interface device.

.4 Execute its logic and control using primary inputs and outputs connected directly to its onboard input/output field terminations or slave devices, and without need with other controller. Secondary input used for reset such as outdoor air temperature may be located in other Controller(s).

1.6 DESIGN REQUIREMENTS

.1 To include:

.1 Scanning of AI and DI connected inputs for detection of change of value and processing the detection of alarm conditions.

.2 Perform On-Off digital control of connected points, including the resulting required states generated through programmable logic output.

.3 Perform Analog control using programmable logic, (including PID) with adjustable dead bands and deviation alarms.

.4 Control of systems as described in sequence of operations.

.5 Execution of optimization routines as listed in this section.

.2 Total spare capacity for MCUs and LCUs: at least 25% of each point type distributed throughout the MCUs and LCUs.

.3 Field Termination and Interface Devices.

.1 To conform to CSA C22.2 No. 205.

.2 Electronically interface sensors and control devices to processor unit.

.3 Include, but not be limited to, following:

.1 Programmed firmware or logic circuits to meet functional and technical requirements.

.2 Power supplies for operation of logic devices and associated field equipment.

.3 Lockable wall cabinet.

.4 Required communications equipment and wiring.

.5 Leave controlled system in "fail-safe" mode in event of loss of communication with, or failure of, processor unit.

.6 Input/Output interface to accept as minimum AI, AO, DI, DO functions as specified.

.7 Wiring terminations: use conveniently located screw type or spade lug terminals.

.4 AI interface equipment to:

.1 Convert analog signals to digital format with 12 bit analog-to-digital resolution.

.2 Provide for following input signal types and ranges:

.1 4 - 20 mA;

.2 0-10V DC

.3 10 K ohm.

.3 Meet IEEE C37.90.1 surge withstand capability.

.4 Have common mode signal rejection greater than 60 dB to 60 Hz.

.5 Where required, dropping resistors to be certified precision devices which complement accuracy of sensor and transmitter range specified.

.5 AO interface equipment:

.1 Convert digital data from controller processor to acceptable analog output signals using 12 bit digital-to-analog resolution.

.2 Provide for following output signal types and ranges:

.1 4 - 20 mA.

.2 0 - 10 V DC.

.3 Meet IEEE C37.90.1 surge withstand capability.

.6 DI interface equipment:

.1 Able to reliably detect contact change of sensed field contact and transmit condition to controller.

.2 Meet IEEE C37.90.1 surge withstand capability.

.3 Accept pulsed inputs up to 2 kHz.

.7 DO interface equipment:

.1 Respond to controller processor output, switch respective outputs. Each DO hardware to be capable of switching up to 0.5 amps at 24 V AC.

.2 Switch up to 5 amps at 220 V AC using optional interface relay.

.4 Controller's and associated hardware and software: operate in conditions of 0°C to 44°C and 20 % to 90 % non-condensing RH.

.5 Controllers (MCU, LCU): mount in wall mounted cabinet with hinged, keyed-alike locked door.

.1 Provide for conduit entrance from top, bottom or sides of panel.

.2 ECUs to be mounted in equipment enclosures or separate enclosures.

.3 Mounting details as approved by Owner for ceiling mounting.

.6 Cabinets to provide protection from water dripping from above, while allowing sufficient airflow to prevent internal overheating.

.7 Provide surge and low voltage protection for interconnecting wiring connections.

1.7 SUBMITTALS

.1 Make Submittals in accordance with Section 01 33 00 – Submittal Procedures and Section 25 05 02 – EMCS: Submittals and Review Process.

.1 Submit product data sheets for each product item proposed for this project.

1.8 MAINTENANCE PROCEDURES

.1 Provided manufacturers recommended maintenance procedures for insertion in Section 25 05 03 – EMCS: Project Record Documents.

PART 2 PRODUCTS

2.1 MASTER CONTROL UNIT (MCU)

.1 Primary function of MCU is to provide co-ordination and supervision of subordinate devices. Supervisory role shall include coordination of subordinate devices in the execution of optimization routines such as demand limiting or enthalpy control.

.2 Include high speed communication LAN Port for Peer to Peer communications with OWS(s) and other MCU level devices. Include support for Open System Protocols, BACnet.

.3 MCU shall have local I/O capacity as follows;

.1 To have at least 16 I/O points of which minimum to be 2AO, 6AI, 4DI, 4DO.

.2 LCU's to be added to support system functions as indicated in I/O Summary List.

.4 Central Processor Unit (CPU)

.1 Processor to consist of at minimum a 16 bit microprocessor capable of supporting software to meet specified requirements.

.2 CPU idle time to be more than 30 % when system configured to maximum input and output with worst case program use.

.3 Minimum addressable memory to be at manufacturer's discretion but to support at least all performance and technical specifications. Memory to include:

.1 Non-volatile EEPROM to contain operating system, executive, application, sub-routine, other configurations definition software. Tape media not acceptable.

.2 Battery backed (72 hr minimum capacity) RAM (to reduce the need to reload operating data in event of power failure) RAM to contain CDLs, application parameters, operating data or software that is required to be modifiable from operational standpoint such as schedules, setpoints, alarm limits, PID constants and CDL and hence modifiable on-line through operator panel or remote operator's interface. RAM to be downline loadable from OWS, CAB-Gateway, or locally installed floppy disk.

.4 Include uninterruptible clock accurate to plus or minus 5 secs/month, capable of deriving month/day/hour/minute/second, with rechargeable batteries for minimum 72 hr operation in event of power failure.

.5 Local Operator Terminal (OT)

.1 OT to:

.1 Have integral access/display panel where immediate access to OWS is not available.

.2 Support operator's terminal for local command entry, instantaneous and historical data display, programs additions and modifications.

.3 Simultaneously display minimum of 16 points with full English identification to allow operator to view single screen dynamic displays depicting entire mechanical systems.

.2 Functions to include, but not be limited to, following:

.1 Start and stop points.

.2 Modify setpoints.

.3 Modify PID loop setpoints.

.4 Override PID control.

.5 Change time/date.

.6 Add/modify/start/stop weekly scheduling.

.7 Add/modify setpoint weekly scheduling.

.8 Enter temporary override schedules.

.9 Define holiday schedules.

.10 View analog limits.

.11 Enter/modify analog warning limits.

.12 Enter/modify analog alarm limits.

.13 Enter/modify analog differentials.

.3 OT to provide access to real and calculated points in controller to which it is connected or to any other controller in network. This capability not to be restricted to subset of predefined "global points" but to provide totally open exchange of data between OT and any other controller in network.

.4 Operator access to OTs to the same as OWS user password. Password changes to automatically be downloaded to controllers on network.

.5 OT to provide prompting to eliminate need for user to remember command format or point names. Prompting to be consistent with user's password clearance and types of points displayed to eliminate possibility of operator error.

.6 Identity of real or calculated points to be consistent with network devices. Use same point identifier as at OWS’s for access of points at OT to eliminate cross-reference or look-up tables.

2.2 LOCAL CONTROL UNIT (LCU)

.1 Provide multiple control functions for typical built-up and package HVAC, hydronic and electrical systems.

.2 Minimum of 16 I/O points of which minimum be 4 AOs, 4 AIs, 4 DIs, 4 DOs.

.3 Points of one Building System to be connected to one controller as listed in I/O Summary designations.

.4 Microprocessor capable of supporting necessary software and hardware to meet specified requirements. As per MCU requirements (section 2.3.4) above with the following additions:

.1 Include as minimum 2 interface ports for connection to local computer terminal.

.2 Design so that shorts, opens or grounds on any input or output will not interfere with other input or output signals.

.3 Physically separate line voltage (50V and over) circuits from DC logic circuits to permit maintenance on either circuit with minimum hazards to technician and equipment.

.4 Include power supplies for operation of LCU and associated field equipment.

.5 In event of loss of communications with, or failure of, MCU, LCU to continue to perform control. Controllers that use defaults or fail to open or close positions not acceptable.

.6 Provide conveniently located screw type or spade lug terminals for field wiring.

.7 LCU to have 25 % spare input and 25 % output point capacity without addition of cards, terminals, etc.

2.3 TERMINAL/EQUIPMENT CONTROL UNIT (TCU/ECU)

.1 Microprocessor capable of supporting necessary software and hardware to meet TCU/ECU functional specifications.

.1 The TCU definition to be consistent with those defined in ASHRAE HVAC Applications Handbook.

.2 Controller to communicate directly with EMCS through EMCS LAN and provide access from EMCS OWS for setting occupied and unoccupied space temperature setpoints, flow setpoints, and associated alarm values, permit reading of sensor values, field control values (% open) and transmit alarm conditions to EMCS OWS.

.3 VAV Terminal Controller

.1 Microprocessor based controller with integral flow transducer, including software routines to execute PID algorithms, calculate airflow for integral flow transducer and measure temperatures as per I/O Summary required inputs. Sequence of operation to ASHRAE HVAC Applications Handbook.

.2 Controller to support point definition; in accordance with section 25 05 01 – EMCS: General Requirements.

.3 Controller to operate independent of network in case of communication failure.

.4 Controller to include damper actuator and terminations for input and output sensors and devices.

2.4 SOFTWARE

.1 General:

.1 Include as minimum: operating system executive, communications, application programs, operator interface, and systems sequence of operation - CDL's.

.2 To include "firmware" or instructions which are programmed into ROM, EPROM, EEPROM or other non-volatile memory.

.3 Include initial programming of all Controllers, for entire system.

.2 Program and data storage:

.1 Store executive programs and site configuration data in ROM, EEPROM or other non-volatile memory.

.2 Maintain CDL and operating data such as setpoints, operating constants, alarm limits in battery-backed RAM or EEPROM for display and modification by operator.

.3 Programming languages:

.1 Control Description Logic software to be programmed using English like or graphical, high level, general control language.

Structure software in modular fashion to permit simple restructuring of program modules if future software additions or modifications are required. GO TO constructs not allowed.

.4 Operator terminal interface:

.1 MCU to perform operating and control functions specified Section 25 10 02 - EMCS: Operator Work Stations (OWS), including:

.1 Multi-level password access protection to allow user/manager to limit workstation control.

.2 Alarm management: processing and messages.

.3 Operator commands.

.4 Reports.

.5 Displays.

.6 Point identification.

.5 Pseudo or calculated points:

.1 Software to have access to any value or status in controller or other networked controller so as to define and calculate pseudo point from other values/status of controller. When current pseudo point value is derived, normal alarm checks must be performed or value used to totalize.

.2 Inputs and outputs for any process to be able to include data from controllers to permit development of network-wide control strategies. Processes also to permit operator to use results of one process as input to any number of other processes (eg. cascading).

.6 Control Description Logic (CDL):

.1 Capable of generating on-line project-specific control loop algorithms (CDLs). CDLs to be software based, programmed into RAM or EEPROM and backed up to OWS. Owner must have access to these algorithms for modification or to be able to create new ones and to integrate these into CDLs on BC(s) from OWS.

.2 Write CDL in high level language that allows algorithms and interlocking programs to be written simply and clearly. Use parameters entered into system (eg. setpoints) to determine operation of algorithm. Operator to be able to alter operating parameters on-line from OWS or BC(s) and to tune control loops.

.3 Perform changes to CDL on-line.

.4 Control logic to have access to values or status of all points available to controller including global or common values, allowing cascading or inter-locking control.

.5 Energy optimization routines such as enthalpy control, supply temperature reset, etc. to be LCU or MCU resident functions and form part of CDL.

.6 MCU to be able to perform following pre-tested control algorithms:

.1 Two position control.

.2 Proportional Integral and Derivative (PID) control.

.3 Automatic control loop tuning.

.7 Control software to provide the ability to define the time between successive starts for each piece of equipment to reduce cycling of motors.

.8 Provide protection against excessive electrical-demand situations during start-up periods by automatically introducing time delays between successive start commands to heavy electrical loads.

.9 Power Fail Restart: Upon detection of power failure system to verify availability of emergency power as determined by emergency power transfer switches and analyze controlled equipment to determine its appropriate status under emergency power conditions and start or stop equipment as defined by I/O Summary. Upon resumption of normal power as determined by emergency power transfer switches, MCU to analyze status of controlled equipment, compare with normal occupancy scheduling, turn equipment on or off as necessary to resume normal operation.

.7 Event and Alarm management: The system to use a management by exception concept for Alarm Reporting. This is a system wide requirement. This approach will insure that only principal alarms are reported to OWS. Events which occur as a direct result of the primary event to be suppressed by the system and only events which fail to occur to be reported. Such event sequence to be identified in I/O Summary and sequence of operation. Examples of above are, operational temperature alarms limits which are exceeded when main air handler is stopped, or General Fire condition shuts air handlers down, only Fire alarm status shall be reported. The exception is, when an air handler which is supposed to stop or start fails to do so under the event condition.

.8 Energy management programs: The following programs shall include specific summarizing reports, to include the date stamp indicating sensor details which activated and or terminated the feature.

.1 MCU in coordination with subordinate LCU, TCU, ECU to provide for the following energy management routines:

.1 Time of day scheduling.
.2 Calendar based scheduling.
.3 Holiday scheduling.
.4 Temporary schedule overrides.
.5 Optimal start stop.
.6 Night setback control.
.7 Enthalpy (economizer) switchover.
.8 Peak demand limiting.
.9 Temperature compensated load rolling.
.10 Fan speed/flow rate control.
.11 Cold deck reset.
.12 Hot deck reset.
.13 Hot water reset.
.14 Chilled water reset.
.15 Condenser water reset.

.16 Chiller sequencing.

.17 Night purge.

.2 Programs to be executed automatically without need for operator intervention and be flexible enough to allow customization.

.3 Apply programs to equipment and systems as specified or requested by the Owner.

.9 Function/Event Totalization: features to provide predefined reports which show daily, weekly, and monthly accumulating totals and which include high rate (time stamped) and low rate (time stamped) and accumulation to date for month.

.1 MCUs to accumulate and store automatically run-time for binary input and output points.

.2 MCU to automatically sample, calculate and store consumption totals on daily, weekly or monthly basis for user-selected analog or binary pulse input-type points.

.3 MCU to automatically count events (number of times pump is cycled off and on) daily, weekly or monthly basis.

.4 Totalization routine to have sampling resolution of 1 min or less for analog inputs.

.5 Totalization to provide calculations and storage of accumulations up to 99,999.9 units (eg. kWH, litres, tonnes, etc.).

.6 Store event totalization records with minimum of 9,999,999 events before reset.

.7 User to be able to define warning limit and generate user-specified messages when limit reached.

2.5 LEVELS OF ADDRESS

.1 Upon operator's request, EMCS to present status of any single 'point', 'system' or point group, entire 'area', or entire network on printer or OWS as selected by operator.

.1 Display analog values digitally to 1 place of decimals with negative sign as required.

.2 Update displayed analog values and status when new values received.

.3 Flag points in alarm by blinking, reverse video, different colour, bracketed or other means to differentiate from points not in alarm.

.4 Updates to be change-of-value (COV)-driven or if polled not exceeding 2 second intervals.

2.6 POINT NAME SUPPORT

.1 Controllers (MCU, LCU) to support point naming convention as defined in

Section 25 05 01 – EMCS: General Requirements.

PART 3 EXECUTION

3.1 LOCATION

.1 Location of Controllers to be approved by Owner.

3.2 INSTALLATION

.1 Install Controllers in secure enclosures as indicated.

.2 Provide necessary power from local 120 V branch circuit panel for equipment.

.3 Install tamper locks on breakers of circuit breaker panel.

.4 Use Uninterruptible Power Supply (UPS) and emergency power when equipment must operate in an emergency and co-ordinating mode.

END OF SECTION

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 25 05 02 - EMCS: Submittals and Review Process.

.2 Section 25 05 03 - EMCS: Project Records Documents.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)

.1 ANSI C12.7, Requirements for Watthour Meter Sockets.

.2 ANSI/IEEE C57.13, Requirements for Instrument Transformers.

.2 Canadian Standards Association (CSA)

.1 CSA Type 1 Enclosure

.2 CSA Type 4X Enclosures

.3 CSA Type 12 Enclosures

1.3 SUBMITTALS

.1 Submit shop drawings and manufacturer's installation instructions in accordance with Section 25 05 02 - EMCS: Submittals and Review Process.

.2 Include:

.1 Information as specified for each device.

.2 Manufacturer's detailed installation instructions.

.3 Pre-Installation Tests

.1 Submit samples at random from equipment shipped, as requested by Owner, for testing before installation. Replace devices not meeting specified performance and accuracy.

.4 Manufacturer's Instructions

.1 Submit manufacturer's installation instructions for specified equipment and devices.

1.4 CLOSEOUT SUBMITTALS

.1 Submit operating and maintenance data for inclusion in operation and maintenance manual in accordance with Section 25 05 03 - EMCS: Project Records Documents.

PART 2 PRODUCTS

2.1 GENERAL

.1 Control devices of each category to be of same type and manufacturer.

.2 External trim materials to be corrosion resistant. Internal parts to be assembled in watertight, shockproof, vibration-proof, heat resistant assembly.

.3 Operating conditions: 0 - 32 °C with 10 - 90 % RH (non-condensing) unless otherwise specified.

.4 Terminations: use standard conduit box with slot screwdriver compression connector block unless otherwise specified.

.5 Transmitters to be unaffected by external transmitters (eg. walkie talkies).

.6 Account for hysteresis, relaxation time, maximum and minimum limits in applications of sensors and controls.

.7 Outdoor installations: use weatherproof construction in CSA 4X enclosures.

.8 Devices to be installed in user occupied space must not exceed Noise Criteria (NC) of 35. Noise generated by any device must not be detectable above space ambient conditions.

2.2 TEMPERATURE SENSORS

.1 General: except for VAV box control to be resistance or thermocouple type to following requirements:

.1 Thermisters 10 K ohm, + 0.2° C accuracy, less than 0.1° C drift over 10 year span. Power supply 5 V dc, 10-35 Vdc, 24 Vac.

.2 RTD's: 1000 ohm at 0 °C (plus or minus 0.2 ohms) platinum element with strain minimizing construction, 3 integral anchored leadwires. Coefficient of resistivity: 0.00385 ohms/ohm□C.

.3 Immersion wells: NPS 3/4, stainless steel spring loaded construction, with heat transfer compound compatible with sensor. Insertion length 100 mm as indicated.

.2 Sensors:

.1 Room type: wall mounting, in slotted type covers, LCD display °C or °F, with guard as indicated. Dual set point momentary push button, override switch.

.2 Room type for VAV boxes: as for room type, above. Include setpoint adjustment, local indication, push button override for night set back function.

.3 General purpose duct type: suitable for insertion into ducts at any angle, insertion length 460 mm.

.4 Averaging duct type: continuous filament with minimum immersion length 6000 mm. Bend probe at field installation time to 100 mm radius at any point along probe without degradation of performance.

.5 Outside air type: complete with probe length 100 - 150 mm long, non-corroding shield to minimize solar and wind effects, threaded fitting for mating to 13 mm conduit, weatherproof construction in CSA 4X enclosure.

.6 Immersion type: spring loaded probe, NPT ½ fitting insertion to suit pipe size.

2.3 TEMPERATURE TRANSMITTERS

.1 Requirements:

.1 Input circuit: to accept 3-lead, 100 ohm at 0 deg C, platinum resistance detector type sensors.

.2 Power supply: 575 ohms at 24 V DC into load of 575 ohms. Power supply effect less than 0.01 deg C per volt change.

.3 Output signal: 4 - 20 mA into 500 ohm maximum load.

.4 Input and output short circuit and open circuit protection.

.5 Output variation: less than 0.2 % of full scale for supply voltage variation of plus or minus 10 %.

.6 Combined non-linearity, repeatability, hysteresis effects: not to exceed plus or minus 0.5 % of full scale output.

.7 Maximum current to 100 ohm RTD sensor: not to exceed 22.5 mA.

.8 Integral zero and span adjustments.

.9 Temperature effects: not to exceed plus or minus 1.0 % of full scale/ 50 °C.

.10 Long term output drift: not to exceed 0.25 % of full scale/ 6 months.

.11 Transmitter ranges: Select narrowest range to suit application from following:

.1 Minus 50 °C to plus 50 °C, plus or minus 0.5 °C.

.2 0 to 100 °C, plus or minus 0.5 °C.

.3 0 to 50 °C, plus or minus 0.25 °C.

.4 0 to 25 °C, plus or minus 0.1 °C.

.5 10 to 35 °C, plus or minus 0.25°C.

2.4 HUMIDITY SENSORS

.1 Requirements:

.1 Range: 5 - 95 % RH minimum.

.2 Operating temperature range: -40°C to 85°C.

.3 Absolute accuracy:

.1 Duct sensors: plus or minus 5 %.

.2 Room sensors: plus or minus 2 %.

.4 Sheath: stainless steel with integral shroud for specified operation in air streams of up to 10 m/s.

.5 Maintenance: by simple field method such as washing with solvent or mild detergent solution so as to remove anticipated airborne contaminants.

.6 Maximum sensor non-linearity: plus or minus 0.5% RH with defined curves.

.7 Room sensors: wall mounted as indicated.

.8 Duct mounted sensors: locate so that sensing element is between 1/3 and 2/3 distance across any duct dimension.

.9 Sensors to be unaffected by external transmitters such as walkie-talkies. Demonstrate to Owner.

.10 Power supply: 18-35 V dc, 18-32 Vac with temperature sensor.

2.5 HUMIDITY TRANSMITTERS

.1 Requirements:

.1 Input signal: from 1000 ohm RTD.

.2 Output signal: 4 - 20 mA into 1000 ohm maximum load, 0-5 Vdc, 0-10 Vdc.

.3 Input and output short circuit and open circuit protection.

.4 Output accuracy: not to exceed 0.1 % of full span.

.5 Output linearity error: plus or minus 1.0 % maximum of full scale output.

.6 Integral zero and span adjustment.

.7 Temperature range: 0-70^{o}C, -40^{o}C to 85^{o}C for outside air.

.8 Long term output drift: not to exceed 0.25 % of full scale output/ 6 months.

2.6 PRESSURE/CURRENT (P/I) TRANSMITTERS

.1 Requirements:

.1 Range: as indicated in I/O summaries.

.1 Pressure sensing elements: bourdon tube, bellows or diaphragm type.

.2 Internal materials: suitable for continuous contact with industrial standard instrument air, compressed air, water, steam, as applicable.

.2 Output signal: 4 - 20 mA, 0-5V, 0-10V.

.3 Output variations: + 1 % full scale for supply voltage variations of plus or minus 10 %.

.4 Combined non-linearity, repeatability, and hysteresis effects: not to exceed plus or minus 1% of full scale output over entire range.

.5 Integral zero and span adjustment.

.6 Temperature effects: not to exceed plus or minus 1.5 % full scale/ 50 °C.

.7 Over-pressure input protection to at least twice rated input pressure.

.8 Output short circuit and open circuit protection.

.9 Pressure ranges: see I/O Summaries.

.10 Accuracy: plus or minus 1 % of full scale.

.11 LCD Display.

2.7 DIFFERENTIAL PRESSURE (KPA) TRANSMITTERS

.1 Requirements:

.1 Internal materials: suitable for continuous contact with industrial standard instrument air, compressed air, water, steam, as applicable.

.2 Output signal: 4 - 20 mA, 0-5V, 0-10V.

.3 Output variations: + 1 % full scale for supply voltage variations of plus or minus 10 %.

.4 Combined non-linearity, repeatability, and hysteresis effects: not to exceed plus or minus 1 % of full scale output over entire range.

.5 Integral zero and span adjustment.

.6 Temperature effects: not to exceed plus or minus 1.5 % full scale/ 50 °C.

.7 Over-pressure input protection to at least twice rated input pressure.

.8 Output short circuit and open circuit protection.

.9 The unit to have a NPT connections. The enclosure shall be an integral part of the unit.

.10 LCD Display.

2.8 DIFFERENTIAL PRESSURE (PA) TRANSMITTERS

.1 Requirements:

.1 Output signal: 4 - 20 mA in 400 ohms, 0-5V into 5K ohms minimum, 0-10 V into 10K ohms minimum.

.2 Output variations: + 1% full scale for supply voltage variations of plus or minus 10%.

.3 Integral zero and span adjustment.

.4 Temperature effects: not to exceed plus or minus 3% full scale/ 50 °C.

.5 Output short circuit and open circuit protection.

.6 The unit to have a NPT ½ conduit connection. The enclosure shall be an integral part of the unit.

.7 Pressure ranges: see I/O Summaries.

.8 LCD Display.

2.9 FAN SYSTEM STATIC PRESSURE SENSORS

.1 As per 2.10

2.10 FAN SYSTEM STATIC PRESSURE TRANSMITTERS

.1 Requirements:

.1 Output signal: 4 - 20 mA in 400 ohms, 0-5V into 5K ohms minimum, 0-10 V into 10K ohms minimum.

.2 Output variations: + 1% full scale for supply voltage variations of plus or minus 10%.

.3 Integral zero and span adjustment.

.4 Temperature effects: not to exceed plus or minus 3% full scale/ 50 °C.

.5 Output short circuit and open circuit protection.

.6 The unit to have a NPT ½ conduit connection. The enclosure shall be an integral part of the unit.

.7 Pressure ranges: see I/O Summaries.

.8 LCD Display.

2.11 DUCT SYSTEM VELOCITY PRESSURE SENSORS

.1 Requirements:

.1 Multipoint static and total pressure sensing element with self-averaging manifold with integral air equalizer and straightener section.

.2 Maximum pressure loss: 37 Pa at 1000 m/s.

.3 Accuracy: plus or minus 1 % of actual duct velocity.

2.12 FAN SYSTEM VELOCITY PRESSURE TRANSMITTERS

.1 Requirements:

.1 Output signal: 4 - 20 mA linear into 500 ohm maximum load.

.2 Calibrated span: not to exceed 25 % of duct velocity pressure at maximum flow.

.3 Accuracy: 0.4 % of span.

.4 Repeatability: within 0.1 % of output.

.5 Linearity: within 0.5 % of span.

.6 Deadband or hysteresis: 0.1 % of span.

.7 External exposed zero and span adjustment.

.8 The unit to have a NPT ½ conduit connection. The enclosure shall be an integral part of the unit.

2.13 PRESSURE AND DIFFERENTIAL PRESSURE SENSORS AND SWITCHES

.1 Requirements:

.1 Range: as indicated in I/O summaries.

.1 Pressure sensing elements: bourdon tube, bellows or diaphragm type.

.2 Adjustable setpoint and differential.

.3 Switch: snap action type, rated at 120V, 15 amps AC or 24 V DC.

.4 Sensor assembly: to operate automatically and reset automatically when conditions return to normal. Over-pressure input protection to at least twice rated input pressure.

.5 Accuracy: within 2% repetitive switching.

.6 Provide sensor pressure and accuracy ratings:

.1 Chilled and condenser water: 860 kPa.

.2 Hot water: 860 kPa.

.3 Low pressure steam, compressed air: 1050 kPa. Range: 0 to 200 kPa. Accuracy: plus or minus 3 kPa.

.4 Medium pressure steam, compressed air: 1050 kPa. Range: 0 to 700 kPa. Accuracy: plus or minus 7 kPa.

.5 High pressure steam: 2100 kPa. Range: 0 to 2100 kPa. Accuracy: plus or minus 14 kPa.

.6 High temperature water: 2700 kPa. Range: 0-2700 kPa. Accuracy: plus or minus 25 kPa.

.7 For fan operation: Range: 0 to 3000 Pa. Adjustable differential: 10 to 300 Pa.

.7 Provide sensors with isolation valve and snubber between sensor and pressure source on liquid service.

.8 Sensors on steam and high temperature hot water service: provide pigtail syphon.

2.14 TEMPERATURE SWITCHES

.1 Requirements:

.1 Range: see I/O summaries.

.2 Temperature sensor: liquid, vapour or bimetallic type. Operate automatically. Reset automatically, except as follows:

.1 Freeze protection: manual reset. Optional if software does not auto restart.

.2 Fire detection: manual reset. Optional if software does not auto restart.

.3 Duct Heater: high limit manual reset in addition to automatic reset.

.3 Adjustable setpoint and differential.

.4 Accuracy: plus or minus 1 °C.

.5 Snap action rating: 120V, 15 amps or 24V DC as required. Switch to be DPST for hardwire and EMCS connections.

.6 Type as follows:

.1 Room: for wall mounting on standard electrical box with or without protective guard as indicated.

.2 Duct, general purpose: insertion length = 460 mm.

.3 Thermowell: stainless steel, with compression fitting for NPS 3/4 thermowell. Immersion length: 100 mm.

.4 Freeze detection: continuous element with 6000 mm insertion length, duct mounting, to detect coldest temperature in any 300 mm length.

.5 Strap-on: with helical screw stainless steel clamp.

2.15 ELECTRICAL RELAYS

.1 Requirements:

.1 Double voltage, DPDT, plug-in type with termination base.
.2 Coils: rated for 120V AC or 24V DC. Other voltage: provide transformer.
.3 Contacts: rated at 5 amps at 120 V AC.
.4 Relay to have visual status indication

2.16 SOLID STATE RELAYS

.1 Requirements:

.1 CSA approved.
.2 Suitable to the application as recommended by manufacturer.
.3 Voltage range: 75-265 VAC
.4 Panel mounting.
.5 Suitable for AC or DC loads.
.6 Output surge absorbing element for inductive on/off loads.
.7 Input capacitor/resistor circuit for pulse noise absorption.
.8 For input inductive noise use twisted-pair wires for electromagnetic noise and shielded cable for static noise.

2.17 CURRENT TRANSDUCERS

.1 Requirements:

.1 Range: in accordance with Equipment Schedules.
.2 Purpose: measure line current and produce proportional signal in one of following ranges:
  .1 4-20 mA DC.
  .2 0-5 volt DC.
  .3 0-10 volts DC.
  .4 2-10 volts DC.
.3 Frequency insensitive from 10 - 80 hz.
.4 Accuracy to 0.5% full scale.
.5 Zero and span adjustments. Field adjustable range to suit motor applications.
.6 Adjustable mounting bracket to allow for secure/safe mounting inside the MCC or starter enclosure.

2.18 CURRENT SENSING RELAYS

.1 Requirements:

.1 Complete with metering transformer ranged to match load, plug-in base and shorting shunt to protect current transformer when relay is removed from socket.

.2 Suitable for single or 3 phase metering into single relay.

.3 To have adjustable latch level, adjustable delay on latch and minimum differential of 10 % of latch setting between latch level and release level.

.4 3-Phase application: provide for discrimination between phases.

.5 To have adjustable latch level to allow detection of worst case selection. To be powered from control circuit of motor starter being metered. Relay and base to be mounted in adjacent auxiliary cabinet only if control circuit power to be brought into auxiliary cabinet. Adjustments to be acceptable from auxiliary cabinet.

.6 Relay contacts: capable of handling 10 amps at 240 V AC.

2.19 CONTROL DAMPERS

.1 Construction: blades, 152 mm wide, 1219 mm long, maximum. Modular maximum size, 1219 mm wide x 2438 mm high. Multiple sections to have stiffening mullions and jack shafts.

.2 Materials

.1 Frame: 2.3 mm minimum thickness galvanized steel.

.2 Blades: galvanized steel with two sheets 0.5 mm thick or otherwise reinforced to ensure specified low leakage when fully closed.

.3 Bearings: oil impregnated sintered bronze. Provide thrust bearings for vertical blades.

.4 Linkage and shafts: zinc plated steel.

.5 Seals: replaceable neoprene or stainless steel spring on sides, top, bottom of frame, along all blade edges and blade ends.

.3 Performance:

.1 Capacity: refer to I/O Summaries.

.2 0.02 L/s.m 2 maximum allowable leakage against 1000 Pa static pressure.

.3 Temperature range: minus 50°C to plus 100°C.

.4 Arrangements: dampers mixing warm and cold air to be parallel blade, mounted at right angles to each other, with blades opening to mix air stream.

2.20 ELECTRONIC CONTROL DAMPER OPERATORS

.1 Requirements

.1 Push-pull proportional type as indicated.

.2 Spring return for "fail-safe" in Normally Open or Normally Closed position as indicated.

.3 Operator: size so as to control dampers against maximum pressure or dynamic closing pressure (whichever is greater).

.4 Power requirements: 5 VA maximum at 24 V AC.

.5 Operating range: 4-20 mA. 0-10 V DC, 2-10 V DC.

2.21 CONTROL VALVES

.1 Requirements:

.1 NPS 2 and under: bronze with screwed ends.
.2 NPS 2 1/2 and over: cast iron with flanged ends.
.3 Trim: type 316 stainless steel.
.4 Leakage: 0.5 % of rated flow maximum.
.5 Two or three port as indicated. Normally Open or Normally Closed, as indicated.
.6 Flow characteristics: linear or equal percentage as indicated.
.7 Rangeability: 50:1 minimum.
.8 Performance: Capacity refer to I/O Summaries and Valve Schedule.

2.22 ELECTRONIC/ELECTRIC VALVE ACTUATORS

.1 Requirements:

.1 Construction: steel, cast iron, aluminum.
.2 Control voltage: 0-5, 0-10, 2-10V DC, or 4-20 mA.
.3 Positioning time: to suit application, 90 sec maximum.
.4 Spring return to normal position as indicated.

2.23 PANELS

.1 Either free-standing or wall mounted enameled steel cabinets with hinged and key-locked front door.

.2 To be modular multiple panels as required to handle requirements with additional space to accommodate future capacity as required by Owner without adding additional cabinets.

.3 Panels to be lockable with same key.

2.24 ELECTRONIC AIR FLOW MEASUREMENT STATIONS AND TRANSMITTERS

.1 Each station to contain an array of velocity sensing elements and straightening vanes inside a flanged sheet metal casing. The velocity sensing elements to be of the thermal, temperature compensated thermistor type, with linearizing means. The sensing elements to be distributed across the duct cross section in the quantity and pattern set forth for measurements and instruments of ASHRAE and SMACNA for the traversing of ducted air flows. The resistance to air flow through the airflow measurement station not to exceed 20 Pa gauge at an airflow of 10 m/s. Station construction suitable for operation at airflows of up to 25 m/s over a temperature range of 5 to 50 degrees C, and accuracy plus or minus 3 percent over a range of 0.625 to 12.5 m/s scaled to air volume.

.2 Transmitters to produce a linear, temperature compensated 4-20 mAdc output corresponding to the required velocity pressure measurement. The transmitter to be a 2-

wire, loop powered device with local indication where indicated. The output error of the transmitter not to exceed 0.5 percent of the calibrated measurement.

PART 3 EXECUTION.

3.1 INSTALLATION

.1 Install field control devices, conduit and wire in accordance with manufacturers recommended methods, procedures and instructions. Wiring and conduit above 50 volts by electrical Division. Coordinate requirements with Electrical Contactor.

.2 Temperature transmitters, humidity transmitters, current-to-pneumatic transducers, solenoid air valves, controllers, relays: install in CSA 2 enclosures or as required for specific applications. Provide for electrolytic isolation in all cases when dissimilar metals make contact.

.3 Support field-mounted transmitters, sensors on pipe stands or channel brackets.

.4 Install wall mounted devices on plywood panel properly attached to wall.

3.2 TEMPERATURE AND HUMIDITY SENSORS

.1 Stabilize to ensure minimum field adjustments or calibrations.

.2 To be readily accessible and adaptable to each type of application so as to allow for quick easy replacement and servicing without special tools or skills.

.3 Outdoor installation:

.1 Protect from solar radiation and wind effects by stainless steel shields.

.2 Install in CSA 4X enclosures.

.4 Duct installations

.1 Do not mount in dead air space.

.2 Location to be within sensor vibration and velocity limits.

.3 Securely mount extended surface sensor used to sense average temperature.

.4 Thermally isolate elements from brackets and supports so as to respond to air temperature only.

.5 Support sensor element separately from coils, filter racks.

.5 Averaging duct type temperature sensors:

.1 Sensor length to be not less than 1000 mm per square metre of duct cross-sectional area.

.2 Use multiple sensors where single sensor does not meet minimum length ratio. Wire multiple sensors in series for freeze protection applications.

.3 Wire multiple sensors separately for temperature measurement.

.4 Use either software averaging algorithm to derive overall average for control purposes or separate inputs, based on site requirements.

.6 Thermowells: install for piping installations. Where pipe diameter is less than well insertion length, locate well in elbow. Thermowell to restrict flow by less than 30%.

3.3 PANELS

.1 Arrange for conduit and tubing entry from top, bottom or either side.

.2 Use modular multiple panels if necessary to handle all requirements, with space for additional 20% PCU or FID if applicable without adding additional panels. Space to accommodate maximum capacity of associated controller (ECU, LCU, MCU, PCU, TCU).

.3 Wiring and tubing within panels: locate in trays or individually clipped to back of panel.

.4 Identify wiring and conduit clearly.

3.4 PRESSURE AND DIFFERENTIAL PRESSURE SWITCHES

.1 Install isolation valve and snubber on sensors between sensor and pressure source. In addition, protect sensing elements on steam and high temperature hot water service with pigtail syphon between valve and sensor.

3.5 IDENTIFICATION

.1 Identify field devices properly.

.2 Refer to Section 25 05 54 - EMCS: Identification.

3.6 AIR FLOW MEASURING STATIONS

.1 Cap manifold until cleaning of ducts is completed.

3.7 TESTING

.1 Calibrate and test field devices for accuracy and performance. Submit report detailing tests performed, results obtained to Owner for approval. Owner will verify results at random. Provide testing equipment and manpower necessary for this verification.

3.8 COMMISSIONING

.1 Refer to Section 25 08 20 - EMCS: Warranty and Maintenance.

END OF SECTION

PART 1 GENERAL

1.1 DESCRIPTION

.1 This specification describes a high performance variable frequency drive (VFD) used to control the speed of a NEMA design B induction motor.

.2 Load filters shall be supplied with all drives.

.3 A building automation system serial communication module and EMCS communication card shall be supplied with all drives.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

.3 Section 01 91 13.13 – Commissioning (Cx) Requirements.

1.3 REFERENCES

.1 Institute of Electrical and Electronic Engineers (IEEE)

.1 Standard 519 Guide for Harmonic Content and Control.

.2 Underwriters laboratories (ULC)

.1 UL508C Power Conversion Equipment

.3 National Electrical Manufacturer's Association (NEMA)

.1 ICS 7.0, AC Adjustable Speed Drivers

.4 International ElectroTechnical Commission (IEC)

.1 IEC 61800 Adjustable Speed Electrical Power Drive Systems

.5 International Standards Organization (ISO)

.1 ISO-9001 Quality Management Systems

1.4 SUBMITTALS

.1 Submittals shall include the following information:

.1 Outline dimensions, conduit entry locations and weight.
.2 Customer connection and power wiring diagrams.
.3 Complete technical product description include a complete list of options provided.

.4 Compliance to IEEE 519 – harmonic analysis for particular jobsite including total harmonic voltage distortion and total harmonic current distortion (TDD).

.1 The VFD manufacturer shall provide calculations; specific to this installation, showing total harmonic voltage distortion is less than 5%. Input line filters shall be sized and provided as required by the VFD manufacturer to ensure compliance with IEEE standard 519. All VFD's shall include a minimum of 5% impedance reactors, no exceptions.

.5 In accordance with Section 01 33 00 - Submittal Procedures.

1.5 QUALITY ASSURANCE

.1 The VFD manufacturing facility shall be ISO 9001 certified. The VFD shall be UL listed, Canadian UL listed, CSA listed, IEEE listed, and NEMA listed.

.2 All printed circuited boards shall be completely tested and burned-in before being assembled into the completed VFD. The VFD shall then be subjected to a preliminary functional test, burn-in, and computerized final test. The burn-in shall be at 40°C, at full rated load, or cycled load. Drive input power shall be continuously cycled for maximum stress and thermal variation. Conformal coating of boards shall be included for each drive.

.3 The drive shall be designed to provide 250 000 hours mean time before failure (MTBF) when the specified preventative maintenance is performed.

.4 VFD manufacturer shall have an analysis laboratory to evaluate the failure of any component. The failure analysis lab shall allow the manufacturer to perform complete electrical testing, x-ray components, and decap or delaminate components and analyze failures within the component.

PART 2 PRODUCTS

2.1 VARIABLE FREQUENCY DRIVES

.1 The VFD package as specified herein shall be enclosed in a NEMA Type 1 or optional NEMA 12 enclosure, completely assembled and tested by the manufacturer in an ISO9001 facility. The VFD tolerated voltage window shall allow the VFD to operate from a line of +30% nominal, and -35% nominal voltage as a minimum.

.1 Environmental operating conditions: 0 to 40°C continuous duty. VFD's that can operate at 40° C intermittently (during a 24 hour period) are not acceptable and must be oversized. Altitude 0 to 1000m above sea level, less than 95% humidity, non-condensing.

.2 Enclosure shall be type NEMA 1 and shall be UL listed as a plenum rated VFD. VFD's without these ratings are not acceptable.

.2 All VFD's shall have the following standard features:

.1 All VFD's shall have the same customer interface, including digital display, and keypad, regardless of horsepower rating. The keypad shall be removable, capable of remote mounting and allow for uploading and downloading of parameter settings as an aid for start-up of multiple VFD's.

.2 The keypad shall include Hand-Off-Auto selections and manual speed control. The drive shall incorporate "bumpless transfer" of speed reference when switching between "Hand" and "Auto" modes. There shall be fault reset and "Help" buttons on the keypad. The Help button shall include "on-line" assistance for programming and troubleshooting.

.3 There shall be a built-in time clock in the VFD keypad. The clock shall be used to date and time stamp faults and record operating parameters at the time of fault. The clock shall also be programmable to control start/stop functions, constant speeds, PID parameter sets and output relays.

.4 The VFD's shall utilize pre-programmed application macros specifically designed to facilitate start-up. The Application Macros shall provide one command to reprogram all parameters and customer interfaces for a particular application to reduce programming time.

.5 The VFD shall be capable of starting into a coasting load (forward or reverse) up to full speed and accelerate or decelerate to setpoint without safety tripping or component damage (flying start).

.6 The VFD shall have the ability to automatically restart after an over-current, over-voltage, under-voltage, or loss of input signal protective trip. The number of restart attempts, trial time, and time between attempts shall be programmable.

.7 The VFD shall have an integral 5% impedance reactor to reduce the harmonics to the power line and to add protection from AC line transients. The 5% impedance may be from dual (positive and negative DC bus) reactors, or 5% AC line reactors. VFD's with only one DC reactor shall add AC line reactors.

.8 The VFD shall include a coordinated AC transient protection system consisting of 4-120 joule rated MOV's (phase to phase and phase to ground), a capacitor clamp, and 5% impedance reactors.

.9 The VFD shall be capable of sensing a loss of load (broken belt / broken coupling) and signal the loss of load condition. The drive shall be programmable to signal this condition via a keypad warning, relay output and/or over the serial communications bus. Relay outputs shall include programmable time delays that will allow for drive acceleration from zero speed without signaling a false underload condition.

.10 If the input reference (4-20mA or 2-10V) is lost, the VFD shall give the user the option of either (1) stopping and displaying a fault, (2) running at a programmable preset speed, (3) hold the VFD speed based on the last good reference received, or (4) cause a warning to be issued, as selected by the user. The drive shall be programmable to signal this condition via a keypad warning, relay output and/or over the serial communication bus.

.3 All VFD's to have the following adjustments:

.1 Two (2) PID Setpoint controllers shall be standard in the drive. Two (2) programmable analog inputs shall accept current or voltage signals.

.2 Two (2) programmable analog outputs (0-20ma or 4-20 ma). The outputs may be programmed to output proportional to frequency, motor speed, output voltage, output current, motor torque, motor power (kW), DC bus voltage, active reference, and other data.

.3 Six (6) programmable digital inputs. There shall be a run permissive circuit for damper or valve control. Regardless of the source of a run command (keypad, input contact closure, time-clock control, or serial communications) the VFD shall provide a dry contact closure that will signal the damper to open (VFD motor does not operate). When the damper is fully open, a normally open dry contact (end-switch) shall close. The closed end-switch is wired to a VFD digital input and allows VFD motor operation. Two separate safety interlock inputs shall be provided. When either safety is opened, the motor shall be commanded to coast to stop, and the damper shall be commanded to close. The keypad shall display "start enable 1 (or 2) missing". The safety status shall also be transmitted over the serial communications bus. All digital inputs shall be programmable to initiate upon an application or removal of 24VDC.

.4 Three (3) programmable digital Form-C relay outputs. The relays shall include programmable on and off delay times and adjustable hysteresis. Default settings shall be for run, not faulted (fail safe), and run permissive. The relays shall be rated for maximum switching current 6 amps at 30 VDC and 250 VAC and 0.4 A at 120 VDC; Maximum voltage 300 VDC and 250 VAC; continuous current rating 2 amps RMS. Outputs shall be true form C type contacts; open collector outputs are not acceptable.

.5 The VFD shall include a motor flux optimization circuit that will automatically reduce applied motor voltage to the motor to optimize energy consumption and audible motor noise.

.6 The VFD shall include a carrier frequency control circuit that reduces the carrier frequency based on actual VFD temperature that allows the highest carrier frequency without derating the VFD or operating at high carrier frequency only at low speeds.

.4 Serial Communications

.1 The VFD shall have an RS-485 port as standard. The standard protocols shall be Modbus, Johnson Controls N2 bus, and Siemens Building Technologies FLN, protocols for LonWorks, BACnet, Profibus, Ethernet, and DeviceNet shall be available. Each individual drive shall have the protocol in the base VFD. The use of third party gateways and multiplexers is not acceptable. All protocols shall be "certified" by the governing authority. Use of non-certified protocols is not allowed.

.2 Serial communication capabilities shall include, but not be limited to; run-stop control, speed set adjustment, proportional/integral/derivative PID control adjustments, current limit, accel/decel time adjustments, and lock and unlock the keypad. The drive shall have the capability of allowing the DDC to monitor

feedback such as process variable feedback, output speed / frequency, current (in amps), % torque, power (kW), kilowatt hours (resettable), operating hours (resettable), and drive temperature. The EMCS shall also be capable of monitoring the VFD relay output status, digital input status, and all analog input and analog output values. All diagnostic warning and fault information shall be transmitted over the serial communications bus. Remote VFD fault reset shall be possible. The following additional status indications and settings shall be transmitted over the serial communications bus – keypad "Hand" or "Auto" selected, the ability to change the PID setpoint, and the ability to force the unit to bypass. The EMCS system shall also be able to monitor if the motor is running in the VFD mode or bypass mode (if bypass is specified) over serial communications. A minimum of 15 field parameters shall be capable of being monitored.

.3 The VFD shall allow the EMCS to control the drive's digital and analog outputs via the serial interface. This control shall be independent of any VFD function.

.5 EMI / RFI filters. All VFD's shall include EMI/RFI filters. The onboard filters shall allow the VFD assembles to be CE Marked and the VFD shall meet product standard EN 61800-3 for the First Environment restricted level.

PART 3 PART 3 – EXECUTION

3.1 INSTALLATION

.1 Installation shall be the responsibility of the EMCS contractor. The contractor shall install the drive in accordance with the recommendations of the VFD manufacturer as outlined in the installation manual.

.2 Power wiring shall be completed by the electrical contractor. Three copper conductors and a ground wire are required. Separate the input power wiring from the output power wiring in individual metallic conduit. Do not combine. Provide a separate metallic conduit for control wiring. The contractor shall complete all wiring in accordance with the recommendations of the VFD manufacturer as outlined in the installation manual.

3.2 START-UP

.1 Certified factory start-up shall be provided for each drive by a factory authorized service center in accordance with Section 01 91 13.13 – Commissioning (Cx) Requirements and Section 26 05 00 Common Work Results - Electrical. A certified start-up form shall be filled out for each drive with a copy provided to the owner, and a copy kept on file at the manufacturer.

3.3 PRODUCT SUPPORT

.1 Factory trained application engineering and service personnel that are thoroughly familiar with the VFD products offered shall be locally available at both the specifying and installation locations. A 24/365 technical support line shall be available on a toll-free line.

3.4 WARRANTY

.1 Warranty shall be 24 months from the date of certified start-up, not to exceed 30 months from the date of shipment. The warranty shall include all parts, labor, travel time and expenses. There shall be 365/24 support available via a toll free phone number.

END OF SECTION

PART 1 GENERAL

1.1 DESIGN DOCUMENTATION

.1 Design documentation for each system to include, as a minimum:

- .1 Narrative type of Sequence of Operation.
- .2 Control Description Logic (CDL).
- .3 Input/Output Summary Schedules.
- .4 Schematics.

1.2 EMCS LANGUAGE DESIGN CRITERIA

.1 Language: refer to Section 25 05 01 - EMCS: General Requirements.

.2 Levels of EMCS Language

- .1 Level 1: alarm and operational messages to convey alarm conditions or operational messages.
- .2 Level 2: full names of equipment and control points. The various systems, their equipment and components and all control points are named in accordance with this section.
- .3 Level 3: system, equipment, component and control point descriptors: unique, alphanumeric identifiers derived from full names of corresponding system component and control point.
- .4 Level 4: commands: represent various computer functions and routines.
  - .1 Operational commands - relate to building operations and building system controls.
  - .2 Computer system commands - relate to computer maintenance, upgrading or development software used to improve and maintain the application software for the building site.
- .5 Level 5: machine language. Languages specific to each manufacturer's product, used internally to perform its functions and routines.

.3 Additional Equipment, Components and/or Control Points. Where additional equipment, components and/or control points are required on specific projects, the following procedures shall be adopted:

- .1 Full names of the equipment, component and control points shall be not more than 40 characters, including numerals.
- .2 SYSTEM descriptors shall be not more than 10 alphanumeric characters. INPUT and OUTPUT descriptors shall be not more than 10 alphanumeric characters. The letters shall be based upon the English/French language full name, and should, where possible, be the first letter of each word of the full name.

.4 The descriptor shall be unique.

.5 Descriptors and expansions: table lists standardized system identifiers and point identifiers.

.1 Table:

Identifiers and Expansions

English Identifier (10 characters max)	English Expansion (40 characters max)
OAD	Outside air damper
OAT	Outside air temperature
OAH	Outside air humidity
OAV	Outside air volume
RAD	Return air damper
RAT	Return air temperature
RAH	Return air humidity
RASP	Return air static pressure
MAD	** Mixed air dampers **
MAT	Mixed air temperature
MAPSP	Mixed air plenum static pressure

** MAD shall be used for applications where outside air and return air dampers are controlled from one (1) only output signal.

EAD	Exhaust air damper
PFPD	Pre-filter pressure drop
PFALM	Pre-filter pressure drop alarm
FFPD	Final filter pressure drop
FFALM	Final filter pressure drop alarm
HCVLV	Heating coil valve
HCVLVC	Heating coil valve control
HCVLVS	Heating coil valve status
BPD	Heating coil face and bypass damper
HCFA	Heating coil freeze alarm
CCVLV	Cooling coil valve
CCVLVC	Cooling coil valve control

CCVLVS	Cooling coil valve status
SVLV	Steam valve
SVLVC	Steam valve control
SVLVS	Steam valve status
SF#-C	Supply fan # control
SF#-S	Supply fan # status
SF#-VSD	Supply fan # VSD control
SF#-VSDF	Supply fan # VSD fault
SAV	Supply air volume
SAVC	Supply air volume control
SAT	Supply air temperature
SAH	Supply air humidity
SAVP	Supply air velocity pressure
SASP	Supply air static pressure
RF#-C	Return fan #control
RF#-S	Return fan # status
RF#-VSD	Return fan # VSD control
RF#-VSDF	Return fan # VSD fault
RAV	Return air volume
RAVC	Return air volume control
RAT	Return air temperature
RAH	Return air humidity
RAVP	Return air velocity pressure
RASP	Return air static pressure
EF#-C	Exhaust fan # control
EF#-S	Exhaust fan s# status
EXAT	exhaust air temperature
EXAV	exhaust air volume
Chiller #1:	
CH1F	flow rate
CH1LWT	leaving chilled water temperature
CH1LWP	Leaving chilled water pressure
CH1EWT	Entering chilled water temperature
CH1EWP	Entering chilled water pressure
CD1EWT	Entering condenser water temperature
CD1EWP	Entering condenser water pressure

CD1LWT	Leaving condenser water temperature
CD1LWP	Leaving condenser water pressure
CHP1F	Chilled water pump #1 flow rate
CHP1DP	Chilled water pump #1 discharge pressure
CHP1S	Chilled water pump #1 status
CP3C	Circulating pump #3 control
CP3F	Circulating pump #3 flow rate
CP3DP	Circulating pump #3 discharge pressure
CP3S	Circulating pump #3 status
HTA	High temperature alarm
LTA	Low temperature alarm
HTCO	High temperature cutout
LTCO	Low temperature cutout
HLA	High level alarm
LLA	Low level alarm
HLCO	High level cutout
LLCO	Low level cutout
HWF	Heating water flow rate
HWST	Heating water supply temperature
HWRT	Heating water return temperature
STP	Steam pressure
STF	Steam flow rate
RM-T	Room temperature
RM-H	Room humidity
RM-SP	Room static pressure (add reference point)

Examples of specific space conditions:

RM-TNPER 2	Space temperature, North Perimeter, 2nd floor
RM-SPSPER I9	Space static pressure, South Perimeter, 19th floor
RM-HEINT 9	Space humidity, East Interior, 9th floor
AFS	Air Flow Switch
AFM	Air Flow Monitor
F	Flow
P	Pressure

ST	Supply temperature
RT	Return temperature
FA	Fire alarm
FTA	Fire trouble alarm
CW	Chilled water system
CD	Condenser Water System
HWH	Hot water heating system
RADN	Radiation system
CDR	Condensate return system
HPS	Steam - High pressure system
LPS	Steam - Low pressure system
DCW	Domestic cold water system
DHW	Domestic hot water system
DHWR	Domestic hot water system Recirculation
SANP	Sanitary sewage - pumped system
STMP	Storm water - pumped system
SPRD	Sprinkler - Dry pipe system
SPRW	Sprinkler - Wet pipe system
FSTP	Fire standpipe & hose system
VBA	Volume Box Control Assembly

1.3 I/O SUMMARY SCHEDULES

.1 General:

.1 The EMCS contractor shall provide a complete I/O summary schedule similar to the one listed below, listing and describing all I/O's in detail. Contractor's standard schedule may be used provided all relevant information is provided.

.2 PCU no: identifies the PCU to which all points in the I/O Summary Schedule are wired.

.3 Building/Area: unique label given to each building forming part of a multi-building facility.

.4 Area/System Label: unique label given to each area of the building or to each system.

.1 Column 1: Point no: I/O Summary Schedule reference number.

.2 Column 2: Point label: unique label for each point in the system. Point labels may be repeated for other buildings or systems.

.3 Column 3: Description: describes the point label in expanded terms.

.4 Column 4: Type: (eg. AI, AO, DI, DO).

.5 Column 5: Eng. Units: Describes the engineering units used (eg. for AI, AO: C, kPa, Amp Volt. For DI, DO: OFF, ON).

.6 Column 6: Access level: Defines the level of access for varying complexity of functions. Usually associated with password feature. Usually assigned value between 0 (lowest) and 4 (highest).

.7 Column 7: Sensor type: describes in 2 or 3words.

.8 Column 8: Assoc. Point: Identifies/ describes points for purposes of alarm suppression, software interlocks.

.9 Column 9: Type: defines the type of alarm (eg. CR = CRITICAL, CA = CAUTIONARY, M = MAINTENANCE).

.10 Column 10: DI/DO, NO/NC: defines the NORMAL condition of alarm. (NC = NORMALLY CLOSED. NO = NORMALLY OPEN).

.11 Column 11: Limits: Defines alarm levels (eg. L2 = Low alarm, Level2. H1 = High alarm, Level1).

.12 Column 12: Alarm Mess: Defines alarm message number. This number is related to pre-composed message detailing the problem and describing the required action.

.13 Column 13: Maint Mess: defines maintenance message number. This number as related to pre-composed message detailing the problem and describing the required action.

.14 Column 14: Set Point: Defines the design set-point of the control loop.

.15 Column 15: Dead band: defines the range above or below the set-point at which no change in output signal is to occur.

.16 Column 16: Dev alarm limit: defines the limit on deviation of the measured value from the set-point (sometimes also referred to as the "error limit").

.17 Column 17: NC/NO: defines NORMAL condition when de-energized. NC - NORMALLY CLOSED. NO = NORMALLY OPEN. DA/RA: defines the form of action. DA = direct acting. RA = REVERSE ACTING.

.18 Column 18: Contacts: NO/NC: defines NORMAL condition when de-energized. NC = NORMALLY CLOSED. NO = NORMALLY OPEN.

.19 Column 19: Delay Succ starts: defines the time limits (usually in seconds). To prevent overheating of motors or equipment from frequent re-starting.

.20 Column 20: Heavy motor delay: defines the time (usually up to 60seconds). To prevent heavy electrical load from simultaneous starting of large consumption equipment.

.21 Column 21: auto-reset: A = AUTOMATIC. M=MANUAL.

.22 Column 22: Programs:

.1 Examples of Applications Programs include: Night set-back; optimum start/stop; demand limiting (load shedding).

.2 Optimization routines (eg. chiller optimization, supply air temperature optimization, enthalpy control) should be described as part of CDL's.

.3 Parameters for all application programs should be provided separately as part of the design documentation (eg. the Systems Operation Manual).

.4 Note requirements for computer totalization, recording, print-out of accumulated value of a point over a period of time. If totalization depends upon a number of analog points, include for pseudo energy points.

.5 Run time totals: for calculation of operation of digital points.

.6 Optimum start/stop: Example: HVAC unit to start before scheduled occupancy, based upon HVAC unit capacity, heat loss, interior and exterior environmental conditions, etc.

.2 Schedule:

INPUT/OUTPUT			SCHEDULE PCU NO.					(see 1.3.2)		
PROJECT NO.			BLDG/AREA				NAME	(see 1.3.3)		
PROJECT NAME			AREA/SYSTEM				NAME	(see 1.3.3)		
POINT IDENTIFICATION								ALARMS		
1	2	3	4	5	6	7	8	9	10	11
Point. No	Point Label	Descrip	Type	Eng. Unit	Access Level	Sensor type	Assoc Point	Type (M,CR)	DI/D0 NO/NC	Limits

MESSAGES							DI/DO			
12	13	14	15	16	17	18	19	20	21	22
Alarm Limit	Maint	Set-Point MO/MA	Dead band start	Dev. alarm delay	NO/NC DA/RA	Cont's NO/NC	Delay succ.	Heavy Motor	Auto reset	Prog

1.4 CONTROL NARRATIVE SEQUENCE OF OPERATIONS

.1 Dual Deck Laboratory AHU Operation:

.1 The dual-deck air handling unit supply fan, return fan (RF-1), and exhaust fan (EF-1) shall normally operate on a preset daily schedule. When the system is off, the outside air damper shall be closed, the exhaust air damper shall be closed, the return air damper shall be open, and the return relief damper discharging to the mechanical room shall be closed. All heating coil control valves shall be closed. Glycol circulation pumps shall remain enabled for freeze protection. All temperature and pressure sensors shall continue to monitor, but no alarms shall be generated during unoccupied periods.

.2 To start the system, the EMCS controller shall command the unit on. The outside air damper shall open to the minimum position. When the outside air damper end switch proves open, the supply fan shall start. After a short adjustable time delay, the return fan RF-1 and exhaust fan EF-1 shall start. All fans shall ramp up under VFD control to their respective initial speed setpoints.

.3 The supply fan, return fan RF-1, and exhaust fan EF-1 shall be controlled by VFDs. The supply fan speed shall modulate to maintain supply duct static pressure in the hot and cold deck. The return fan shall modulate to maintain building pressure relative to outdoors. The exhaust fan shall track return fan airflow to maintain neutral pressure in the mechanical room plenum.

.4 Should any fan fail to prove operation via current sensing relay within an adjustable time period (initially set at 60 seconds) after a start command, the affected fan shall be shut down and an alarm shall be generated.

.5 Minimum outside air shall be maintained by modulating the outside air, return air, and exhaust air dampers. The minimum outside air position shall be initially set at 25 percent of design airflow. Mixed air temperature shall be prevented from falling below 12°C by limiting outside air damper position.

.6 During economizer operation, the EMCS controller shall modulate the outside air, return air, and exhaust air dampers to maintain the cold deck supply air temperature setpoint (initially set at 13°C). There is no mechanical cooling provided.

.7 When the outdoor air temperature rises above the economizer high limit setpoint (initially set at 18°C), the outside air damper shall return to the minimum position and economizer operation shall be disabled.

.8 A glycol preheat coil shall be provided in the mixed air section. The EMCS controller shall modulate the steam control valve serving the steam-to-glycol heat exchanger to maintain the preheat leaving air temperature setpoint. Two ECM glycol pumps shall be provided in duty/standby configuration. Pumps shall alternate on a weekly basis.

.9 Glycol pump status shall be monitored via current sensing. Failure of the duty pump shall generate an alarm and automatically enable the standby pump. A low glycol temperature alarm shall be generated if the glycol supply temperature falls below the freeze protection setpoint (initially set at 7°C).

.10 For cold deck temperature control in heating conditions, the preheat coil shall be used to maintain the cold deck supply air temperature setpoint. No cooling coil is provided.

.11 For hot deck temperature control, a steam reheat coil shall be provided. The EMCS controller shall modulate the hot deck steam control valve to maintain the hot deck discharge air temperature setpoint (initially set at 32°C). Hot deck air temperature shall be monitored downstream of the reheat coil.

.12 Dual-deck mixing boxes or terminal units shall proportion hot deck and cold deck air to satisfy zone temperature demands. Supply air temperature reset shall be enabled based on aggregate zone demand.

.13 The mechanical room shall act as a plenum for return air relief. A motorized return relief damper located upstream of the AHU mixing box shall modulate to discharge return air into the mechanical room as required. The exhaust fan EF-1 shall exhaust air from the mechanical room to outdoors.

.14 The return relief damper and exhaust air damper shall modulate in coordination with the return fan and exhaust fan to maintain building pressure setpoint. Mechanical room pressure shall be monitored to prevent over-pressurization.

.15 The system shall alarm if supply air temperature falls below the low temperature alarm setpoint (initially set at 10°C) or rises above the high temperature alarm setpoint (initially set at 30°C).

.16 Prefilter and final filter banks shall be monitored by differential pressure sensors. An alarm to indicate dirty filters shall be generated when the differential pressure exceeds the adjustable setpoint to be determined after air balancing.

.17 The EMCS controller shall monitor all damper end switches. Failure of any outdoor air, return air, exhaust air, or relief damper to reach its commanded position shall generate an alarm.

.18 Miscellaneous Safeties and Alarms:

.19 The supply fan, return fan RF-1, and exhaust fan EF-1 shall be shut down and an alarm generated upon any of the following conditions:

- .1 Smoke detector activation in the supply air stream
- .2 Low temperature limit sensor detects air temperature below 5°C
- .3 Supply duct static pressure exceeds +1200 Pa
- .4 Mechanical room pressure exceeds high limit setpoint

.20 Upon shutdown command, the supply fan shall stop first. The return fan RF-1 and exhaust fan EF-1 shall continue to operate for an adjustable purge period before stopping. All dampers shall then return to their normal shutdown positions.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

PART 1 GENERAL

1.1 GENERAL

.1 This Section covers items common to Sections of Division 26. This section supplements requirements of Division 1, Division 23, Division 27, Division 28, Division 33 and Division 34. Refer to Section 01 00 00 – Bid Depository Sections where applicable for bid depository.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

.2 CAN/CSA-22.3 No. 1, Overhead Systems.

.3 CAN3-C235, Preferred Voltage Levels for AC Systems, 0 to 50,000 V.

1.3 CARE, OPERATION AND START-UP

.1 Instruct Owner's Representative and operating personnel in the operation, care and maintenance of systems, system equipment and components.

.2 Operating instructions to include following:

.1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.

.2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.

.3 Safety precautions.

.4 Procedures to be followed in event of equipment failure.

.5 Other items of instruction as recommended by manufacturer of each system or item of equipment.

.3 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.

.4 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with all aspects of its care and operation.

1.4 DESIGN REQUIREMENTS

.1 Operating voltages: to CAN3-C235

.2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

1.5 SUBMITTALS

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Newfoundland and Labrador, Canada.

.2 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure coordinated installation.

.3 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.

.4 Indicate of drawings clearances for operation, maintenance, and replacement of operating equipment devices.

.5 Quality Control: in accordance with Section 01 45 00 - Quality Control.

.1 Provide CSA certified equipment and material. Where CSA certified equipment and material is not available, submit such equipment and material to authority having jurisdiction for approval before delivery to site.

.2 Submit test results of installed electrical systems and instrumentation.

.3 Submit, upon completion of Work, load balance report as described in sentence 3.4.6.

.4 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Owner's Representative.

.6 Manufacturer's Field Reports: submit to Owner's Representative within seven (7) working days of review, verifying compliance of Work and electrical system and instrumentation testing, as described in paragraph 3.6- FIELD QUALITY CONTROL.

1.6 PERMITS, FEES AND INSPECTION

.1 Submit to Electrical Inspection Division and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work.

.2 Pay associated fees.

.3 Owner's Representative will provide drawings and specifications required by Electrical Inspection Division and Supply Authority at no cost.

.4 Notify Owner's Representative of changes required by Electrical Inspection Division prior to making changes.

.5 Furnish Certificates of Acceptance from Electrical Inspection Division or authorities having jurisdiction on completion of work to Owner's Representative.

1.7 CO-ORDINATION

.1 Co-ordinate work with work of other divisions to avoid conflict.

.2 Locate distribution systems, equipment, and materials to provide minimum interference and maximum usable space.

.3 Locate all existing underground services and make all parties aware of their existence and location.

.4 Where interference occurs, Owner's Representative must approve relocation of equipment and materials regardless of installation order.

.5 Notwithstanding the review of shop drawings, this division may be required to relocate electrical equipment which interferes with the equipment of other trades, due to lack of co-ordination by this Division. The cost of this relocation shall be the responsibility of this Division. The Owner's Representative shall decide the extent of relocation required.

1.8 CUTTING AND PATCHING

.1 Inform all other divisions in time, concerning required openings. Where this requirement is not met, bear the cost of all cutting. Openings of 200 mm or smaller shall be the responsibility of Division 26. Openings larger than 200 mm shall be the responsibility of Division 1. Obtain written approval of Structural engineer before drilling any beams or floors.

1.9 PROTECTION

.1 Protect exposed live equipment during construction for personnel safety.

.2 Shield and mark all live parts "LIVE 120 VOLTS", or with appropriate voltage in English.

.3 Arrange for installation of temporary doors for rooms containing electrical distribution equipment. Keep these doors locked except when under direct supervision of electrician.

1.10 RECORD DRAWINGS

.1 Obtain and pay for three sets of white prints. As the job progresses, mark these prints to accurately indicate installed work. Have the white prints available for inspection at the site at all times and present for scrutiny at each job meeting.

.2 Show on the record drawings the installed inverts of all services entering and leaving the building and the property. Dimension underground services at key points of every run in relation to the structure and building.

.3 Indicate exact location of all services for future work. Show and dimension all work embedded in the structure.

.4 Submit record drawings prior to close-out of project.

1.11 INSPECTION OF WORK

.1 The Owner will make periodic visits to the site during construction to ascertain reasonable conformity to plans and specifications but will not execute quality control. The Contractor shall be responsible for the execution of his work in conformity with the construction documents and with the requirements of the inspection authority.

1.12 SCHEDULING OF WORK

.1 Work shall be scheduled in phases as per other divisions of the architectural specifications.

.2 Become familiar with the phasing requirements for the work and comply with these conditions.

.3 No additional monies will be paid for contractor's requirement to comply with work phasing conditions.

1.13 FIRE RATING OF PENETRATIONS

.1 Maintain fire ratings around conduits passing through floors, ceilings and fire rated walls.

.2 Use 3M brand or equal fire barrier products at each penetration.

.3 Acceptable products for fire barrier products shall be 3M #CP25 fire barrier caulk, #303 putty, #FS 195 wrap and #CS195 sheet.

.4 Acceptable manufacturers: Nelson, Fire Stop Systems, 3M or approved equal. Material of same manufacturer to be used throughout project..

PART 2 PRODUCTS

2.1 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

.1 Supplier and installer responsibility is indicated in Motor, Control and Equipment Schedule on electrical drawings and related mechanical responsibility is indicated on Mechanical Equipment Schedule on mechanical drawings, where applicable.

.2 Control wiring and conduit is specified in Division 26 except for conduit, wiring and connections below 50 V which are related to control systems specified in Division 25 and shown on mechanical drawings. Division 25 – EMCS Controls Contractor is responsible for all conduit, wiring and connections below 50V which are related to control systems in Division 25 and shall comply with the requirements of Division 26 for standard of quality..

2.2 MATERIALS AND EQUIPMENT

.1 Provide materials and equipment in accordance with Section 01 61 00 - Common Product Requirements.

.2 Equipment and material to be CSA certified. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from Electrical Inspection Division.

.3 Factory assemble control panels and component assemblies.

2.3 FINISHES

.1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

.1 Paint outdoor electrical equipment "equipment green" finish to EEMAC Y1-1.

.2 Paint indoor switchgear and distribution enclosures light grey to EEMAC 2Y-1.

2.4 WARNING SIGNS

.1 As specified and to meet requirements of Electrical Inspection Department and Owner's Representative.

.2 Porcelain enamel decal signs, minimum size 175 x 250 mm.

2.5 WIRING TERMINATIONS

.1 Lugs, terminals, screws used for termination of wiring to be suitable for either copper or aluminum conductors.

2.6 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with nameplates and labels as follows:

.1 Nameplates: Lamicoid 3 mm thick plastic engraving sheet, black white face, black white core, mechanically attached with self tapping screws.

.2 Sizes as follows:

NAMEPLATE SIZES

Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters

.2 Labels:

.1 Embossed plastic labels with 6 mm high letters unless specified otherwise.

.3 Wording on nameplates and labels to be approved by Owner's Representative prior to manufacture.

.4 Allow for average of twenty-five (25) letters per nameplate and label.

.5 Identification to be English (and French where applicable).

.6 Nameplates for terminal cabinets and junction boxes to indicate system name and voltage characteristics.

.7 Disconnects, starters and contactors: indicate equipment being controlled and voltage.

.8 Terminal cabinets and pull boxes: indicate system name and voltage.

.9 Transformers: indicate capacity, primary and secondary voltages and transformer number.

2.7 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour code: to CSA C22.1, Canadian Electrical Code.

.4 Use colour coded wires in communication cables, matched throughout system.

2.8 CONDUIT AND CABLE IDENTIFICATION

.1 Colour code conduits, boxes and metallic sheathed cables.

.2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.

.3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

Conduit System	Prime Color	Auxiliary Color
up to 250 V	Yellow	
up to 600 V	Yellow	Green
up to 5 kV	Yellow	Blue
up to 15 kV	Yellow	Red
Telephone	Green	
Other Communication Systems	Green	Blue
Fire Alarm	Red	
Emergency Voice	Red	Blue
Other Security Systems	Red	Yellow

PART 3 EXECUTION

3.1 NAMEPLATES AND LABELS

.1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

3.2 CONDUIT AND CABLE INSTALLATION

.1 Install conduit and sleeves prior to pouring of concrete. Sleeves through concrete: schedule 40 steel pipe, sized for free passage of conduit, and protruding 50 mm.

.2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.

.3 Install cables, conduits and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.

3.3 MOUNTING HEIGHTS

.1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.

.2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

.3 Install electrical at following heights unless indicated otherwise.

.1 Panelboards: as required by Code or as indicated.

3.4 ARC FLASH, SHORT CIRCUIT &CO-ORDINATION STUDY

.1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

.2 Provide information to owner to allow them to update the existing study. Apply label to new Panelboard.

3.5 FIELD QUALITY CONTROL

.1 All electrical work to be carried out by qualified, licensed electricians or apprentices as per the conditions of the Provincial Act respecting manpower vocational training and qualification. Employees registered in a provincial apprentices program shall be permitted, under the direct supervision of a qualified licensed electrician, to perform specific tasks – the activities permitted shall be determined based on the level of training attained and the demonstration of ability to perform specific duties.

.2 The work of this division to be carried out by a contractor who holds a valid Code 1 Electrical Contractor License as issued by the Province.

.3 Perform tests in Accordance with this section as noted and Section 01 91 13 – Commissioning (Cx) Requirements.

.4 Load Balance:

.1 Measure phase current to panelboard with normal loads (lighting) operating at time of acceptance. Adjust branch circuit connections as required to obtain best balance of current between phases and record changes.

.2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.

.3 Submit, at completion of work, report listing phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load. State hour and date on which each load was measured, and voltage at time of test.

.5 Conduct and pay for following tests:

.1 Distribution system including phasing, voltage, grounding and load balancing.

.2 Circuits originating from branch distribution panels.

.3 Lighting and its control.

.4 Motors, heaters and associated control equipment including sequenced operations of systems where applicable.

.6 Furnish manufacturer's certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturer's instructions.

.7 Insulation resistance testing.

.1 Megger and record 350 – 600 V circuits, feeders and equipment with a 1000 V instrument.

.2 Check resistance to ground before energizing and record value.

.8 Carry out tests in presence of Owner's Representative.

.9 Provide instruments, meters, equipment and personnel required to conduct tests during and conclusion of project.

.10 Submit test results for Owner's Representative's review and include in Commissioning Report specified in Section 01 91 13 – Commissioning (Cx) Requirements.

3.6 CLEANING

.1 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

.2 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

.1 Materials and installation for wire and box connectors.

1.2 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results - Electrical.

1.3 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CAN/CSA-C22.2 No.18, Outlet Boxes, Conduit Boxes and Fittings.

.2 CAN/CSA-C22.2 No.65, Wire Connectors (Tri-National Standard with UL 486A-486B and NMX-J-543-ANCE-03).

.2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)

.1 EEMAC 1Y-2, Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).

.3 National Electrical Manufacturers Association (NEMA)

PART 2 PRODUCTS

2.1 MATERIALS

.1 Pressure type wire connectors to: CSA C22.2 No.65, with current carrying parts of copper sized to fit copper conductors as required.

.2 Fixture type splicing connectors to: CSA C22.2 No.65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.

.3 Bushing stud connectors: to EEMAC 1Y-2 to consist of:

.1 Connector body and stud clamp for stranded copper conductors.

.2 Clamp for copper bar.

.3 Stud clamp bolts.

.4 Bolts for copper bar.

.5 Sized for conductors and bars as indicated.

.4 Clamps or connectors for armoured cable, aluminum sheathed cable, mineral insulated cable, flexible conduit, non-metallic sheathed cable as required to: CAN/CSA-C22.2 No.18.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Remove insulation carefully from ends of conductors and:

.1 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2 No.65.

.2 Install fixture type connectors and tighten. Replace insulating cap.

.3 Install bushing stud connectors in accordance with EEMAC 1Y-2.

END OF SECTION

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 26 05 20 - Wire and Box Connectors - 0 - 1000 V.

.2 Refer to drawings for wiring type required under different applications.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CSA C22.2 No .0.3, Test Methods for Electrical Wires and Cables.
.2 CAN/CSA-C22.2 No. 131, Type TECK 90 Cable.

PART 2 PRODUCTS

2.1 BUILDING WIRES

.1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.

.2 Copper and ACM alloy conductors: size as indicated, with 600 V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE.

.3 Copper conductors: size as indicated, with thermoplastic insulation type TWH rated at 600 V, typically used for insulated ground wires.

.4 Type ACM conductors permitted for service and panel feeders above 60 amps.

2.2 ARMOURED CABLES

.1 Conductors: insulated, copper, size as indicated.

.2 Type: AC90.

.3 Armour: interlocking type fabricated from aluminum strip.

.4 Connectors: standard as required, complete with double split rings.

2.3 CONTROL CABLES

.1 Type LVT: 2 soft annealed copper conductors, sized as indicated, with thermoplastic insulation, outer covering of thermoplastic jacket.Low energy 300 V control cable: stranded annealed copper conductors sized as indicated, with PVC insulation type TW -40° C polyethylene insulation with shielding of tape coated with paramagnetic material wire braid over each conductor and overall covering of PVC jacket.

2.4 NON-METALLIC SHEATHED CABLE

.1 Non-metallic sheathed copper cable type: NMD90 nylon, size as indicated.

2.5 ACM CONDUCTORS

.1 Annealed, compacted aluminum alloy conductor material (ACM) for circuits 60 amps or more, single or multi-conductor, 600 volt insulation.

.2 Type: AC90, ACWU90.

.3 Armour: interlocked aluminum strip.

.4 Conductivity: 61% IACS to that of copper.

.5 Outer jacket: ACWU90 PVC jacket, FT-4 rated suitable for direct buried and Div. 1 and Div. 2 hazardous locations.

2.6 TECK CABLE

.1 Cable: to CAN/CSA-C22.2 No. 131.

.2 Conductors:

.1 Grounding conductor: copper.

.2 Circuit conductors: copper and ACM alloy, size as indicated.

.3 Insulation:

.1 Cross-linked polyethylene XLPE, rating – 600 V.

.4 Inner jacket: polyvinyl chloride material.

.5 Armour: interlocking aluminum, compliant to applicable Building Code classification for this project.

.6 Overall covering: thermoplastic polyvinyl chloride material.

.7 Fastenings:

.1 One hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.

.2 Channel type supports for two or more cables at 1500 mm centers.

.3 Threaded rods: 6 mm dia. to support suspended channels.

.8 Connectors:

.1 Watertight and/or type approved for TECK cable, as indicated.

PART 3 EXECUTION

3.1 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Perform tests using method appropriate to site conditions and to approval of Owner's Representative and local authority having jurisdiction over installation.

.3 Perform tests before energizing electrical system.

.4 No splices permitted in panel board feeders in new construction. Splices in re-work or renovation projects only with pre-approval by Owner's Representative.

3.2 GENERAL CABLE INSTALLATION

.1 Install cable in trenches in accordance with Section 33 71 73.02 - Underground Electrical Service.

.2 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - (0-1000 V).

.3 Cable Colour Coding: to Section 26 05 00 Common Work Results for Electrical.

.4 Conductor length for parallel feeders to be identical.

.5 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.

.6 Wiring in walls: typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls to be avoided unless indicated.

.7 Branch circuit wiring for surge suppression receptacles and permanently wired computer and electronic equipment to be 2-wire circuits only, i.e. common neutrals not permitted.

.8 Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend. Obtain wiring diagram for control wiring.

3.3 INSTALLATION OF BUILDING WIRES

.1 Install wiring as follows:

- .1 In conduit systems in accordance with Section 26 05 34- Conduits, Fastenings and Fittings.
- .2 In underground ducts in accordance with Section 26 05 43.01- Installation of Cables in Ducts.
- .3 In trenches in accordance with Section 26 05 43.01- Installation of Cables in Trenches.

3.4 INSTALLATION OF ARMOURED CABLES (AC-90)

.1 Group cables wherever possible.

3.5 INSTALLATION OF CONTROL CABLES

.1 Install control cables in conduit as indicated.

.2 Ground control cable shield.

3.6 INSTALLATION OF NON-METALLIC SHEATHED CABLE

.1 Install cables.

.2 Install straps and box connectors to cables as required.

.3 Use permitted in wood stud construction only.

3.7 INSTALLATION OF ACM CONDUCTORS

.1 Install ACM cables as per the latest edition of the Canadian Electrical Code and manufacturers installation requirements.

.2 Do not terminate ACM conductors with a copper bodied connector.

.3 Apply oxide coating on base cables as per electrical code requirements.

3.8 INSTALLATION OF TECK CABLE 0 -1000 V

.1 Install cables.

.1 Group cables wherever possible on channels.

.2 Install cable concealed, securely supported by straps and hangers.

.3 Use permitted as indicated on drawings.

END OF SECTION

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results - Electrical.

.2 Grounding conductors for all distribution grounding to be insulated copper, uninsulated where in contact with earth. Copper conductors shall, at a minimum, be used in the following areas: grounding of transformer neutrals, service entrance switch ground of neutral, padmount transformer grounding, ground rider conductors from main ground station to sub-closets, telephone and data system grounds and circuits rated less than 60 amps. Where type ACM conductors are used for circuits rated 60 amps or greater, type ACM bonding conductor is permitted.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE)

.1 ANSI/IEEE 837, Qualifying Permanent Connections Used in Substation Grounding.

.2 Canadian Standards Association, (CSA)

.1 CAN/CSA Z32, Electrical Safety and Essential Electrical Systems in Health Care Facilities, where applicable.

PART 2 PRODUCTS

2.1 EQUIPMENT

.1 Clamps for grounding of conductor: size as indicated 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 indicated.

.3 Rod electrodes: copper clad steel 19 mm dia by 3 m long.

.4 Grounding conductors: bare stranded copper, soft annealed, size as indicated.

.5 Insulated grounding conductors: green, type TW.

.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, as required by local authority having jurisdiction..
.4 Thermit welded type conductor connectors, as indicated.
.5 Bonding jumpers, straps.

.6 Pressure wire connectors.

PART 3 EXECUTION

3.1 INSTALLATION GENERAL

.1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories. Where EMT is used, run insulated copper ground wire in conduit.

.2 Install connectors in accordance with manufacturer's instructions.

.3 Protect exposed grounding conductors from mechanical injury.

.4 Make buried connections, and connections to conductive water main, electrodes, using copper welding by thermit process.

.5 Use mechanical connectors for grounding connections to equipment provided with lugs.

.6 Soldered joints not permitted.

.7 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.

.8 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.

.9 Connect building structural steel and metal siding to ground by welding copper to steel.

.10 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.

.11 Bond single conductor, metallic armoured cables to cabinet at supply end and load end.

3.2 ELECTRODES

.1 Make ground connections to continuously conductive underground water pipe on street side of water meter.

.2 Install water meter shunt.

.3 Install concrete encased electrodes in building foundation footings, with terminal connected to grounding network.

.4 Install rod, plate electrodes and make grounding connections.

.5 Bond separate, multiple electrodes together.

.6 Use size # 6 AWG copper conductors for connections to electrodes as required by code.

.7 Make special provision for installing electrodes that will give acceptable resistance to ground value where rock or sand terrain prevails. Ground as indicated.

3.3 SYSTEM AND CIRCUIT GROUNDING

.1 Install system and circuit grounding connections to neutral of primary 600 V system, secondary 208 V system.

3.4 EQUIPMENT GROUNDING

.1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, building steel work, generators, elevators and escalators, distribution panels, outdoor lighting.

3.5 GROUNDING BUS

.1 Install copper grounding bus mounted on insulated supports on wall of electrical room.

.2 Ground items of electrical equipment in electrical room to ground bus with individual bare stranded copper connections size as required by code.

3.6 COMMUNICATION SYSTEMS

.1 Install grounding connections for telephone, sound, fire alarm, intercommunication systems as follows:

.1 Telephones: make telephone grounding system in accordance with telephone company's requirements.

.2 Sound, fire alarm, intercommunication systems as indicated.

3.7 PERMAFROST

.1 Bond non-current carrying metal parts together with size 3/0 AWG copper equipotential conductor. Run conductor from separate lug or service neutral bar to, but not necessarily limited to, following indoor systems and equipment:

.1 Hot water heating system.

.2 Main water pipe.

.3 Main building drain.

.4 Oil line.

.5 Telephone, radio/tv, emergency and fire alarm lead-in or service conduits, near panels.

.6 Make connections to pipes on building side of main valves and tanks. Connect jumpers across boilers to supply and return hot water heating pipes.

.2 Drive three -19 mm diam x 3 m copper clad ground rods at least 1.8 m apart in original undisturbed ground. If rods will not penetrate permafrost, drive at angle not more than 60^{o} from vertical, and in same direction. Rods must be driven, not trenched.

.3 Install ground wire from service neutral bar to rods and where buried use bare copper not smaller than size 1AWG7- strand or size 4AWG solid, and at least 460 mm below ground. Bond ground conductor, or short tap from it, to outside metal sheathing of building close to power service conduit. Use lug or cast clamp, with bronze or plated bolt, nut and washers (not sheet metal screw or wood screw). Remove paint from sheathing for good contact. Conduit is required only on outside wall of building. Indoors, run bare and fasten as specified for equipotential bonding wire.

.4 Install electrode interconnections where metal parts, circuits or grounding conductors and/or electrodes are in proximity to lightning rod conductors.

3.8 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 – Common Work Results – Electrical.

.2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Owner's Representative and local authority having jurisdiction over installation.

.3 Perform tests before energizing electrical system.

.4 Disconnect ground fault indicator during tests.

END OF SECTION

PART 1 GENERAL (NOT APPLICABLE)

PART 2 PRODUCTS

2.1 SUPPORT CHANNELS

.1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted suspended or set in poured concrete walls and ceilings as required.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Secure equipment to hollow or solid masonry, tile and plaster surfaces with lead anchors or nylon shields.

.2 Secure equipment to poured concrete with expandable inserts.

.3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.

.4 Secure surface mounted equipment with twist clip fasteners to inverted T bar ceilings. Ensure that T bars are adequately supported to carry weight of equipment specified before installation.

.5 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

.6 Fasten exposed conduit or cables to building construction or support system using straps.

- .1 One-hole steel straps to secure surface conduits and cables 50 mm and smaller.
- .2 Two-hole steel straps for conduits and cables larger than 50 mm.
- .3 Beam clamps to secure conduit to exposed steel work.
- .4 Strap AC-90 cable at box location plus every 900 mm.

.7 Suspended support systems.

- .1 Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.
- .2 Support 2 or more cables or conduits on channels supported by 6 mm dia threaded rod hangers where direct fastening to building construction is impractical.

.8 For surface mounting of two or more conduits use channels at 1.5 m on centre spacing.

.9 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.10 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

.11 Do not use wire lashing, wood blocking, plastic strap or perforated strap to support or secure raceways or cables.

.12 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Owner’s Representative.

.13 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

END OF SECTION

PART 1 GENERAL

1.1 REALTED SECTIONS

.1 Section 26 05 00 – Common Work Results – Electrical.

1.2 SUBMITTALS

.1 Submit shop drawings and product data for cabinets.

.2 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Provide drawings stamped and signed by professional engineer registered or licensed in the Province of Newfoundland and Labrador, Canada.

PART 2 PRODUCTS

2.1 SPLITTERS

.1 Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.

.2 Main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.

.3 At least three spare terminals on each set of lugs in splitters less than 400 A.

2.2 JUNCTION AND PULL BOXES

.1 Welded steel construction with screw-on flat covers for surface mounting.

.2 Covers with 25 mm minimum extension all around, for flush-mounted pull and junction boxes.

2.3 CABINETS

.1 Type E: sheet steel, hinged door and return flange overlapping sides, handle, lock and catch, for surface mounting.

.2 Type T: sheet steel cabinet, with hinged door, latch, lock, 2 keys, containing 19 mm fir plywood backboard for surface flush mounting.

PART 3 EXECUTION

3.1 SPLITTER INSTALLATION

.1 Install splitters and mount plumb, true and square to the building lines.

.2 Extend splitters full length of equipment arrangement except where indicated otherwise.

3.2 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

.1 Install pull boxes in inconspicuous but accessible locations.

.2 Mount cabinets with top not higher than 2 m above finished floor.

.3 Install terminal block as indicated in Type T cabinets.

.4 Only main junction and pull boxes are indicated. Install pull boxes so as not to exceed 30 m of conduit run between pull boxes.

3.3 IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results - Electrical.

.2 Install size 2 identification labels indicating system name voltage and phase.

END OF SECTION

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results – Electrical.

.2 Section 26 05 29 – Hangers and Supports for Electrical Systems.

.3 Section 26 05 34 – Conduits, Conduit Fastenings and Fittings.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CSA C22.1, Canadian Electrical Code, Part 1.

PART 2 PRODUCTS

2.1 OUTLET AND CONDUIT BOXES GENERAL

.1 Size boxes in accordance with CSA C22.1.

.2 102 mm square or larger outlet boxes as required for special devices.

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

.5 347 V outlet boxes for 347 V switching devices.

.6 Combination boxes with barriers where outlets for more than one system are grouped.

.7 RPVC boxes where devices are installed in spaces with refrigerated panel walls.

2.2 GALVANIZED STEEL OUTLET BOXES

.1 Electro-galvanized steel single and multi gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.

.2 Electro-galvanized steel utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.

.3 102 mm square or octagonal outlet boxes for lighting fixture outlets.

.4 102 mm square outlet boxes with extension and plaster rings for flush mounting devices in finished plaster walls.

2.3 MASONRY BOXES

.1 Electro-galvanized steel masonry single and multi gang boxes for devices flush mounted in exposed block walls.

2.4 CONCRETE BOXES

.1 Electro-glavanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

2.5 FLOOR BOXES

.1 Concrete tight electro-galvanized sheet steel floor boxes with adjustable finishing rings to suit floor finish with brass faceplate. Device mounting plate to accommodate short or long ear duplex receptacles. Minimum depth: 28 mm for receptacles; 73 mm for communication equipment.

.2 Adjustable, watertight, concrete tight, cast floor boxes with openings drilled and tapped for 12 mm and 19 mm conduit. Minimum size: 73 mm deep.

2.6 CONDUIT BOXES

.1 Cast FS or FD aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacle.

2.7 OUTLET BOXES FOR NON-METALLIC SHEATHED CABLE

.1 Electro-galvanized, sectional, screw ganging steel boxes, minimum size 76 x 50 x 63 mm with two double clamps to take non-metallic sheathed cables. For use in wood stud construction only.

2.8 FITTINGS - GENERAL

.1 Bushing and connectors with nylon insulated throats.

.2 Knock-out fillers to prevent entry of debris.

.3 Conduit outlet bodies for conduit up to 32 mm and pull boxes for larger conduits.

.4 Double locknuts and insulated bushings on sheet metal boxes.

.5 Double split rings for AC-90 terminations.

2.9 SERVICE FITTINGS

.1 'High tension' receptacle fitting made of 2 piece die-cast aluminum with brushed aluminum housing finish for 1 duplex receptacles. Bottom plate with two knockouts for centered or offset installation.

.2 Pedestal type 'low tension' fitting made of 2 piece die cast aluminum with brushed aluminum housing finish to accommodate two amphenol jack connectors.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Support boxes independently of connecting conduits.

.2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.

.3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.

.4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.

.5 Vacuum clean interior of outlet boxes before installation of wiring devices.

.6 Identify systems for outlet boxes as required.

END OF SECTION

PART 1 GENERAL

1.1 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CAN/CSA C22.2 No. 18, Outlet Boxes, Conduit Boxes, and Fittings and Associated Hardware, a National Standard of Canada.

.2 CSA C22.2 No. 56, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.

.3 CSA C22.2 No. 83, Electrical Metallic Tubing.

.4 CSA C22.2 No. 211.2, Rigid PVC (Unplasticized) Conduit.

.5 CAN/CSA C22.2 No. 227.3, Nonmetallic Mechanical Protection Tubing (NMPT), a National Standard of Canada.

1.2 SUBMITTALS

.1 Product data: submit manufacturer's printed product literature, specifications and datasheets.

.1 Submit cable manufacturing data.

.2 Quality assurance submittals:

.1 Test reports: submit certified test reports.

.2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.3 Instructions: submit manufacturer's installation instructions.

PART 2 PRODUCTS

2.1 CONDUITS

.1 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.

.2 Rigid PVC conduit: to CSA C22.2 No. 211.2.

.3 Flexible metal conduit: to CSA C22.2 No. 56, aluminum liquid-tight flexible metal.

.4 .3,

2.2 CONDUIT FASTENINGS

.1 One hole steel straps to secure surface conduits 50 mm and smaller. Two hole steel straps for conduits larger than 50 mm.

.2 Beam clamps to secure conduits to exposed steel work.

.3 Channel type supports for two or more conduits at 1.5 m oc.

.4 Threaded rods, 6 mm dia., to support suspended channels.

2.3 CONDUIT FITTINGS

.1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.

.2 Factory "ells" where 90°, 45 ° or 22.5 ° bends are required for 25 mm and larger conduits.

.3 Ensure conduit bends other than factory “ells” are made with an approved bender. Making offsets and other bends by cutting and rejoining 90 degree bends are not permitted.

.4 Connectors and couplings for EMT. Steel set-screw type, size as required.

2.4 EXPANSION FITTINGS FOR RIGID CONDUIT

.1 Weatherproof expansion fittings with internal bonding assembly suitable for 100 mm linear expansion.

.2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection in all directions.

.3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.5 FISH CORD

.1 Polypropylene.

PART 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install all conduit, conduit fittings and accessories in accordance with the latest edition of the Canadian Electrical Code in a manner that does not alter, change or violate any part of the installed system components or the CSA/UL certification of these components.

.2 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.3 Conceal conduits except in mechanical and electrical service rooms and in unfinished areas.

.4 Surface mount conduits except in finished areas or as indicated.

.5 Use electrical metallic tubing (EMT) except in cast concrete and above 2.4 m not subject to mechanical injury, as well as concealed work in masonry construction.

.6 Use rigid PVC conduit underground and buried in or under concrete slab on grade.

.7 Use rigid PVC conduit surface mounted in spaces with refrigerated panel walls.

.8 Use flexible metal conduit for connection to motors in dry areas connection to recessed incandescent fixtures without a prewired outlet box connection to surface or recessed fluorescent fixtures work in movable metal partitions.

.9 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.

.10 Use AC-90 for vertical power supply drops to light fixtures.

.11 .

.12 Minimum conduit size for lighting and power circuits: 19 mm. 12 mm conduit is acceptable for switch leg drops only where one two-wire circuit and ground is required.

.13 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.14 Mechanically bend steel conduit over 19 mm dia.

.15 Install fish cord in empty conduits.

.16 Run 2 - 25 mm spare conduits up to ceiling space and 2 - 25 mm spare conduits down to ceiling space from each flush panel. Terminate these conduits in 152 x 152 x 102 mm junction boxes in ceiling space or in case of an exposed concrete slab, terminate each conduit in flush concrete type box.

.17 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.

.18 Dry conduits out before installing wire.

3.3 SURFACE CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.

.3 Run conduits in flanged portion of structural steel.

.4 Group conduits wherever possible on suspended channels.

.5 Do not pass conduits through structural members except as indicated.

.6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.4 CONCEALED CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Do not install horizontal runs in masonry walls.

.3 Do not install conduits in terrazzo or concrete toppings.

3.5 CONDUITS IN CAST-IN-PLACE CONCRETE

.1 Locate to suit reinforcing steel. Install in centre one third of slab. Use rigid PVC conduit.

.2 Protect conduits from damage where they stub out of concrete. Use rigid steel conduit for stub-up and adapt to in floor rigid PVC conduit.

.3 Install sleeves where conduits pass through slab or wall.

.4 Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed. Use cold mastic between sleeve and conduit.

.5 Do not place conduits is slabs in which slab thickness is less than 4 times conduit diameter.

.6 Encase conduits completely in concrete with minimum 25 mm concrete cover.

.7 Organize conduits in slab to minimize cross-overs.

3.6 CONDUITS IN CAST-IN-PLACE SLABS ON GRADE

.1 Run conduits 25 mm and larger below slab and encased in 75 mm concrete envelope. Provide 50 mm of sand over concrete envelope below floor slab.

3.7 CONDUITS UNDERGROUND

.1 Slope conduits to provide drainage.

.2 Waterproof joints (PVC excepted) with heavy coat of bituminous paint.

3.8 CLEANING

.1 On Completion and verification of performance of installation, remove surplus materials, excess materials rubbish, tools and equipment.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

.1 Materials and installation for standard and custom breaker type panelboards.

1.2 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results - Electrical.

.2 Section 26 28 16.02 - Moulded Case Circuit Breakers.

1.3 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CSA C22.2 No.29, Panelboards and enclosed Panelboards.

1.4 SUBMITTALS

.1 Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

PART 2 PRODUCTS

2.1 PANELBOARDS

.1 Panelboards: to CSA C22.2 No.29 and product of one manufacturer.

.1 Install circuit breakers in panelboards before shipment.

.2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.

.2 600 V panelboards: bus and breakers rated for 25 kA (symmetrical) minimum interrupting capacity and as indicated on electrical drawings.

.3 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.

.4 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.

.5 Two keys for each panelboard and key panelboards alike.

.6 Tin plated aluminum bus with neutral of same ampere rating as mains.

.7 Mains: suitable for bolt-on breakers.

.8 Trim with concealed front bolts and hinges.

.9 Trim and door finish: baked grey enamel.

.10 All panelboards shall be supplied and installed with a lockable door.

2.2 BREAKERS

.1 Breakers: to Section 26 28 16.02 - Moulded Case Circuit Breakers.

.2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.

2.3 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results - Electrical.

.2 Nameplate for each panelboard size 4 engraved as indicated.

.3 Nameplate for each circuit in distribution panelboards size 2 engraved as indicated.

.4 Complete circuit directory with typewritten legend showing location and load of each circuit.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.

.2 Install surface mounted panelboards on fire retardant plywood backboards. Where practical, group panelboards on common backboard.

.3 Mount panelboards to height specified in Section 26 05 00 – Common Work Results - Electrical or as indicated.

.4 Connect loads to circuits.

.5 Connect neutral conductors to common neutral bus with respective neutral identified.

END OF SECTION

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results - Electrical.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CSA C22.2No.248.12 , Low Voltage Fuses Part 12: Class R (Bi-National Standard with, UL 248-12 (1st Edition).

1.3 SUBMITTALS

.1 Submit fuse performance data characteristics for each fuse type and size above 600 A. Performance data to include: average melting time-current characteristics.

1.4 DELIVERY AND STORAGE

.1 Ship fuses in original containers.

.2 Do not ship fuses installed in switchboard.

.3 Store fuses in original containers in storage cabinet moisture free location.

1.5 MAINTENANCE MATERIALS

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Three spare fuses of each type and size installed above 600 A.

.3 Six spare fuses of each type and size installed up to and including 600 A.

PART 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 for entire project.

2.2 FUSE TYPES

.1 Class L fuses (formerly HRC-L).

.1 Type L1, time delay, capable of carrying 500% of its rated current for 10 s minimum.

.2 Type L2, fast acting.

.2 Class J fuses (formerly HRCI- J).

.1 Type J1, time delay, capable of carrying 500% of its rated current for 10 s minimum.

.2 Type J2, fast acting.

.3 Class R -R fuses (formerly HRCI- R). For UL Class RK1 fuses, peak let-through current and its' peak let-through values not to exceed limits of UL 198E-1982, table 10.2.

.1 Type R1, (UL Class RK1), time delay, capable of carrying 500% of its rated current for 10 s minimum, to meet UL Class RK1 maximum let-through limits.

.2 Type R2, time delay, capable of carrying 500% of its rated current for 10 s minimum.

.3 Type R3, (UL Class RK1), fast acting Class R, to meet UL Class RK1 maximum let-through limits.

.4 Class -C fuses (formerly HRCII- C).

2.3 FUSE STORAGE CABINET

.1 Fuse storage cabinet, manufactured from 2.0 mm thick aluminum 750 mm high, 600 mm wide, 300 mm deep, hinged, lockable front access door finished in accordance with Section 26 05 00 – Common Work Results - Electrical.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install fuses in mounting devices immediately before energizing circuit. Ensure correct fuses fitted to physically matched mounting devices.

.1 Install Class R rejection clips for HRCI-R fuses.

.2 Ensure correct fuses fitted to assigned electrical circuit.

.3 Where UL Class RK1 fuses are specified, install warning label "Use only UL Class RK1 fuses for replacement" on equipment.

.4 Install spare fuses in fuse storage cabinet.

END OF SECTION

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 26 05 00 - Common Work Results – Electrical.

1.2 SUBMITTALS

.1 Include time-current characteristic curves for breakers with ampacity of 600 A and over or with interrupting capacity of 22,000 A symmetrical (rms) and over at system voltage.

PART 2 PRODUCTS

2.1 BREAKERS GENERAL

.1 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40°C ambient.

.2 Common-trip breakers: with single handle for multi-pole applications.

.3 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting. Trip settings on breakers with adjustable trips to range from 3-8 times current rating.

.4 Circuit breakers with interchangeable trips as indicated.

.5 Circuit breakers to have minimum of kA symmetrical rms interrupting capacity rating or as indicated on drawings schedule.

2.2 THERMAL MAGNETIC BREAKERS DESIGN A

.1 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

2.3 OPTIONAL FEATURES

.1 Include where indicated:

.1 shunt trip.
.2 auxiliary switch.
.3 motor-operated mechanism c/w time delay unit.
.4 under-voltage release.
.5 on-off locking device.
.6 handle mechanism.

2.4 ENCLOSURE

.1 Mounted in NEMA 1 type enclosure, sprinkler proof as indicated.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install circuit breakers as indicated.

END OF SECTION

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results - Electrical.

PART 2 PRODUCTS

2.1 DISCONNECT SWITCHES

.1 Fusible and non-fusible, disconnect switch in CSA Enclosure type 1, size as indicated.

.2 Provision for padlocking in on-off switch position by three locks.

.3 Mechanically interlocked door to prevent opening when handle in ON position.

.4 Fuses: size as indicated, to Section 26 28 13.01 - Fuses - Low Voltage.

.5 Fuseholders: suitable without adaptors, for type and size of fuse indicated.

.6 Quick-make, quick-break action.

.7 ON-OFF switch position indication on switch enclosure cover.

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results - Electrical.

.2 Indicate name of load controlled on size 4 nameplate.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install disconnect switches complete with fuses as indicated.

END OF SECTION

PART 1 GENERAL

1.1 SCOPE OF WORK

.1 Testing and commissioning are called for throughout the individual specifications. This does not relieve this trade from providing all testing and commissioning necessary to ensure that systems and equipment operate as required and that they interface with other systems and equipment as required.

1.2 SECTION INCLUDES

.1 Commissioning of all building electrical systems and component including:

- .1 Testing and adjustment.
- .2 Demonstrations and Training.
- .3 Instructions of all procedures for Owner's personnel.
- .4 Updating as-built data.
- .5 Coordination of Operation and Maintenance material.

1.3 RELATED SECTION

.1 Section 01 77 00 – Closeout Procedures.

.2 Section 01 91 13 – Commissioning (Cx) Requirements.

.3 Section 26 05 00 – Common Work Results - Electrical.

1.4 REFERENCES

.1 CSA (Canadian Standards Association).

.2 Underwriters Laboratories of Canada.

1.5 QUALITY ASSURANCE

.1 Provide qualified trades persons, certified testing agencies, factory trained and approved by the Commissioning Team Leader.

.2 Submit the names of all personnel to be used during the Commissioning activities for Owner Approval.

1.6 COMMISSIONING

.1 The purpose of the commissioning process is to fully test all building systems including architectural, mechanical and electrical components and operating procedures by challenging these systems to realistic operation conditions.

.2 The Commissioning activities shall be coordinated by the General Contractor.

.3 Commissioning activities for the electrical systems must have available up to date as-built drawing information and accurate Operations and Maintenance Manuals. These documents shall be a major part of this activity.

.4 Contractor shall be responsible to update all documentation with information and any changes duly noted during the Commissioning exercise.

.5 Contractor shall arrange for all outside suppliers, equipment manufacturers, test agencies and others as identified in the commissioning sections of this specification. The cost associated with this requirement shall be included as part of the tender price.

1.7 SUBMITTALS

.1 A commissioning document shall be prepared by the Owner's Representative prior to conducting these activities for use by the Commissioning Team.

.2 The electrical sub-contractor shall be responsible for ensuring all activities are properly documented in this manual and coordinated through the General Contractor.

.3 As-built drawings and data books must be available two weeks prior to commissioning for review and use by the consultant and Commissioning Team prior to the start of the commissioning activities.

1.8 PREPARATION

.1 Provide test instruments required for all activities as defined in the commissioning documents.

.2 Verify all systems are in compliance with the requirements of the commissioning documents prior to the pre-commissioning check out operation.

.3 Confirm all scheduled activities have identified personnel available.

.4 Where systems or equipment do not operate as required, make the necessary corrections or modifications, re-test and re-commission.

1.9 SYSTEM DESCRIPTION

.1 Perform all start up operations, control adjustment, trouble shooting, servicing and maintenance of each item of equipment as defined in the commissioning documentation.

.2 Owner will provide list of personnel to receive instructions and will co-ordinate their attendance at agreed upon times.

.3 Prepare and insert additional data in the operations and maintenance manuals and update as-built drawings when need for additional data becomes apparent during the commissioning exercise.

.4 Where instruction is specified in the commissioning manual, instruct personnel in all phases of operation and maintenance using operation and maintenance manuals as the basis of instruction.

.5 Conduct presentation on Owner's premises. Owner will provide space.

1.10 FINAL REPORT

.1 This trade shall assemble all testing data and commissioning reports and submit them to the Owner.

.2 Each form shall bear signature of recorder, and that of supervisor of reporting organizer.

1.11 SCHEDULE OF ACTIVITIES

.1 Commissioning activities shall be conducted based on pre-established schedule with all members of the commissioning team, refer to Section 01 91 13 – Commissioning (Cx) Requirements.

.2 In addition, there will be two meetings held through the contract duration to introduce the parties of the commissioning team, establish the schedules and deadlines for the various activities and review the Commissioning Manual.

.3 Adhering to the established schedule is very important as the co-ordination and scheduling of the participants will be difficult to alter once this is established. Close coordination of this schedule is important.

.4 In the event project cannot be commissioned in the allotted time slot, the contractor shall pay for all costs associated with assembling the Commissioning Team at a later date. If the contractor has not performed his duties to reach commissioning stage as outlined earlier, he will incur all expenses of other trades and the Commissioning Team due to his non-compliance.

END OF SECTION

PART 1 GENERAL

1.1 GENERAL

.1 This section describes the extent of services to be provided for wiring of equipment supplied by others.

.2 Within the context of this section, Others means:

- .1 Other divisions of this specification (i.e.: Division 25 – Integrated Automation).
- .2 The Owner, as defined in the Contract.
- .3 Other contractors supplying and installing equipment to the contract.

1.2 EXTENT OF SERVICES PROVIDED

.1 The work of this contract is to include all power and control wiring of equipment which is provided by Division 26.

.2 All power and control wiring above 50 V for equipment supplied by Division 25 will be the responsibility of this contractor. Coordinate with Integrated Automation contractor for exact requirements.

.3 All control wiring 50 V and less for equipment supplied by Division 25 will be the responsibility of Division 25- Integrated Automation Contractor. Conduit and wire associated with this is the responsibility of Division 25.

.4 All power and control wiring associated with equipment supplied by Division 01 will be the responsibility of this contractor. Coordinate with general contractor for exact requirements. See Section 26 27 97 – Door Hardware Wiring for exceptions for wiring of door lock systems.

.5 Final connection of all wiring to equipment provided by others (except control wiring below 50 V associated with Division 25 equipment) will be by division 26. Coordinate with the provider for connection instructions.

1.3 RESPONSIBILITY OF DIVISION 26

.1 It is the responsibility of the Division 26 subcontractor to verify final requirements for wiring of all equipment noted. Verification of wiring requirements to include:

- .1 Confirmation of electrical characteristics.
- .2 Location of connection point.
- .3 Method of connection (i.e. direct or plug-in etc.)

.2 Obtain and become familiar with shop drawings for all relevant equipment.

.3 No claim for extra will be entertained for wiring equipment which has been indicated, or changes to installed wiring where installation proceeded prior to verification of electrical requirements.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

PART 1 GENERAL

1.1 RELATED WORK

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 78 00 - Closeout Procedures.

.3 Section 01 91 13 - Commissioning (Cx) Requirements.

.4 Section 26 05 00 - Common Work Results - Electrical.

.5 Section 26 05 21 - Wires and Cables (0-1000V).

.6 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

1.2 REFERENCES

.1 Codes and standards referenced in this section refer to the latest edition thereof.

.2 Government of Canada

.1 NBCC, National Building Code of Canada, latest edition.

.2 TB OSH Chapter 3-3, Treasury Board of Canada, Occupational Safety and Health, Chapter 3-3, Fire Protection Standard for Electronic Data Processing Equipment.

.3 TB OSH Chapter 3-4,Treasury Board of Canada, Occupational Safety and Health, Chapter 3-4, Standard for Fire Alarm Systems.

.3 Underwriter's Laboratories of Canada (ULC)

.1 CAN/ULC-S524, Installation of Fire Alarm Systems.

.2 ULC-S525, Audible Signal Appliances for Fire Alarm.

.3 CAN/ULC-S526, Visual Signal Appliances, Fire Alarm.

.4 CAN/ULC-S527, Control Units, Fire Alarm.

.5 CAN/ULC-S528, Manual Pull Stations.

.6 CAN/ULC-S529, Smoke Detectors, Fire Alarm.

.7 CAN/ULC-S530, Heat Actuated Fire Detectors, Fire Alarm.

.8 CAN/ULC-S536, Inspection and Testing of Fire Alarm Systems.

.9 CAN/ULC-S537, Verification of Fire Alarm Systems.

1.3 SYSTEM DESCRIPTION

.1 Existing system is Edwards EST3 to remain. Add new control module(s) where indicated on drawings. Update software/programming of system as required to accommodate additions/deletions and re-verify.

1.4 REQUIREMENTS OF REGULATORY AGENCIES

.1 System:

.1 Subject to Provincial Fire Commissioner's approval.

.2 Subject to FC inspection for final acceptance.

.3 To electrical inspection approval.

.2 System components: listed by ULC and comply with applicable provisions of National Building Code and meet requirements of local authority having jurisdiction.

1.5 SUBMITTALS

.1 Include:

.1 Details for devices.

1.6 CLOSEOUT SUBMITTALS

.1 Provide system re-verification documentation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

.1 Standard of acceptance: Edwards, no equals.

2.2 MATERIALS

.1 Equipment and devices: ULC listed and labeled and supplied by single manufacturer.

2.3 WIRING

.1 Multi-conductor cable assemblies with dedicated bonding wire CSA FAS105 and FT-4 rated. Standard of Acceptance: Securex I.

.2 To initiating circuits: 18 AWG minimum, and in accordance with manufacturer's requirements.

.3 To signal circuits: 16 AWG minimum, and in accordance with manufacturer's requirements.

.4 To control circuits: 14 AWG minimum, and in accordance with manufacturer's requirements.

.5 Fire alarm cables to be run in EMT conduit. Other cables as indicated on the drawings.

2.4 ADDRESSABLE CONTROL/MONITOR MODULES

.1 Addressable modules with address set in field for control/monitoring of external circuits.

.2 Applications: ventilation unit shut down.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install system components in accordance with CAN/ULC-S524 and TB OSH Chapter 3-4.

.2 Run all fire alarm wiring in conduit unless indicated otherwise.

.3 Install Class A and DCLC primary and alternate wiring circuits in separate raceways with minimum horizontal and vertical separation as mandated by CAN/ULC-S524.

.4 Splices are not permitted. All connections are to be made at devices.

.5 Provide necessary raceways, cables and wiring to make interconnections to annunciator equipment and control panels, as required by equipment manufacturer.

.6 Ensure that wiring is free of opens, shorts or grounds, before system testing and handing over.

.7 Identify circuits and other related wiring at central control unit, annunciators, and terminal boxes.

.8 Identify all conduits and junction/pull boxes.

.9 Install addressable control modules for control of ventilation equipment.

.10 Complete number of network uploads as required for complete working system.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 – Common Work Results - Electrical and Section 01 91 13 – Commissioning (Cx) Requirements.

.2 Fire alarm system:

.1 Test each device and alarm circuit to ensure manual stations, thermal and smoke detectors transmit alarm to control panel and actuate general alarm and ancillary devices.

.2 Simulate grounds and breaks on alarm and signaling circuits to ensure proper operation of system.

.3 Addressable circuits system style DCLA:

.1 Test each conductor on all DCLA addressable links for capability of providing 3 or more subsequent alarm signals on each side of single open-circuit fault condition imposed near midmost point of each link. Operate Acknowledge/Silence switch after reception of each of the 3 signals. Correct imposed fault after completion of each series of tests.

.2 Test each conductor on all DCLA addressable links for capability of providing 3 or more subsequent alarm signals during ground-fault condition imposed near midmost point of each link. Operate Acknowledge/Silence switch after reception of each of the 3 signals. Correct imposed fault after completion of each series of tests.

.3 Provide final PROM program re-burn for system incorporating program changes made during construction.

.4 Provide programming for system to provide identification of alarm and trouble conditions to satisfaction of the owner. Coordinate with the owner prior to programming display items.

END OF SECTION

EACC
Lead Guideline
For Construction, Renovation, Maintenance or Repair
October 2014

Environmental Abatement Council of Canada

Canadian Chapter of the EIA

Foreword

This guideline has been prepared to assist building owners, constructors, contractors, subcontractors and workers who have duties under the Occupational Health and Safety Act and its Regulations to safely perform work activities involving lead, lead-containing or lead-contaminated materials. The guideline is intended to promote safe work practices, the use of appropriate personal protective equipment, worker awareness and training and is based in a thorough review of regulatory and guidance materials available to August 2014, as well as professional experience of the abatement industry in Ontario.

We believe that this guideline will not only help employers fulfill their responsibilities and due diligence, under the Occupational Health and Safety Act, but will also assist them to better address the challenges involved with implementing proper work procedures during activities involving lead, lead-containing or lead-contaminated materials.

Disclaimer

EACC disclaims any liability or risk resulting from the use of the work practices and recommendations discussed in the guideline. It is the user's responsibility to ensure that work practices and recommendations discussed in the guideline apply to specific workplaces and projects and to ensure compliance with all other applicable federal, provincial and local acts, codes and regulations.

EACC
Lead Guideline
For Construction, Renovation, Maintenance or Repair
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1. INTRODUCTION, GENERAL POINTS AND LIMITATIONS

1.1 Introduction

Interpretation and application of existing regulations and guidelines regarding lead are inconsistent within the construction and abatement industry, which impacts decisions regarding worker protection, occupant health and cost. Recognizing these issues, EACC has developed a guideline that transcends barriers between the assessment of lead in building materials and abatement and control procedures.

In this document, work on lead is defined as operations involving the handling, application, removal, disturbance or clean-up of Lead-Containing Materials (LCM) as defined in Appendix II and Section 3.2.

1.2 General Points

This guideline is intended for the environmental abatement industry, construction industry and the painting industry in general. The procedures identified herein are based on the current state of the science, practical experience and industry standard best-practices for lead abatement and dust control methods.

This guideline is not intended to address lead contamination in soil or in water.

1.3 Limitations

EACC is not responsible for the interpretation or use of the information contained within this document. It is the responsibility of the user to determine whether the information contained herein is appropriate to the user's specific activities. While EACC has attempted to identify and provide procedures for common scenarios, where lead abatement and control may be required, not all situations can be anticipated in advance. Therefore, the information contained within this document may not be suitable for all activities involving lead and caution should be used in applying the methods and procedures outlined in this document. Use professional judgement and if in doubt, contact a health and safety professional with experience in lead assessments and lead abatement operations.

2. REGULATIONS AND GUIDELINES

2.1 Canadian Federal Limits for Lead in Paints and Surface Coatings

The Canadian Federal Government began limiting the amount of lead in certain new paints to 0.5% by weight (5,000 mg/kg, µg/g, parts per million [ppm]) in 1976. The Surface Coating Materials Regulation (SOR/2005-109) dated April 19, 2005, as amended, pursuant to the 2005 Hazardous Products Act, revised the standard to limit the amount of lead in certain paints to 0.06% (600 ppm). In October 2010, this was revised to 0.009 % (90 ppm). As detailed in the Surface Coating Materials Regulation (SOR/2005-109), paints and surface coatings manufactured for the following uses are excluded from the limitation on lead content:

1) as an anti-corrosive or an anti-weathering coating applied on the interior or exterior surface of any building or equipment that is used for an agricultural or industrial purpose;
2) as an anti-corrosive or an anti-weathering coating applied on any structure, other than a building, that is used for an agricultural, industrial or public purpose;
3) as a touch-up coating for metal surfaces;
4) on traffic signs;
5) for graphic art on billboards or similar displays;
6) for identification marks in industrial buildings; or
7) as material for the purposes of arts, crafts or hobbies, other than material for use by children (SOR/2010-224, s.1).

2.2 Ontario Regulation 490/09 – Designated Substances

This regulation applies to every employer and worker at a workplace where lead is present, produced, processed, used, handled or stored and at which a worker is likely to be exposed to lead.

2.3 Ministry of Labour Guideline – Lead on Construction Projects

This document is intended to assists persons who have duties under the Occupational Health and Safety Act, and its regulations, to protect workers from exposure to inorganic lead on construction projects.

3. HISTORY OF LEAD AND LEAD USES

3.1 History

Lead has been commonly used for many industrial and commercial purposes for thousands of years, primarily because it is widely available, easy to extract and easy to work with. Lead is a naturally occurring heavy metal that is solid at room temperature and has a melting point of 327.5 degrees Celsius. Metallic lead has a bluish-white colour after being freshly cut and tarnishes to a dull gray when exposed to air. Lead was, and is, used in applications where low melting point, malleability and high density are useful.

3.2 Common Uses of Lead in Buildings

The following list includes the most common uses or application of lead in buildings. The list is not intended to be exhaustive.

1) Acoustic dampening baffles;
2) Additive in brass and other alloys;
3) Babbitt (bearing metal);
4) Batteries;
5) Cable and wire casing;
6) Cast iron pipe gaskets and connections;
7) Counterweights;
8) Decorative pieces;
9) Flashing;
10) Gaskets;
11) Glazing;
12) Indoor firing ranges;
13) Lead glass;
14) Late 19th and early 20th century tinted mortar at stone cladding;
15) Paint and surface coatings;
16) Pipes;
17) Radiation shielding (bricks or sheeting);
18) Solder (plumbing and electrical);
19) Stained glass and window came; and
20) Structural steel primer.

3.3 Exposure Risks to Workers by Activity

Exposure to lead can result in almost any trade. Primarily, workers at highest risk for lead exposure include those involved in iron work, construction work, demolition, painting, plumbing, welding, heating and air conditioning work, building maintenance and repair work, electrical work and carpentry, renovation, and remodeling work.

Operations with the potential to expose workers to lead include, but are not limited to, the following list of activities where lead-containing materials are being disturbed. The list is not intended to be exhaustive.

1) Abrasive blasting;
2) Application or removal (e.g. by scraping, sanding) of lead-based or lead-containing paints and surface coatings;
3) Heat gun applications;
4) Lead burning;
5) Demolition, renovation or repair of structures where lead, lead-based or lead-containing paints or surface coatings are present;
6) Removing, repointing or disturbing lead-containing mortar;
7) Welding, high temperature cutting, torch cutting and burning of primed or painted steel structures;
8) Soldering;
9) Removing lead paint from bridges, structural steel and other materials; and
10) Installing or removing lead products (such as lead panels, lead sheeting and lead bricks used for shielding radiation sources).

4. HAZARDS OF LEAD AND HEALTH EFFECTS

For the purpose of this document, lead refers to inorganic lead. Lead may affect the health of workers if it is in a form that may be inhaled or ingested. Inhalation of lead is considered the primary route of occupational exposure. When lead is present in the air as dust, fume or mist, it can be inhaled into the lungs and upper respiratory tract and then absorbed into the body. Incidental ingestion may occur when lead on work surfaces are transferred, to clothes and hands, and then to the mouth during eating, drinking, smoking, chewing or, touching of the face. Incidental ingestion may also occur when workplace surfaces are not properly cleaned, and good hygiene practices are not followed.

Lead exposure may occur in the form of dust (created through cutting, drilling, grinding, abrading, sanding, vibrating or polishing; as well as through activities related to renovation, demolition, repair or maintenance operations) or fume (created when lead is heated to temperatures above its melting point). Typically, temperatures above 500°C experienced during smelting, refining, welding and flame cutting or burning, are required before significant airborne concentrations of fumed lead are produced.

When lead is inhaled or ingested, it can enter the bloodstream and travel to soft tissues (such as the liver, kidneys, lungs, brain, spleen, muscles and heart). Some of this lead is filtered out of the body and excreted via urine, faeces, sweat and sloughing of dead skin. However, over time, lead in the body will move into the bones and teeth and can be stored there for a long time. Lead does not have a known function in the human body. It disrupts the function of enzyme systems that use other metals such as calcium, zinc and iron. Many of the health effects from lead take a long time to develop and may only become apparent after years of exposure.

Chronic exposure to small amounts of lead can result in a build-up of lead in the body over time, and the more lead in the body, the more likely that health problems will be experienced. Lead will naturally leave the body over time, but under conditions of continued exposure not all lead will be eliminated and will accumulate in body tissues and bone.

4.1 Symptoms of Lead Exposure

Harmful effects can follow a high exposure over a short-term (acute exposure), or a low exposure over a long-term (chronic exposure).

Table 1: Symptoms and Adverse Health Effects of Lead Poisoning

Acute	• Abdominal cramps • Acute encephalopathy, a condition affecting the brain that develops quickly into seizures, coma, and death from cardiorespiratory arrest (extremely rare) • Constipation	• Diarrhea • Headaches • Irritability • Metallic taste in the mouth • Muscle and joint pain • Tiredness • Vomiting
Chronic	• Anemia, a low number of blood cells • Anxiety • Blue line on the gums • Colic with severe abdominal pain • Constipation • Damage or impairment to the reproductive systems • Damage to the blood forming system • Damage to the brain and kidneys • Damage to the nervous system • Damage to the urinary system • Dizziness • Excessive tiredness • Headaches • High blood pressure	• Hyperactivity • Impaired intellectual development, behaviour, size and hearing of infants. • Insomnia • Loss of appetite • Metallic taste in the mouth • Muscle and/or joint pain or soreness • Nausea • Nervous Irritability • Numbness • Pallor • Possible carcinogen (cancer causing) • Tremors • Weakness (including in fingers, wrists, or ankles) • Wrist drop (the inability to hold the hand extended)

Symptoms listed above should not be relied upon to warn of or to self-diagnose lead-exposure. Some workers may not exhibit a change in health and two workers with similar exposures may exhibit significantly different symptoms. Proper medical assessment and testing by a physician is the only way to assess health impacts due to lead exposure.

Workers may carry lead-containing dust home on clothes, footwear, skin or hair, thereby increasing secondary exposure to themselves and potentially exposing family members to lead. The best approach in preventing lead exposure and lead poisoning is to be aware of its presence, ensure that proper engineering controls are in place and that control measures are properly implemented during the disturbance, handling, disposal and clean-up of lead and to follow proper worker hygiene (washing) procedures.

For additional information on the Health Effects of lead exposure, refer to "*Health Canada Final Human Health State of the Science Report on Lead*", February 2013.

4.2 Blood Lead Level and Total Body Burden

Worker exposure to lead is assessed by two primary exposure indices: Blood Lead Level (BLL) and Lead in Mineralizing Tissues, specifically bones and teeth. Thirdly, some lead may also accumulate in soft body tissue (liver, kidneys, lungs, brain, spleen, muscles and heart). The sum of these indices is referred to as Total Body Burden (TBB). BLL is a measure of the amount of lead in the blood and can be used to determine if additional control measures are required or if workers require removal from a work environment. In order to help ensure lead levels in the body do not reach the point where removal from work or treatment is required, airborne lead exposure limits have been established to control the inhalation exposure to workers and proper hygiene procedures are used to control worker ingestion of lead.

5. OCCUPATIONAL EXPOSURE LIMITS

Employers are required by Ontario Regulation (O. Reg.) 833 "*Control of Exposure to Biological or Chemical Agents*" to limit the exposure of workers to specified hazardous biological or chemical agents in accordance with the values set out in the Regulation. In addition, O. Reg. 490/09 "Designated Substances" specifies worker exposure limits to lead. If a hazardous biological or chemical agent is not listed, the regulation prescribes the use of the exposure values set by the American Council of Governmental Industrial Hygienists (ACGIH). These values restrict the amount and duration of worker exposure to airborne concentrations of hazardous biological or chemical agents.

Currently, construction site projects are exempt from these regulations, however, under the occupational health and safety act general duty requirements, employers are required to do everything reasonable and practicable to protect workers from workplace hazards. Maintaining worker exposure within the prescribed occupational exposure levels is considered best management practice for construction workers.

5.1 Airborne Lead Exposure Limits

Ontario Regulation 490/09

- 0.05 mg/m^3 Time-Weighted Average (TWA)(8 hour day or 40 hour week).

Ontario Regulation 833

- 0.05 mg/m^3 TWA(8 hour day or 40 hour week).

5.2 Rationale for Determination of De Minimis (i.e. virtually safe) Level

O. Reg. 490/09 and O. Reg. 833 prescribe time-weighted average (TWA) occupational exposure levels in Ontario for airborne lead in industry. The Ministry of Labour Guideline "Lead on Construction Projects" established measures and procedures for certain operations to protect worker health based on the type of work (lead operation being done) to maintain worker lead exposure within the TWA prescribed by O. Reg. 490/09 and O. Reg. 833. This guideline provides additional information and procedures for other activities, to enhance worker safety and assist in regulatory compliance.

Work activities involving lead are categorized by this guideline as Class 1, Class 2 or Class 3 Lead Operations. Classes of lead operations are defined in Section 7. Measures, procedures, controls and personal protective equipment requirements for each Class are provided in Section 8.

Various occupational and workplace safety authorities and agencies consider that, depending on the type of disturbance, airborne lead could be generated in hazardous levels from any amount of lead in a paint or surface coating. As such, these agencies have not set a level of lead in paint at which lead-related precautions are not required (a de minimis level). Similarly, there is no established concentration of lead below which lead procedures are not required if a lead-containing material is disturbed.

With no set level below which lead precautions are not required, lead precautions would be required when disturbing a material containing any measureable amount of lead. Several issues arise when abatement, construction repairs or maintenance are required:

- Lead is frequently present in low part per million concentrations in paints and surface coatings due to contaminants in the ingredients. Almost all coatings will be assumed to contain lead since it is not possible, using current analytical methods, to measure zero lead concentration. Therefore, no paint or surface coating can be said to be lead-free.

- If any concentration of lead in paint or surface coating can create an airborne hazard, then every disturbance, including disturbance of new paint or surface coating (legally containing up to 0.009% lead) is a hazard. This implies that tasks such as new paint applications, drilling a hole through a painted surface, or cutting an opening in a painted surface, no matter how small, would be considered a lead operation.
- Nearly every construction or maintenance worker would disturb lead at some point. Therefore, each worker would require lead abatement training, medical surveillance, and every employer would require a respirator program.
- Since there is no Ontario exposure limit for lead exposures in construction, workers on construction sites may not be protected to the same extent as workers in other workplaces.

This guideline establishes a de minimis (i.e. virtually safe) level of lead in paint or surface coatings where a hazard would not likely be present. The following rationale applies to tasks that do not create excessive or significant dust, mist or fume. Tasks that generate significant dust, mist or fume are excluded and always require adherence to Class 2 or Class 3 operations or require an exposure assessment.

Considering:

- The Ontario TWA for lead is 0.05 mg/m^3,
- The Ontario TWA for Particles Not Otherwise Specified (PNOS), sometimes termed "nuisance dust", is 10 mg/m^3 measured as inhalable dust; and
- The U.S. Environmental Protection Agency (EPA) and The Department of Housing and Urban Development (HUD) guideline states that a lead-based paint is any paint containing 0.5% lead (or 1 mg/cm^2 if measured by an X-Ray Fluorescence Analyzer (XRF).

If a paint or surface coating containing 0.5% lead was made completely airborne, but not diluted by other dusts (i.e. if all of the paint was sanded off and made airborne and the substrate untouched), then the PNOS TWA would have to be exceeded in order for the lead TWA to be exceeded:

10 mg/m^3 PNOS (nuisance dust) x 0.5% lead = 0.05 mg/m^3 airborne lead (which equals the TWA)

If work is done on lead-containing paint or surface coatings (containing up to 0.5% lead) and the PNOS TWA is not exceeded then the Occupational Exposure Limit (OEL) for lead cannot be exceeded. This is conservative as some of the substrate would be expected to become airborne in most disturbances (e.g. power tool disturbance of paint on plaster or wood, hand or power sanding of painted wood).

Similarly, if a painted surface with 0.25% lead was made completely airborne (and not diluted) then the TWA for lead could not be exceeded unless the TWA for PNOS was exceeded by at least a factor of two. This represents a concentration that is half the TWA (commonly called an action level) and, consistent with standard occupational hygiene practice, would not require respiratory protection.

The U.S. Occupational Safety and Health Administration (OSHA) has set 0.03 mg/m^3 (30 $\mu g/m^3$, TWA) as an action level:

> *The interim final standard establishes an action level of 30 micrograms of lead per cubic meter of air (30 $\mu g/m^3$), averaged over an 8-hour workday. The action level triggers several ancillary provisions of the standard such as exposure monitoring, medical surveillance, and training.*

Based on this approach OSHA does not require lead-specific precautions if the airborne exposure is below the action level. In this case, the non-lead portion of the paint (particulate matter) is the limiting hazard.

The Workplace Hazardous Material Information System (WHMIS) is enforced in all work places, and at less than 0.1%, an ingredient does not need to be listed on the Material Safety Data Sheet (MSDS). If a material containing less than 0.1% lead was to be made airborne then the TWA for PNOS would have to be exceeded by at least 5 times before the TWA for lead would be exceeded.

Lead content of 0.1% (i.e. 1000 µg/g or 1000 mg/kg or 1000 ppm lead) is considered a de minimis level of lead in paint or surface coatings, provided that aggressive disturbance or heating does not occur.

5.3 "De minimis" or "virtually safe" Lead Level for Paints and Coatings

For the purpose of this guideline:

- Paints or surface coatings containing less than or equal to 0.1% lead by weight (1000 µg/g or 1000 mg/kg or 1000 ppm lead) are considered low-level lead paints or surface coatings. 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.

- Paints or surface coatings containing greater than 0.1% lead by weight (1000 µg/g, or 1000 mg/kg, or 1000 ppm) but less than 0.5% lead by weight (5000 µg/g, or 5000 mg/kg, or 5000 ppm lead) are considered lead-containing paints or surface coatings. 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.
- Regardless of lead content in paints or surface coatings, tasks that create an aggressive disturbance of coatings such as torching/welding, abrasive blasting 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.
- Construction operations involving lead-based paints or surface coatings (i.e. concentrations equal to or greater than 0.5% lead by weight (5000 µg/g, or 5000 mg/kg, or 5000 ppm lead) 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.

5.4 Blood Lead Monitoring and Medical Surveillance

Even with appropriate measures to control lead in the workplace, some workers may be occupationally and non-occupationally exposed. Periodic medical examinations are important for determining if the control measures in place are effective and being properly followed. Medical surveillance is a method of early detection of lead over exposure and assists in prevention of lead poisoning.

EACC recommends that all lead workers be tested for blood lead levels to properly document lead accumulation from all exposure sources including inhalation and ingestion. Testing for blood lead levels is recommended as follows.

1) Prior to starting to work with lead;
2) Immediately prior to long-duration lead abatement projects (regardless of Class);
3) Monthly during;
    a. prolonged lead abatement projects (regardless of Class),
    b. frequently completed lead operations (regardless of Class), or
    c. Class 3 lead abatement projects.

4) At the end of long-duration lead abatement projects (regardless of Class); and

5) At least annually for workers involved in incidental lead work.

Consideration should also be given to additional project-specific testing for Class 2B or Class 3 Operations.

5.5 Blood Lead Guidelines

Blood lead level (BLL), is measured in micrograms of lead per decilitre of blood (µg/dL) or micromoles of lead per litre of blood (µmol/L).

The current Ontario Code for Medical Surveillance of Lead indicates the following limits:

- > 70 µg/dL – remove from work
- > 60 µg/dL – Action Level: enquiry regarding work practices & personal hygiene
- ≤ 50 µg/dL – acceptable for return to work
- > 40 µg/dL – fertile woman must be removed from work

6. WORKER TRAINING

6.1 Training

Training is the first step in ensuring a safe and healthy workplace. It provides employers and workers with the knowledge required to protect themselves and others from injury and illness.

All workers involved in the disturbance or handling of lead-containing materials, or are otherwise exposed to lead, shall receive training.

Training shall be provided by a "Competent Person" as defined by the Occupational Health and Safety Act (OHSA) and ideally by an individual with lead identification and lead abatement training and experience.

The employer shall implement and document a training program for workers and ensure worker participation in the program. Training shall be completed for a worker conducting work which involves lead or may expose a worker to lead. Training shall be provided every 3 years at a minimum. For workers who conduct work that is routinely above the time-weighted average (TWA) for lead (i.e. Class 2 or Class 3 Operations), training shall be provided at least annually.

At a minimum training shall include:

a) Brief history of lead usage with a focus on lead in building materials,

b) Review of Material Safety Data Sheets (MSDS),

c) Review of the health hazards and illnesses association with lead exposure,

d) Discussion on the health effects of lead on adults and children,

e) Lead exposure symptom recognition,

f) Description of how lead is stored in the body and can cause health effects later in life, and the limitations of blood lead monitoring,

g) Explanation of routes of entry into the body including inhalation, ingestion and skin absorption. With attention paid to the risks associated with subsequent ingestion and the prohibiting of eating, smoking or chewing in the work area,

h) Explanation of secondary exposure and exposure of family by taking contamination home on work clothing,

i) The identification and nature of operations and activities that could result in lead exposure,

j) Definition of the di minimis level for lead in paints and surface coatings and an explanation of its concept,

k) Explanation of legislative exposure values for airborne lead,

l) The purpose of Personal Protective Equipment (PPE), particularly coveralls and respirators,

m) The selection, fitting, use, maintenance, and limitations of PPE,

n) The proper donning (putting on) and doffing (taking off) and disposal of PPE,

o) Review proper hand and face washing and hygiene techniques,

p) The benefits of using indicator and chelating soaps and wipes to ensure adequate hand washing,

q) The measures and procedures for various lead operations,

r) The purpose and benefits of a medical surveillance program, and

s) General non-lead hazards that may exist on lead projects.

6.2 Training Requirements – Lead Awareness and Class 1 Operations

In addition to the requirements of sections 6.1:

a) Lead Awareness Training shall be no less than four hours in duration,

b) Workers shall be trained in the measures and procedures prescribed in Class 1 Operations (Section 7.1), and

c) Proper waste classification and disposal in accordance with the Ontario Ministry of Environment Regulations.

6.3 Training Requirements – Class 2 and Class 3 Lead Operations

In addition to the requirements of section 6.2:

a) Class 2 and Class 3 Lead Operations Training Program shall at a minimum be 1 day (7.5 hours) in classroom theory and shall include a practical hands-on training component,

b) The employer shall ensure that every worker performing or involved with Class 2 and Class 3 Operations has successfully completed Lead Awareness Training and Class 2 and Class 3 Operations Training Program,

c) Shall clearly define Class 2 and Class 3 Operations, and

d) Proof of successful completion shall be issued to both the worker and employer in the form of a certificate.

NOTE: A worker certified with the 253H designation granted by the Ontario Ministry of Training Colleges and Universities (MTCU) is considered to have training equivalent to the requirements of Class 2 and Class 3 as stipulated in this guideline.

7. CLASSIFICATION OF WORK OPERATIONS

Each class of work specifies respirators, measures and procedures that shall be used and followed to protect workers and others from lead exposure. Work is classified based on the type of disturbance or activity that may cause lead exposure and/or the anticipated airborne concentration of lead. In this guideline, work involving lead is classified into three groups, Class 1, Class 2 and Class 3 Operations. Class 2 and Class 3 Operations are further subdivided. Airborne lead concentration typically increases as the classification increases.

NOTE: The application of a physical barrier (e.g. an encapsulant or new coat of paint) to a stabilized lead-containing material, or a paint or surface coating, is not considered a Lead Operation regardless of the concentration on lead in the underlying material. This also pertains to

applying new low-lead level paints or surface coatings to lead-containing or lead-based paints or surface coatings (e.g. repainting).

7.1 Class 1 Operations

a) Removal of lead-containing or lead-based paints and surface coatings with a chemical gel/stripper or paste.

b) Application of lead-containing or lead-based paints and surface coatings with a brush, roller or sponge.

c) Installation or removal of lead sheeting or flashing.

d) Installation or removal of lead-containing packing, babbitt, caulking, gasket or similar material.

e) Removal of materials coated with lead-containing or lead-based paints and surface coatings, using non-powered hand tools, where the material remains chiefly intact and is not crumbled, pulverized or powdered.

f) Operating construction or demolition equipment (e.g. excavator, bulldozer) during building renovation or demolition where lead-based paints or surface coatings are present on building materials and are being disturbed.

g) Soldering with lead solder.

h) Removing lead-containing or lead-based paints or surface coatings with a heat gun.

i) Removing lead-containing and lead-based paints and surface coatings using a high-pressure water jet (e.g. pressure washer).

7.2 Class 2 Operations

7.2.1 Class 2A Operations

a) Removal of lead-containing or lead-based paints and surface coatings or lead-containing materials using a power tool that has an effective dust collection system[1] equipped with a HEPA filter.

b) Welding, torching or high temperature cutting of lead-containing materials indoors when using an effective fume collector or smoke eater[2] that filters and exhausts lead fume and expels it directly outdoors (away from occupants, entrances, walkways, rest areas, etc.). Fume collector or smoke eater must have

[1] An effective dust collection system, which is an engineering control, that controls airborne lead concentration levels (measured on the worker) to below 0.05 mg/m^3.

[2] An effective fume collection system/smoke eater, which is an engineering control, that controls airborne lead concentration levels (measured on the worker) to below 0.05 mg/m^3.

effective source control and capture velocity, minimum of 0.5 metres per second (100 feet per minute) at the work surface.

c) Welding, torching or high temperature cutting of lead-containing and lead-based paints and surface coatings or lead-containing materials outdoors.

d) Removal of lead-containing mortar using handheld non-powered tools.

e) Removal of lead-containing and lead-based paints and surface coatings or lead-containing materials by scraping or sanding (including wet sanding) using non-powered hand tools.

f) Demolition of plaster or building components that crumble, pulverize or powder and are covered with lead-containing or lead-based paints or surface coatings.

g) Clean up and removal of a significant amount of lead-containing dust and debris (that can be made easily airborne) using wet methods or HEPA vacuums.

7.2.2 Class 2B Operations

a) Spray application of lead-containing paints and surface coatings.

7.3 Class 3 Operations

7.3.1 Class 3A Operations

a) Removal of lead-containing or lead-based paints and surface coatings or lead-containing materials using a power tool without an effective dust collection system equipped with a HEPA filter.

b) Welding, torching or high temperature cutting of lead-containing materials indoors or in a confined space (e.g. within a ditch or pit).

c) Removal of lead-containing mortar using a powered cutting device.

d) Burning of a material containing lead.

e) Removal, cleaning or repair of a ventilation system or ductwork used for controlling lead exposure.

f) Spray application of lead-based paints and surface coatings.

g) In the absence of an exposure assessment:

   i. demolition or cleanup of a facility where lead-containing products were manufactured and significant dust and debris, which can be made easily airborne, is present.

   ii. cleanup of dust and debris down range of a firing station in an indoor firing range.

iii. an operation that may expose a worker to lead dust, fume or mist that is not a Class 1, Class 2, or Class 3B operation.

7.3.2 Class 3B Operations

a) Abrasive blasting of lead-containing and lead-based paints and surface coatings or lead-containing materials (including wet, slurry and dry abrasive blasting and dry-ice blasting).

7.4 Alternate Work Classification Method

Alternatively, the classification of Lead Operations during construction can be based on airborne concentrations.

Table 2: Determination of Class by Airborne Lead Concentration

Class 1 Operations	Class 2 Operations		Class 3 Operations	
	Class 2a	Class 2b	Class 3a	Class 3b
0.025 to 0.05 mg/m^3	>0.05 to 0.50 mg/m^3	>0.50 to 1.25 mg/m^3	>1.25 to 2.50 mg/m^3	>2.50 mg/m^3

Procedures that generate airborne lead at concentrations below 0.025 mg/m^3 do not require the use of lead procedures or personal protective equipment, however 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 establishing washing facilities for workers to wash hands and face.

Determination of airborne lead concentrations can be made by conducting a negative exposure assessment consistent with the principles of the American Industrial Hygiene Association (AIHA), "Strategy for Assessing and Managing Occupational Exposures". The assessment will measure the airborne lead concentrations during a specific work activity, under specific conditions, while implementing control measures detailed in Section 8. The assessment may demonstrate that engineering controls and other preventive measures are maintaining airborne concentrations of lead within an acceptable exposure range. This proof of exposure control can be used to classify a specific activity or to justify the use of alternative lead-specific precautions pertaining to an existing Class. In order to determine (or reduce) the Classification of a work operation, a negative exposure assessment shall be completed and must include worker personal air monitoring.

Local exhaust ventilation, dust collectors, enclosures or other engineering controls may be used to reduce airborne lead concentrations and reduce the measures and

procedures prescribed in the applicable Class. An exposure assessment shall be performed to ensure the effectiveness of the controls.

8. ENGINEERING CONTROLS, PROCEDURES AND HYGIENE

8.1 Planning

An evaluation of the site shall be completed by a competent person to identify classes of work and prepare a plan to satisfy site specific requirements.

8.2 Inspections

A pre-start inspection shall be completed by a competent person. The purpose of this inspection is to ensure and document that the prescribed measures are established and acceptable prior to the start of any work that will disturb lead. The following are minimum inspection requirements:

a) An inspection of the work area signage and containment, if applicable.

b) An inspection of the equipment.

c) An inspection of the hygiene facilities and intended procedures.

d) An inspection of ventilation controls, if applicable.

Routine inspections must be scheduled while the lead operations are ongoing to ensure and document that the prescribed measures remain in-place and the prescribed procedures are being followed.

Prior to each shift, a competent person shall inspect the work area, any enclosures and washing facility or decontamination facility for defects or deficiencies. All defects and deficiencies shall be corrected before work resumes. The decontamination facility shall be maintained in a clean and sanitary condition.

8.3 General Principles

The strategy for controlling airborne lead hazard is broken down into following basic principles:

a) Worker education,

b) Prevent lead from becoming airborne,

c) Prevent airborne lead from spreading,

d) Remove airborne lead,

e) Prevent workers from inhaling airborne lead and or ingesting lead, and

f) Adequate cleaning to control exposure to lead residue.

To avoid the ingestion, inhalation and unintentional transfer of lead from contaminated areas, it is essential to have the following control methods in place:

a) Engineering controls,

b) Work practices,

c) Hygiene practices, and

d) Protective clothing and equipment.

8.4 Engineering Controls

Workplace stakeholders, which may include owners, constructors, contractors, specification writers, supervisors and workers, involved in construction projects that may expose workers to lead should:

a) Substitute lead-containing materials with low lead content (or materials described commercially as lead-free) alternatives where possible.

b) Select methods and equipment for the removal or installation of lead-containing materials that will reduce dust generation (e.g. wet methods, such as wet sweeping and shovelling) and shall be used whenever practicable.

c) Provide general mechanical ventilation to remove contaminated air from the workplace. The replacement air entering the work area must be free from contamination with any hazardous dust, mist, fume, vapour, or gas.

d) Provide local mechanical ventilation to remove dust, mist and fumes at the source whenever possible. Local mechanical ventilation shall have adequate capture velocity at the source of generation to control worker exposure to dust mist and fumes containing lead. The following should be met.

   i. Cross draft 0.5 metres per second (100 feet per minute), and

   ii. Down draft 0.25 metres per second (50 feet per minute).

e) Unless working in a Class 3 enclosure, power tools used to remove lead-containing paints and surface coatings shall be equipped with an effective dust collection systems attached to HEPA Filters. The dust shroud shall be kept flush with the surface from which the paint or surface coating is being removed.

8.5 Work and Hygiene Practices

Work practices, personal protective equipment and hygiene practices are on-the-job activities that reduce exposure to lead. Lead-containing material can accumulate on the hands, clothing and hair and when disturbed, can be re-suspended in air and inhaled or ingested. Personal protective clothing and equipment for each Class of lead operation is described in Section 9. Workers shall decontaminate at the end of each shift. The specific washing and decontamination facilities that shall be provided for lead work are detailed in Section 10. For all work with the potential for lead exposure, there shall be no smoking, eating, drinking or chewing in contaminated areas. Food, beverages and tobacco products shall be left outside the work area.

An effective housekeeping program requires regular clean-up and removal of lead-containing dust and debris. Surfaces shall be kept clean by washing down with water or cleaning with a vacuum equipped with a HEPA filter. Lead waste containers shall be kept tightly covered (dust tight) to prevent dust from becoming airborne. Cleaning with compressed air or dry sweeping shall not be performed.

8.6 Measures and Procedures for Class 1, Class 2 and Class 3 Operations

This section of the guideline outlines the general measures and procedures for all work with lead-containing materials, followed by specific minimum recommendations for Class 1, Class 2 and Class 3 operations.

8.6.1 Class 1 Operations

a) Washing facilities consisting of a wash basin, clean water, soap (consider the use of lead-specific soaps and hygiene indicators based on the scope of the Operation) and towels shall be provided. Workers shall use these washing facilities upon leaving the work area and before eating, drinking or smoking.

b) Respirators should not be necessary if all general health and safety procedures are followed. However, any worker who requests a respirator shall be provided with a respirator, as prescribed in Table 3, and the worker shall wear the respirator.

c) Coveralls should not be necessary if all general health and safety procedures are followed. However, any worker who requests coveralls shall be provided with coveralls, as prescribed in Section 9, and the worker shall wear the coveralls.

d) Gloves shall be provided, as prescribed in Section 9, and the worker shall wear the gloves.

e) Use removal methods that minimize dust generation whenever possible.

f) Suppress any dust generated.

g) Workers shall not eat, drink, chew or smoke in the work area.

h) Dust and waste shall be cleaned up at regular intervals and placed in a container that is;

   i. dust tight,

   ii. suitable for the type of waste,

   iii. identified as lead waste,

   iv. cleaned with a damp cloth or a vacuum equipped with a HEPA filter, or placed in a clean bag so that a clean exterior surface is achieved immediately prior to removal from the work area,

   v. removed from the workplace frequently and at regular intervals, and

   vi. evaluated for lead-content and disposed of in accordance with applicable regulations.

i) The use of 6 mil polyethylene bags as a waste container is acceptable provided it is appropriate for the type of waste. Double bagging of waste is recommended.

j) Drop sheets shall be used below all lead operations that may produce dust, chips, or debris containing lead.

k) Dry removal of lead-containing or lead-based paints and surface coatings shall be minimized whenever possible.

l) Wetting of materials shall be conducted whenever possible to control dust. The addition of wetting agents should be considered. Wetting should not be used if it may create a hazard or cause damage.

m) Wet methods should be incorporated in the operation to reduce dust generation. Examples of wet methods include wetting surfaces, wet mist, wet scraping and wet shovelling.

n) Cleaning with compressed air or dry sweeping shall not be performed. Sweeping compounds shall be used where wetting is not possible.

o) All equipment, tools, respirators and clothing shall be cleaned by damp wiping, or with a vacuum equipped with a HEPA filter, prior to removal from the work area.

p) Protection of porous or fibrous surfaces is imperative as it is very difficult to remove lead-containing dust from these surfaces. If the material cannot be adequately protected from lead dust or waste it shall be removed and disposed of.

q) Any water generated from cleaning or removal operations must be appropriately contained, treated or disposed of in accordance with applicable legislation.

r) Follow worker hygiene procedures as prescribed in Section 10.

8.6.2 Class 2 Operations

a) Washing facilities consisting of a wash basin, clean water, soap (consider the use of lead-specific soaps and hygiene indicators based on the scope of the Operation) and towels shall be provided. Workers shall use these washing facilities upon leaving the work area and before eating, drinking or smoking.

b) Respirators shall be provided, as prescribed in Table 3, and the worker shall wear the respirator.

c) Gloves, coveralls and other Personal Protective Equipment (PPE) shall be provided, as prescribed in Section 9, and the worker shall wear the PPE.

d) Signage is required and the area shall be delineated to control access. Signs shall be posted in sufficient numbers to warn of the lead hazard and shall state in large clearly visible letters that, i) there is a lead hazard, and ii) Access to the work area is restricted to persons wearing protective clothing.

e) Use removal methods that minimize dust generation whenever possible.

f) Suppress any dust generated.

g) Workers shall not eat, drink, chew or smoke in the work area.

h) Dust and waste shall be cleaned up at regular intervals and placed in a container that is;

   i. dust tight,

   ii. suitable for the type of waste,

   iii. identified as lead waste,

   iv. cleaned with a damp cloth or a vacuum equipped with a HEPA filter, or placed in a clean bag so that a clean exterior surface is achieved immediately prior to removal from the work area,

   v. removed from the workplace frequently and at regular intervals, and

   vi. evaluated for lead-content and disposed of in accordance with applicable regulations.

i) The use of 6 mil polyethylene bags as a waste container is acceptable provided it is appropriate to the type of waste. Double bagging of waste is recommended.

j) Drop sheets shall be used below all lead operations that may produce dust, chips, or debris containing lead.

k) Air-handling (supply and return) systems servicing the area of the Class 2 Operation shall be removed from service or isolated to prevent migration of lead through the air handling system.

l) Dry removal of lead-containing or lead-based paints and surface coatings shall be minimized whenever possible.

m) Wetting of materials shall be conducted whenever possible to control dust. The addition of wetting agents should be considered. Wetting should not be used if it may create a hazard or cause damage.

n) Wet methods shall be incorporated in the operation to reduce dust generation. Examples of wet methods include wetting surfaces, wet mist, wet scraping and wet shovelling.

o) Cleaning with compressed air or dry sweeping shall not be performed. Sweeping compounds shall be used where wetting is not possible.

p) All equipment, tools, respirators and clothing shall be cleaned by damp wiping, or using a vacuum equipped with a HEPA filter, prior to removal from the work area.

q) Protection of porous or fibrous surfaces is imperative as it is very difficult to remove lead-containing dust from these surfaces. If the material cannot be adequately protected from lead dust or waste it shall be removed and disposed of.

r) Any water generated from cleaning or removal operations must be appropriately contained, treated or disposed of in accordance with applicable legislation.

s) Where a dust generating operation is carried out, additional local mechanical ventilation shall be provided to remove dust, mist and fumes at the source. Local mechanical ventilation is recommended for welding, burning or high temperature cutting and for the removal of lead-containing and lead-based paints and surface coatings using power tools that are equipped with a dust collection device attached to a HEPA filter. Where local mechanical ventilation is used, the following should be met:

   i. Air velocity at the source of dust, mist or fume generation shall be no less than 0.5 m/sec (100 ft./min).

   ii. Air discharged from the local mechanical ventilation system shall pass through a HEPA filter.

t) Follow worker hygiene procedures as prescribed in Section 10.

8.6.3 Class 3 Operations

a) A competent supervisor must be present at all times during Class 3 Operations. Only workers and supervisors with proper training shall perform Class 3 Operations.

b) Washing facilities consisting of a wash basin, clean water, soap (consider the use of lead-specific soaps and hygiene indicators) and towels shall be provided. Workers shall use these washing facilities upon leaving the work area and before eating, drinking or smoking.

c) Respirators shall be provided, as prescribed in Table 3, and the worker shall wear the respirator.

d) Gloves, coveralls and other PPE shall be provided, as prescribed in Section 9, and the worker shall wear the PPE.

e) Signage is required and the area shall be delineated to control access. Signs shall be posted in sufficient numbers to warn of the lead hazard and shall state in large clearly visible letters that, i) there is a lead hazard, and ii) access to the work area is restricted to persons wearing protective clothing.

f) Use removal methods that minimize dust generation whenever possible.

g) Suppress any dust generated.

h) Workers shall not eat, drink, chew or smoke in the work area.

i) Dust and waste shall be cleaned up at regular intervals and placed in a container that is,

   i. dust tight,

   ii. suitable for the type of waste,

   iii. identified as lead waste,

   iv. cleaned with a damp cloth or a vacuum equipped with a HEPA filter, or placed in a clean bag so that a clean exterior surface is achieved immediately prior to removal from the work area,

   v. removed from the workplace frequently and at regular intervals, and

   vi. evaluated for lead-content and disposed of in accordance with applicable regulations.

j) The use of 6 mil polyethylene bags as a waste container is acceptable provided it is appropriate for the type of waste. Double bagging of waste is recommended.

k) Enclosures shall be used to separate the work area from other construction activities or work areas, and to prevent lead exposure to persons not directly involved in the lead operation. Barriers should only be used where full and partial enclosures are not practicable.

u) Drop sheets shall be used below all lead operations that may produce dust, chips, or debris containing lead.

l) For Class 3a operations conducted indoors where work areas are not accessible to the public, barriers, partial enclosures, or full enclosures may be used.

m) For all other all other Class 3 operations conducted indoors full enclosures shall be used.

n) For Class 3a and 3b operations conducted outdoors, barriers, partial enclosures, or full enclosures shall be provided.

o) ***Barriers, Partial Enclosures and Full Enclosures***

i. Ropes or barriers do not prevent the release of contaminated dust or other contaminants into the environment. However, barriers can be used to restrict access to only workers who are adequately protected with proper PPE, and prevent entry of individuals not directly involved in the operation. Ropes or barriers shall be placed at a distance far enough from the operation that allows the lead-containing dust to settle. If this is not achievable, warning signs shall be posted at the distance where the lead-containing dust settles to warn that access is restricted to persons wearing PPE. Ropes or barriers shall be located no less than 10 metres from the work area.

ii. Partial enclosures may consist of vertical and/or horizontal tarps and drop sheets (e.g. polyethylene sheeting). The tarps shall overlap and be securely fixed together at the seams. A partial enclosure is not a recommended containment system if significant dust is being generated, however is suitable for containing flakes and chips.

iii. Full enclosures are tight enclosures (with tarps that are generally impermeable (e.g. polyethylene sheeting) with fully sealed joints and chambered air lock entryways/exits and upper seals). Full enclosures allow minimal or no fugitive emissions to reach the area outside the enclosure. For full enclosures, the following requirements shall be met:

a) The enclosure shall be made of windproof materials that are impermeable to dust.

b) The enclosure shall be supported by a secure, adequate and safe structure.

c) All joints in the enclosure shall be fully sealed.

d) Entrances to the enclosure shall be equipped with air locks (curtain walls, flap doors, zipper doors or solid doors).

e) The escape of dust, mist, fume, waste, blast media and debris from the enclosure shall be prevented.

f) General mechanical ventilation shall be provided by a HEPA filtered unit to remove contaminated air from the enclosure. Clean and safe make-up air that is free from hazardous dust, mist, vapours or fumes shall be provided to replace the exhausted air.

g) Filters used on ventilation equipment shall be adequate to ensure that exhausted air quality meets applicable environmental legislation and standards.

h) The air velocity within the enclosure shall provide an average minimum cross-draft or down-draft past each worker during abrasive blasting operations as follows.

- cross draft capture velocity of 0.5 m/sec (100 ft./min) at the worker breathing zone.
- Down draft capture velocity of 0.25 m/sec (50 ft./min) at the worker breathing zone.

p) The spread of lead dust from the work area shall be prevented by creating and maintaining within the enclosed area a minimum negative air pressure of 0.02 inches of water column (5 pascal), relative to the area outside the enclosed work area and/or 6 air changes per hour. Pressure differential readings must be taken and logged at regular intervals during lead removal.

q) Air-handling systems (supply and return) servicing the area of the Class 3 Operation shall be removed from service or isolated to prevent migration of lead through the air handling system.

r) Dry removal of lead-containing or lead-based paints and surface coatings shall be minimized whenever possible.

s) Wetting of materials shall be conducted whenever possible to control dust. The addition of wetting agents should be considered. Wetting should not be used if it may create a hazard or cause damage.

t) Wet methods shall be incorporated in the operation to reduce dust generation. Examples of wet methods include wetting surfaces, wet mist, wet scraping and wet shovelling.

u) Cleaning with compressed air or dry sweeping shall not be performed. Sweeping compounds shall be used where wetting is not possible.

v) All equipment, tools, respirators and clothing shall be cleaned by damp wiping, or using a vacuum equipped with a HEPA filter, prior to removal from the work area.

w) Protection of porous or fibrous surfaces is imperative as it is very difficult to remove lead-containing dust from these surfaces. If the material cannot be adequately protected from lead dust or waste it shall be removed and disposed of.

x) Any water generated from cleaning or removal operations must be appropriately contained, treated or disposed of in accordance with applicable legislation.

y) Where a dust generating operation is carried out, additional local mechanical ventilation shall be provided to remove dust, mist and fumes at the source. Local mechanical ventilation is recommended for welding, burning or high temperature cutting and for the removal of lead-containing and lead-based paints and surface coatings using power tools that are not equipped with a dust collection device attached to a HEPA filter. Where local mechanical ventilation is used, the following should be met:

   i. Air velocity at the source of dust, mist or fume generation shall be no less than 0.5 m/sec (100 ft./min).

   ii. Air discharged from the local mechanical ventilation system shall pass through a HEPA filter.

Class 3 Decontamination Facility

Establishing a decontamination facility is required for workers conducting Class 3 operations. The decontamination facility shall be located as close as practicable to the work area and shall consist of:

a) A suitable area for taking off contaminated protective clothing.

b) A shower that includes;

   i. Hot and cold water with individual controls inside the room to regulate water flow and temperature; or

   ii. Water of a constant temperature that is not less than 40° Celsius or more than 50° Celsius.

   iii. Clean towels.

   iv. Soap that is suitable for removing lead, and

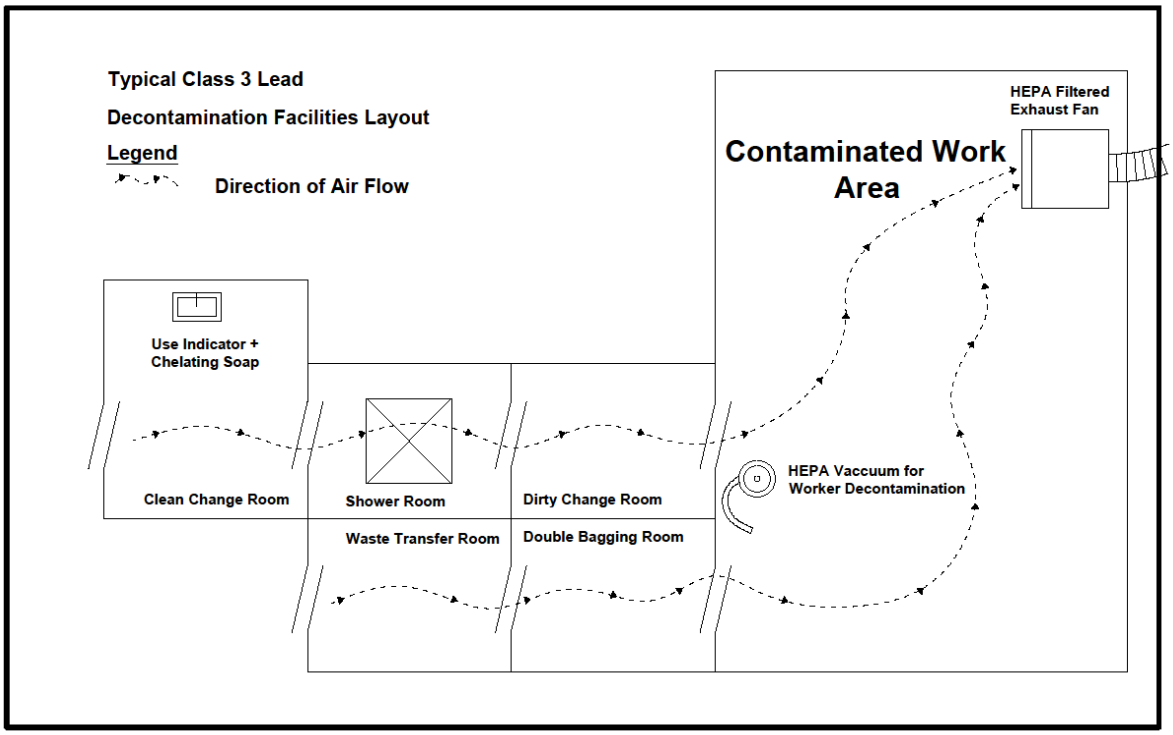
   v. Hygiene indicators to visually confirm that lead has been removed from workers hands.

c) a suitable area for changing in to street clothes and for storing clean clothing and equipment

d) Follow worker hygiene procedures as prescribed in Section 10.

Refer to Figure 1 as an example of a typical Class 3 Lead Operation decontamination facility layout.

Figure 1: Typical Class 3 Lead Operation Decontamination Facilities Layout



9. PERSONAL PROTECTIVE EQUIPMENT

Employers must ensure workers who are involved in Lead Operations, are provided with appropriate personal protective equipment (PPE) including:

a) Dust-impermeable gloves appropriate for the work being completed and disposable chemical resistant gloves for application of solvents, strippers and detergents. Refer to the Material Safety Data Sheets (MSDS) for recommended glove selection. Consideration should be given to wearing two layers of gloves in high lead exposure operations to reduce contaminant transfer during removal of protective clothing.

b) Full body coveralls made of a material that does not readily retain nor permit penetration of lead, is equipped with a hood or head covering, and that fits

snugly at the ankles, wrists and neck, in order to prevent lead dust from reaching the garments and skin under the protective clothing. Coveralls shall be repaired or replaced if torn. Suitable footwear or coverings shall be worn.

c) Respirators as prescribed by Table 3.

The following table indicates anticipated airborne concentrations of lead, associated with each Class of lead operation, with the corresponding minimum recommended respiratory protection. Respirators shall be NIOSH approved and the worker shall be fit-tested for the specific type and size of respirator.

Table 3: Lead-Specific Personal Protective Equipment

Class 1 Operation	Minimum Respirator Requirement	Lead-Specific PPE
(0.025 - 0.05 mg/m^3)	Respirators should not be necessary if the general procedures listed in Section 8 are followed and if the level of lead in the air is less than 0.05 mg/m^3. If a worker requests to wear a respirator, a half-face air purifying respirator with N-, R- or P- series filters, and 95, 99 or 100% efficiency shall be provided.	Appropriate gloves. If a worker requests, coveralls, boot covers and respirator shall be provided.
Class 2a Operation	**NIOSH APF = 10**	
(>0.05 to 0.50 mg/m^3)	Half-face air purifying respirator with N-, R- or P-series filter, and 95, 99 or 100% efficiency.	Appropriate gloves, coveralls and boot covers, respirator
Class 2b Operation	**NIOSH APF = 50**	
(>0.50 to 1.25 mg/m^3)	Full-face piece air-purifying respirator with N-, R- or P- series filter, and 100% efficiency.	Appropriate gloves, coveralls and boot covers, respirator
Class 3a Operation	**NIOSH APF = 50**	
(>1.25 to 2.50 mg/m^3)	Full-face piece air-purifying respirator with N-, R- or P- series filter, and 100% efficiency. Tight-fitting powered air-purifying respirator with a high efficiency filter. Full-face piece supplied-air respirator operated in demand mode. Half-mask or full-face piece supplied air respirator operated in continuous-flow mode.	Appropriate gloves, coveralls and boot covers, respirator
Class 3b Operation	**NIOSH APF ≥ 1000**	
(> 2.50 mg/m^3)	Type CE abrasive-blast supplied air respirator operated in a positive pressure mode with a tight-fitting half-mask face piece.	Appropriate gloves, coveralls and boot covers, respirator

	Full-face piece supplied-air respirator operated in pressure-demand or other positive-pressure mode.	

NIOSH APF – National Institute of Occupational Safety and Health Assigned Protection Factor.

Compressed air systems used with supply air respirators shall meet the requirements of CSA Standard Z180.1-13.

10. WORKER HYGIENE PROCEDURES

Good hygiene practices must be implemented during lead-related work to protect the worker from lead exposure. Every Class of lead work requires that workers thoroughly wash hands and face when leaving the work area and prior to eating, drinking, smoking or chewing. Proper hand washing techniques specific to lead decontamination shall be posted in the washing facility and products including lead specific hand soaps which combine surfaction, chelation, *p*H adjustment and mechanical removal of lead from the skin may be used. The use of post washing indicator methods that demonstrate workers have adequately removed lead from skin is strongly recommended.

Using lead wipe indicators will help the worker identify if washing was effective in removing lead. Standard soap and water alone may not be effective at removing lead from skin which can result in secondary exposure by ingestion.

10.1 Class 1 Operations

10.1.1 Decontamination and Personal Hygiene Facilities

a) Clean change areas with lockers or hangers and hooks for workers' street clothes and personal belongings. The Clean Room will also have a mirror to permit workers to fit respiratory equipment properly.

b) The Clean Area will accommodate at least one worker allowing sufficient space to change comfortably.

c) A clean lunch/break area will be provided and kept as free as practicable of lead contamination.

10.1.2 Entering the Work Area

Workers will use the following sequence when entering the work area:

a) Remove street clothes, if required.

b) Don appropriate PPE, as prescribed in Table 3, before entering the work area.

10.1.3 Exiting the Work Area

a) Remove gross contamination from coveralls, if worn, person and personal protective equipment by wet wiping, and/or using a vacuum equipped with a HEPA filter, before leaving Work Area.

b) If worn, remove coveralls while minimizing contact with undergarments or body (i.e. by removing coveralls downwards and outwards while rolling onto itself).

c) Proceed to decontamination facility to wash hands and face.

d) Washing procedure should be similar to the following sequence.

i. Wet hands and face (and respirator if worn) with water.

ii. Apply soap to cover hand surface.

iii. Rub palm to palm, back of the hands, and in between fingers for 15-20 seconds.

iv. Wash and rinse face (and respirator if worn).

v. Remove respirator if worn.

vi. Wash face, ensuring all surfaces cleaned including ears and neck.

vii. Rinse hands and face with running water.

viii. Dry hands with a single use towel.

ix. Turn off faucet with the towel and dispose of the towel.

10.2 Class 2 Operations

10.2.1 Decontamination and Personal Hygiene Facilities

a) Clean change areas with lockers or hangers and hooks for workers' street clothes and personal belongings. The Clean Room will also have a mirror to permit workers to fit respiratory equipment properly.

b) The Clean Area will accommodate at least one worker allowing sufficient space to change comfortably.

c) A clean lunch/break area will be provided and kept as free as practicable of lead contamination.

10.2.2 Entering the Work Area

Workers will use the following sequence when entering the work area:

a) Remove street clothes, if required.

b) Don appropriate PPE, as prescribed in Table 3, before entering the work area.

10.2.3 Exiting the Work Area

a) Remove gross contamination from coveralls, if worn, person and personal protective equipment by wet wiping, and/or using a vacuum equipped with a HEPA filter, before leaving Work Area.

b) If worn, remove coveralls while minimizing contact with undergarments or body (i.e. by rolling coveralls downwards and inwards into it).

c) Leave respirator on and place contaminated disposable PPE in waste container.

d) Wash hands, face, and respirator prior to respirator removal then wash face and hands again before leaving the work area.

e) Washing procedure should be similar to the following sequence.

i. Wet hands, face and respirator with water.

ii. Apply soap to cover hand surface.

iii. Rub palm to palm, back of the hands, and in between fingers for 15-20 seconds.

iv. Wash and rinse face and respirator.

v. Remove respirator.

vi. Wash face, ensuring all surfaces are cleaned including ears and neck.

vii. Rinse hands, face and respirator with running water.

viii. Dry hands and face with a single use towel.

ix. Turn off faucet with the towel and dispose of the towel.

f) Don street clothes in Clean Room prior to leaving work site.

g) Upon completion of lead abatement, dispose of shoe coverlets as contaminated waste or clean thoroughly inside and out using lead-specific soap and water, and test with lead indicator wipes before removing from the Work Area.

10.3 Class 3 Operations

10.3.1 Decontamination and Personal Hygiene Facilities

a) Establish a decontamination facility in accordance with Section 8.

b) A clean lunch/break area will be provided and kept as free as practicable of lead contamination.

10.3.2 Entering the Work Area

Workers will use the following sequence when entering the work area:

a) Remove street clothes, if required.

b) Don appropriate PPE, as prescribed in Table 3, before entering the work area.

c) Proceed through the shower facility.

d) Don reusable PPE that remains in the 'dirty change area'.

10.3.3 Exiting the Work Area

a) Remove gross contamination from coveralls, if worn, person and personal protective equipment by wet wiping, and/or using a vacuum equipped with a HEPA filter, before leaving Work Area.

b) If worn, remove coveralls while minimizing contact with undergarments or body (i.e. by rolling coveralls downwards and inwards into itself).

c) Leave respirator on and place contaminated disposable PPE in waste container. Shower without removing the respirator and clean respirator while in the shower.

d) Proceed to clean room, remove cleaned respirator and store in a sealed plastic bag/container.

h) Washing procedure, prior to leaving the clean room, should be similar to the following sequence.

i. Wet hands, face and respirator with water.

ii. Apply soap to cover hand surface.

iii. Rub palm to palm, back of the hands, and in between fingers for 15-20 seconds.

iv. Wash and rinse face and respirator.

v. Remove respirator.

vi. Wash face, ensuring all surfaces are cleaned including ears and neck.

vii. Rinse hands, face and respirator with running water.

viii. Dry hands and face with a single use towel.

ix. Turn off faucet with the towel and dispose of the towel.

e) Don street clothing before leaving the work area

11. WORK AREA CLEANING PROCEDURES

The following final cleaning procedures are minimum requirements. Additional final cleaning procedures may be necessary to meet project-specific requirements.

11.1 Class 1 Operations

a) Cleaning shall be completed in a top-to-bottom methodology (i.e. start in high locations and clean down towards floor level) and beginning at the farthest point of the work area from the entrance (i.e. clean towards the entrance to the work area).

b) Compressed air or dry sweeping shall not be used to clean the work area.

c) Clean all surfaces in the work area by wet wiping and/or using a vacuum equipped with a HEPA filter.

d) When using wet wipe cleaning, frequently and at regular intervals,
   i. Use folding technique to expose a clean surface of the cloth.
   ii. Rinse cloth with clean water.
   iii. Replace soiled cloth with clean cloth.
   iv. Replace dirty water with clean water.

e) Clean and rinse a small area at a time before proceeding to the next area.

f) Place waste in an appropriate container frequently and at regular intervals.

g) Wet and carefully roll drop sheets toward the centre of the work area. Remove visible dust and debris by wet wiping and/or using a vacuum equipped with a HEPA filter.

h) Place drop sheets in an appropriate waste container.

i) Inspect work area for cleanliness. Deficiencies shall be corrected when they are identified.

j) Complete rinsing with clean water.

k) Avoid re-contamination of clean areas.

l) Clean all tools, supplies and equipment in the work area by wet wiping and/or using a vacuum equipment with a HEPA filter. Equipment that cannot be readily cleaned (e.g. vacuum hose, wire brushes, etc.) shall be cleaned to the extent that is practical and placed in sealed containers before removing from the work area.

m) Waste containers shall be thoroughly cleaned on the exterior and sealed prior to leaving the work area.

n) Conduct clearance testing if required.

o) Following a successful visual inspection, and clearance testing if required, a sealant or an encapsulant may be applied.

11.2 Class 2 Operations

a) Cleaning shall be completed in a top-to-bottom methodology (i.e. start in high locations and clean down towards floor level) and beginning at the farthest point of the work area from the entrance (i.e. clean towards the entrance to the work area).

b) Compressed air or dry sweeping shall not be used to clean the work area.

c) The use of lead-specific cleaning solutions may be required as part of the cleaning process.

d) Clean all surfaces in the work area by wet wiping and/or using a vacuum equipped with a HEPA filter.

e) When using wet wipe cleaning, frequently and at regular intervals,

   i. Use folding technique to expose a clean surface of the cloth.

   ii. Rinse cloth with clean water.

   iii. Replace soiled cloth with clean cloth.

   iv. Replace dirty water with clean water.

f) Clean and rinse a small area at a time before proceeding to the next area.

g) Place waste in an appropriate container frequently and at regular intervals.

h) Wet and carefully roll drop sheets toward the centre of the work area. Remove visible dust and debris by wet wiping and/or using a vacuum equipped with a HEPA filter.

i) Place drop sheets in an appropriate waste container.

j) Inspect work area for cleanliness. Deficiencies shall be corrected when they are identified.

k) Complete rinsing with clean water.

l) Avoid re-contamination of clean areas.

m) Clean all tools, supplies and equipment in the work area by wet wiping and/or using a vacuum equipment with a HEPA filter. Equipment that cannot be readily cleaned (e.g. vacuum hose, wire brushes, etc.) shall be cleaned to the extent that is practical and placed in sealed containers before removing from the work area.

n) Waste containers shall be thoroughly cleaned on the exterior and sealed prior to leaving the work area.

o) Conduct clearance testing if required.

p) Following a successful visual inspection, and clearance testing if required, a sealant or an encapsulant may be applied.

11.3 Class 3 Operations

a) Cleaning shall be completed in a top-to-bottom methodology (i.e. start in high locations and clean down towards floor level) and beginning at the farthest point of the work area from the entrance (i.e. clean towards the entrance to the work area).

b) Compressed air or dry sweeping shall not be used to clean the work area.

c) The use of lead-specific cleaning solutions may be required as part of the cleaning process.

d) Clean all surfaces in the work area by wet wiping and/or using a vacuum equipped with a HEPA filter.

e) When using wet wipe cleaning, frequently and at regular intervals,

   i. Use folding technique to expose a clean surface of the cloth.

   ii. Rinse cloth with clean water.

   iii. Replace soiled cloth with clean cloth.

   iv. Replace dirty water with clean water.

f) Clean and rinse a small area at a time before proceeding to the next area.

g) Place waste in an appropriate container frequently and at regular intervals.

h) Wet and carefully roll drop sheets toward the centre of the work area. Remove visible dust and debris by wet wiping and/or using a vacuum equipped with a HEPA filter.

i) Place drop sheets in an appropriate waste container.

j) Inspect work area for cleanliness. Deficiencies shall be corrected when they are identified.

k) Complete rinsing with clean water.

l) Avoid re-contamination of clean areas.

m) Clean all tools, supplies and equipment in the work area by wet wiping and/or using a vacuum equipment with a HEPA filter. Equipment that cannot be readily cleaned (e.g. vacuum hose, wire brushes, etc.) shall be cleaned to the extent that is practical and placed in sealed containers before removing from the work area.

n) Waste containers shall be thoroughly cleaned on the exterior and sealed prior to leaving the work area.

o) When HEPA Filtered Exhaust Fan (negative air units) are used, cleaning shall start at the farthest locations from the negative air units (i.e. cleaning shall be completed moving towards negative air units).

p) Cleaning shall include the worker decontamination chambers and waste transfer rooms.

q) Minimize water pooling within the work area.

r) Leave the work area and surrounding areas dry and visibly free of dust and debris for visual inspection by the project authority.

s) Conduct clearance testing if required.

t) Following a successful visual inspection, and clearance testing if required, a sealant or an encapsulant may be applied.

11.3.1 Work Area Tear Down

a) Inspect the work area prior to starting tear down. Ensure the work area has achieved the appropriate level of cleanliness, that clearance sample requirements have been met, and that clearance has been accepted by the project authority.

b) Remove polyethylene sheeting used during abatement by wetting and carefully rolling towards the centre of the work area. Remove visible dust and debris by wet wiping and/or using a vacuum equipped with a HEPA filter.

c) Immediately upon shutting down negative air units, seal air inlet grill and exhaust vent with polyethylene and tape. Clean the cabinet by wet wiping before removal from the work area.

d) Following enclosure dismantling, a post tear down visual inspection should be completed. If required, additional cleaning should be completed by wet wiping and/or using a vacuum equipped with a HEPA filter.

12. LEAD CLEARANCE STANDARDS

12.1 Lead Clearance Assessments

12.1.1 Class 1 and Class 2 Operations

A lead clearance assessment shall be conducted upon the completion of Class 1 and 2 Operations and shall consist of a visual assessment. The area shall pass the inspection if it is visually clean. Special consideration shall be given to areas that are difficult to access, or clean, such as corners or rough surfaces.

Lead clearance wipe sampling may be considered for large scale Operations conducted in areas of buildings occupied by sensitive populations including:

a) Children (e.g. daycares and primary schools).

b) Pregnant and nursing women.

c) Food preparation, processing and serving areas.

d) Pediatrics, labour and delivery, and maternity areas of hospitals.

e) Residential buildings.

12.1.2 Class 3 Operations

Lead clearance testing shall be conducted upon the completion of Class 3 Operations. The purpose of clearance testing is to verify that work areas have been

cleaned sufficiently and to demonstrate that it is safe for workers and occupants. The clearance assessment and testing must be completed by a competent person.

The clearance assessment has two components:

1. A visual assessment

The work area passes the visual inspection if it is adequately cleaned of dust and debris. Special consideration shall be given to areas that are difficult to access or clean such as corners or rough surfaces. The presence of dust, debris or residue indicates that the cleaning was insufficient and additional cleaning shall be completed. Following additional cleaning, a follow-up inspection is required.

2. Collection and analysis of wipe samples

Wipe sampling shall not be completed until the area passes visual inspection. Wipe samples shall be collected in accordance with a validated analytical method. Wipe samples may not be required if a physical barrier will be installed over cleaned surfaces in a manner that prevents access (to the cleaned surfaces) by building occupants.

12.2 Clearance Wipe Sampling

Clearance wipe sampling provides analytical confirmation that an area has been adequately cleaned. Representative sample locations and sample quantities must be collected from the project area in order to effectively demonstrate that the lead concentration is within acceptable levels. Samples shall be collected in accordance with the procedures in Section 13. The following table lists the minimum number of clearance wipe samples to be collected.

Table 4: Minimum Number of Clearance Wipe Samples

Area of Work or Cleaned Surface(s)	**Minimum Number of Wipe Samples**
1 square meter or less	1
Greater than 1 square meter but less than 10 square meters	2
Greater than 10 square meter but less than 100 square meters	3
Every additional 100 square meters	1
If present, inside the clean room entrance/exit to the work area	1
Clearance for Indoor Firing Ranges	
Exhaust fan inlet area and outlet area (1 sample in each area)	2
Range floor	3
Horizontal surfaces other than the floor (i.e. counters, sills)	3
Bullet trap area	3
Vertical surfaces such as walls, frames	3
Horizontal surfaces exterior to range (i.e. at entrances)	3

If present, inside the clean room entrance/exit to the work area	1

A minimum of 1 field blank shall be collected for each clearance sampling event. No less than 1 field blank for every 10 field samples, or part thereof, shall be submitted for laboratory analysis.

12.2.1 Wipe Sampling Clearance Criteria

Lead concentrations of clearance wipe samples, when at or below the assigned clearance criteria, provides analytical confirmation that an area has been adequately cleaned.

Wipe sampling clearance criteria, as detailed in Table 5, are not intended to be an action level or trigger to initiate cleanup activities.

Table 5: Wipe Sampling Clearance Criteria

Area or Surface to be Tested	Clearance Criteria[3]	
	µg/100 cm^2	µg/ft^2
Exterior concrete and rough surfaces	86.1	800
Interior concrete, window troughs, rough surfaces	43	400
Interior window sills	26.9	250
Firing ranges and work places where lead is used	21.5	200
Floors and other surfaces: Non-Residential	21.5	200
Floors and other surfaces: Residential	4.3	40
Child care facilities, primary schools, food preparation, food processing, pediatrics, labour and delivery, and maternity areas of hospitals (all surfaces routinely accessible by occupants or used in food processing).	4.3	40

12.3 Air Sampling for Lead Clearance

Surface wipe sampling is the preferred clearance testing method over air sampling as it more accurately represents the remaining lead and the potential for future worker or occupant exposure. Air sampling should not be used alone for clearance purposes, but can be considered to supplement clearance wipe sampling.

12.4 Composite Wipe Sampling

Composite wipes are wipe samples consisting of more than one co-mingled wipe per container. Composite samples provide an average level of lead over the

[3] If these levels cannot be achieved, a barrier (e.g., drywall, paint or surface coating, tile) may be installed to prevent access to the cleaned surface by building occupants.

multiple samples and, therefore, low levels in some samples may mask higher levels (that exceed clearance standards) in others.

There is a lack of inter-laboratory proficiency testing programs for analysis of composited wipe samples that may place the validity of the data under scrutiny. Due to accreditation reporting requirements most laboratories will be obligated to place significant disclaimers and limitations on the results of composite wipes which may further confound interpretation and call into question the value of the results.

If a composite sample is analyzed and exceeds the clearance criteria, all areas encompassed by that composite sample must be re-cleaned (possibly multiple rooms or a large area). Alternatively, if a discrete sample is collected in each room/area, only the room/area associated with a sample that exceeds the criteria will require re-cleaning.

If a competent person determines that composite wipe sampling is appropriate for clearance or pre-abatement assessment of lead, then the following recommendations, in addition to general wipe sample requirements and quality assurance and quality control measures, should be observed:

a) Confirm that the laboratory is accredited to perform lead analysis and can analyze composite samples and, if so, whether special quality assurance practices are required.

b) Wipes used for composite samples shall meet the requirements of a validated analytical method.

c) Composite samples must not contain subsamples from different component or surface types. All the subsamples must be collected from same building components and surface type (e.g. a single composite sample shall not be collected from a carpeted floor and a concrete floor).

d) The same type of wipe must be used for all subsamples of a composite sample.

e) The surface areas of subsamples used in a composite sample must swab the same surface area. For example, each subsample in a single composite sample would wipe 100 square centimeters.

f) The areas to be sampled and composited shall be determined prior to the start of sampling.

g) A new wipe must be used for each area sampled. No more than four subsamples shall make up a composite sample.

h) All subsamples must be inserted into the same container.

i) Composite samples must not be taken from rooms/areas that have dramatically different conditions.

j) Laboratory-supplied containers must be used to contain wipe samples to facilitate quantitative rinsing.

The clearance level criterion must be adjusted relative to the number of subsamples in the composite sample. This is done by dividing the clearance level by half the number of subsamples in the composite.

> **Example:** A composite wipe sample contains four (4) subsample wipes. The applicable clearance level for the surface sampled is 40µg/ft^2. Divide 40µg/ft^2 by 2 (which is half of the 4 subsamples). The adjusted clearance level is 20µg/ft^2. All samples must meet the adjusted clearance level to be considered a pass.

The total number of required samples shall meet the requirements of Table 4 (i.e. where two samples are required in the table, either two discrete samples or two composite samples are required).

13. LEAD SAMPLING ANALTYICAL METHODOLGY

Prior to sample collection, an accredited laboratory and validated analytical method shall be selected for the sample analysis. Samples shall be collected by a competent person in accordance with the validated method.

13.1 Laboratory Accreditations

Ensure laboratories are accredited to perform the analysis requested. The following accrediting agencies are recommended as accrediting bodies for the National Lead Laboratory Accreditation Program (NLLAP):

- Canadian Agency for Laboratory Accreditation (CALA)
- American Industrial Hygiene Association (AIHA)
- American Association for Laboratory Accreditation (A2LA)
- Perry Johnson Laboratory Accreditation, Inc. (PJLA)
- ANSI-ASQ National Accreditation Board/ACLASS
- Laboratory Accreditation Bureau

13.2 Analytical Methods and Limits of Detection

The following table is a summary of analytical methods, applicable to a specific sample matrix (i.e. paint chips, solids, dust wipes, air), and the corresponding limit of detection for each method. An accredited laboratory should be consulted if additional information or clarification is required.

Table 6: Analytical Methods and Corresponding Limits of Detection

Method	Matrix	Limit of Detection (LOD)	Weight/Area/ Volume required for the LOD
Flame Atomic Absorption Spectrometry			
SW846-7000B	Paint Chips	100 mg/Kg (0.010% wt.)	0.2 g
	Solids	40 mg/Kg (0.004% wt.)	0.5 g
	Dust (wipes)	10 µg/ft^2	144 in^2
NIOSH 7082	Air	0.004 mg/m^3	1000 L
Inductively Coupled Plasma Atomic Emission Spectrometry			
SW846-6010B/C	Solids	1 mg/Kg (0.0001% wt.)	0.5g
	Dust (wipes)	0.5 µg/ft^2	144 in^2
NIOSH 7300 modified	Air	0.0005 mg/m^3	1000 L
Graphite Furnace Atomic Absorption Spectrometry			
SW846-7010	Solids	0.3 mg/Kg (0.00003% wt.)	0.5 g
	Dust (wipes)	0.075 µg/ft^2	144 in^2
NIOSH 7105	Air	0.00003 mg/m^3	1000 L

13.3 Sample Collection

13.3.1 Air Sampling / Air Monitoring

Air monitoring may be necessary to:

a) Ensure work operations are not producing airborne concentrations of lead which exceed the Time-Weighted Average (TWA) or the protection factor for the respirators being used.

b) Ensure that workers or occupants in areas adjacent to the work area are not being exposed to airborne lead at concentrations exceeding the TWA.

Air monitoring may be performed inside or outside of the Work Area. If airborne lead levels in the Work Area exceed the Maximum Use Concentration specified for the assigned respirator, work procedures shall be reviewed and altered to reduce airborne lead levels or determine if alternate respiratory protection is required.

If airborne lead is detected at concentrations exceeding the TWA in occupied areas adjacent to the Work Area, an evaluation to determine the cause shall be conducted and an adequate means to control the exposure implemented.

Air sampling collection should be completed following approved analytical methods.

13.3.2 Paint and Surface Coating Bulk Sampling

Collect samples of distinctive paint finishes and surface coatings, present in more than an insignificant application, where removal of the paint is possible. Collect samples by scraping the paint or surface coating to include all layers.

The following is designed for use as a reference. Samples shall be collected in accordance with the requirements of the analytical method selected and in consultation with the analytical laboratory.

Required Equipment

a) Appropriate, sealable sample container – one per sample.

b) Sampling tool (e.g. scraper, knife).

c) Disposable Gloves.

d) Indelible Marker.

e) Chain of Custody Form.

Sampling Procedure

a) Don clean disposable gloves in preparation for sample collection.

b) Select discreet area for sample collection.

c) Remove all layers of paint (to substrate), place into a sample container and seal the sample container.

d) Using indelible marker, label the container with a unique sample number identifier.

e) Clean up sampling area by wet wiping or using a vacuum equipped with a HEPA filter.

f) Encapsulate or repair damaged area, as appropriate.

g) Complete the Chain of Custody form and submit to an accredited laboratory.

13.3.3 Wipe Sampling

Wipe sample collection should follow NIOSH method 9100 “Lead in Surface Wipe Samples” or NIOSH method 9102 “Elements on Wipes”.

13.4 Sampling Using Portable X-Ray Fluorescence (XRF) Analyzer

The U.S. Environmental Protection Agency (EPA) and U.S. Department of Housing and Urban Development (HUD) historically stated that concentrations of lead in paints and surface coatings of one milligram per square centimetre (mg/cm^2) were comparable to 0.5% and were considered “elevated” for lead.

In cases when laboratory analysis is impractical, or when virtually immediate results are required, a hand-held portable X-Ray Fluorescence Analyzer (XRF) may prove useful. An XRF can provide fast, non-destructive, on-site, analysis of lead concentration in paints and surface coatings, soil, air and surface dust.

13.4.1 Paint and Surface Coating Sampling by XRF

It is of critical importance to understand the Limit of Detection (LOD) of an XRF analyzer. Although the accuracy of XRF analyzers has improved in recent years, the LOD for portable XRF analyzers varies depending on the model used. An XRF can readily determine what paints and surface coatings contain elevated lead above 1mg/cm^2 (comparable to 0.5 % lead by weight), however, may not be able to determine if lead concentrations are below the de minimis level (i.e. 0.1%). Portable XRF analyzers may be used as a screening tool to confirm if paints and surface coatings are considered to be lead-based (i.e. lead concentration of 1mg/cm^2 or greater). Physical samples of paints or surface coatings with readings below 1mg/cm^2 should be collected for laboratory analysis to confirm lead content.

13.4.2 Air Sample and Dust Wipe Sample Analysis by XRF

An XRF analyzer can quickly determine the composition of elemental lead collected on an air filter cassette and dust wipe sample. This can be beneficial for worker exposure monitoring, providing instructions to workers regarding cleaning methods, evaluating the efficacy of engineering controls and hygiene practices and to perform clearance sample analysis. It is important to realize that the use of portable direct-read instrumentation is not necessarily directly comparable to laboratory analytical methods. Consideration should be given to using portable direct-read instruments in conjunction with laboratory analysis.

To properly obtain and analyze air samples by XRF, samples must be collected and analyzed in accordance with U.S. National Institute of Occupational Safety and Health (NIOSH) Manual of Analytical Methods, Fourth Edition, Method 7702, Issue 1 Lead By Field Portable XRF (January 15, 1998).

APPENDIX I

LIST OF LEGISLATION, GUIDELINES AND RELEVANT DOCUMENTS

Environmental Protection Agency (EPA). (2001, January 5). *40 CFR Part 745 Lead; Identification of Dangerous Levels of Lead; Final Rule.*

Government of Canada. (2005, April 19). *Surface Coating Materials Regulations SOR/2005-109 CANADA CONSUMER PRODUCT SAFETY ACT.*

Government of Canada. (2011, June 6). *Hazardous Products Act R.S.C., 1985, c. H-3* .

Health Canada. (2013, February). *Final Human Health State of the Science Report on Lead.* Ottawa: Publications, Health Canada.

Health Canada. (2013, February). *Risk Management Strategy for Lead.* Ottawa: Publications, Health Canada.

Occupational Safety and Health Administration. (2004). *OSHA3142-12R200; Lead in Construction.*

Occupational Safety and Health Administration. (n.d.). *Regulations (Standards - 29 CFR) - Table of Contents; Part Number: 1910; Part Title: Occupational Safety and Health Standards; Subpart: I; Subpart Title: Personal Protective Equipment; Standard Number: 1910.132; Title: General requirements.*

Occupational Safety and Health Administration. (n.d.). *Regulations (Standards - 29 CFR); Part Number: 1926; Part Title: Safety and Health Regulations for Construction; Subpart: D; Subpart Title: Occupational Health and Environmental Controls; Standard Number: 1926.62; Title: Lead*

Ontario Ministry of Labour. (2011, April). *Lead on Construction Projects*.

Service Ontario. (2009, December 18). *Occupational Health and Safety Act*

Service Ontario. (2013, April 8). *Occupational Health and Safety Act, ONTARIO REGULATION 213/91 CONSTRUCTION PROJECTS.*

Service Ontario. (2013, January 1). *Occupational Health and Safety Act, ONTARIO REGULATION 490/09 DESIGNATED SUBSTANCES*.

U.S. Department of Health and Human Services: Public Health Service: Agency for Toxic Substances and Disease Registry. (2007, August).*Toxicological Profile for Lead*.

U.S. Department of Housing and Urban Development. (2012, July). *Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing; Office of Healthy Homes and Lead Hazard Control Second Edition, July 2012.*

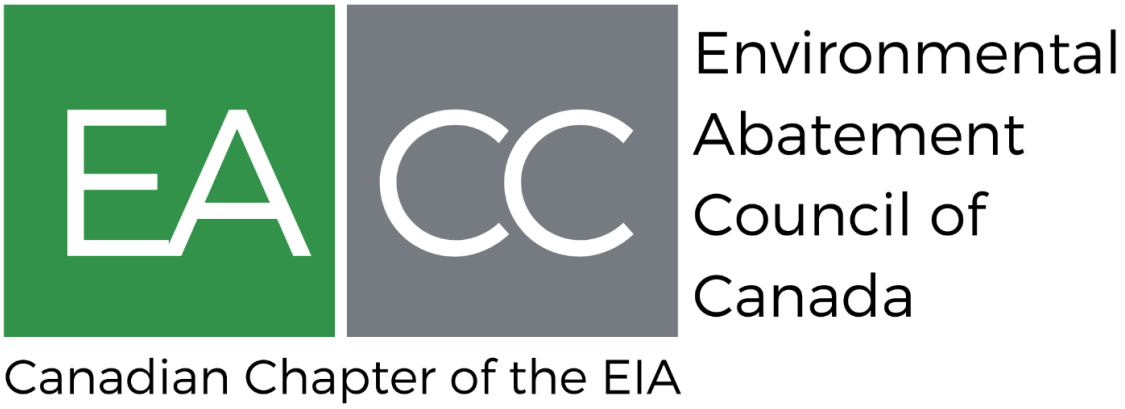
U.S. Environmental Protection Agency; New York City Department of Health and Mental Hygiene; Agency for Toxic Substance and Disease Registry; New York State Department of Health; Occupational Health and Safety Administration. (2003, May). *World Trade Center Indoor Environment Assessment: Selecting Contaminants of Potential Concern and Setting Health-Based Benchmarks.*

United States of America Department of the Navy; Bureau of Medicine and Surgery. (2002, May). *Indoor Firing Ranges Industrial Hygiene Technical Guide.*

Worksafe B.C. (2011). *Lead-Containing Paints and Coatings, Preventing Exposure in the Construction Industry.*

APPENDIX II DEFINITIONS	
Term	**Definition**
Action Level	Concentration of ½ of the Occupation Exposure Limit (OEL) for an airborne contaminant at which precautions are implemented to be protective of worker health.
Clearance Tests	Samples collected and analyzed following abatement to verify an acceptable level of cleanliness.
Competent Person or Supervisor	As defined under the Ontario Occupational Health and Safety Act.
Contaminated Area	The portion of the Project where active disturbance, handling or cleanup of lead is occurring.
Designated Substance	As defined in Ontario Regulation 490/09 under the Ontario Occupational Health and Safety Act.
Dust Suppression	Measures taken to reduce the release of dust during work.
Fit-test	A qualitative or quantitative method to evaluate the efficiency of a specific make, model and size of respirator on an individual.
HEPA Filter	High Efficiency Particulate Air filter capable of capturing and retaining particles greater than or equal to 0.3 micrometers in diameter, at a minimum efficiency of 99.97%.
Lead	A malleable metal that can cause acute and chronic health effects in humans. Lead is an additive and contaminant in many frequently used building materials.
Lead-Containing Material (LCM)	Building materials comprising of lead or which contain lead. Examples are provided in Section 3.2.
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).
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).
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).
MSDS	Material Safety Data Sheet, required by Workplace Hazardous Materials Information System (WHMIS) legislation, and giving information on hazardous materials, including properties, hazards, first-aid, emergency response, and personal protection.
NIOSH	National Institute for Occupational Safety and Health
Polyethylene Sheeting	Plastic sheeting installed with tape along edges, around penetrating objects, over cuts and tears, and elsewhere as required, to provide a continuous membrane to protect underlying surfaces from damage and to prevent escape of airborne contamination into occupied areas.
Respirator	An apparatus worn over the mouth and nose or the entire face to prevent the inhalation of dust, mist, fume, vapours or other noxious substances.
Wetting Agent	A chemical substance, also called surfactant, that increases the spreading and penetrating properties of a liquid by lowering its surface tension. 235 millilitres (1 cup) of detergent to 20 litres of water.

Lead Guideline
For Construction, Renovation, Maintenance or Repair



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MEMORIAL UNIVERSITY

ASBESTOS-CONTAINING MATERIALS SUMMARY

OCEAN SCIENCES CENTER MAIN BUILDING AND ANNEX

The following materials have been identified as asbestos-containing within the Ocean Sciences Center Main Building and Annex:

- Spray Applied Fireproofing
- Vinyl Floor Tiles (VFT):
  - 12X12 Beige with Thick Brown Streak
  - 9X9 Beige with Thick Brown Streak
  - 12X12 Brown with Thick Brown Streak
- Parging cement on Pipe Elbows and Fittings
- Mechanical Insulation on Tanks and Boilers
- Drywall Joint Fill Compound
- Transite
- Textile Cloth Expansion Joints on Ducting

<u>Note:</u> All visually similar materials are considered to be asbestos-containing. Any of the materials identified can be located in wall and ceiling cavities, as well as under existing flooring and should be addressed when uncovered during renovation, demolition or repair work.

ASBESTOS AND LEAD PAINT BUILDING MATERIALS SURVEY FOR: OCEAN SCIENCES CENTER, MAIN BUILDING AND ANNEX MEMORIAL UNIVERSITY OF NEWFOUNDLAND

Prepared for:

Memorial University of Newfoundland

St. John's, NL

Pinchin LeBlanc Environmental Ltd
Project No. 02-02-00900

March 22, 2013

27 AUSTIN STREET, ST. JOHN'S NL, A1B 4C3 TEL: (709) 754-4490 FAX: (709) 754-1359
SAINT JOHN, NB • DARTMOUTH, NS • LABRADOR CITY, NL • CORNER BROOK, NL

EXECUTIVE SUMMARY

Pinchin LeBlanc Environmental Limited (Pinchin) was retained by Memorial University of Newfoundland to perform asbestos and lead paint surveys in selected buildings on the Memorial University of Newfoundland's St. John's, NL campus. A total of twenty-seven (27) buildings were surveyed for asbestos containing materials (ACM) and lead based paints (LBP). This report will provide the findings for the following location;

BUILDING DESCRIPTION: OCEAN SCIENCES CENTER MAIN BUILDING AND ANNEX

BUILDING ADDRESS: MEMORIAL UNIVERSITY OF NL, ST. JOHN'S CAMPUS, NL

A summary of the findings for the Site Building is provided. For specific recommendations regarding any hazardous materials listed the reader will refer to Sections 3 and 4 of this report:

1. Friable asbestos containing materials identified inside the Site Building include: spray fireproofing DEBRIS, parging cement on pipe elbows/fittings, tank insulation, and boiler exhaust insulation.
2. Non-friable asbestos containing materials with the potential to become friable during renovation or construction activities have been identified inside the Site Building, specifically drywall joint compound.
3. Non-friable asbestos containing materials identified inside the Site Building specifically vinyl floor tiles, transite, and textile materials.
4. Analytical results indicate that four (4) of the samples collected of painted surfaces would be considered a risk to worker exposure during construction or renovation activities (with lead concentrations exceeding 0.06%). The off-white paint in room AX-1001 the yellow paint in room AX-1001, the black paint in room AX-3C01, and the blue paint in room AX-3C01.

This Executive Summary is subject to the same standard limitations as contained in the report and must be read in conjunction with the entire report.

TABLE OF CONTENTS

1.0 INTRODUCTION

Pinchin LeBlanc Environmental Ltd. (Pinchin) was retained by Memorial University of Newfoundland to perform asbestos and lead paint surveys in selected buildings on the Memorial University of Newfoundland's St. John's, NL campus. A total of twenty-seven (27) buildings were surveyed for asbestos containing materials (ACM) and lead based paints (LBP). This report will provide the findings for the following location;

BUILDING DESCRIPTION: OCEAN SCIENCES CENTER, MAIN BUILDING AND ANNEX

BUILDING ADDRESS: MEMORIAL UNIVERSITY OF NL, ST. JOHN'S CAMPUS, NL

The report presents a detailed investigation of condition, quantity, location, access, and type of ACM and LBP present in the building. The Overview Report, provided under separate cover, provides detailed information regarding the survey methodology, sampling procedure, evaluation criteria, suspect materials and regulatory information.

Provincial regulations and guidelines distinguish between friable[1] and non-friable[2] materials. The asbestos building materials survey performed by Pinchin included a search for both friable and common non-friable ACM.

For reporting purposes, the survey will be divided into sections. The report is presented in this manner to accommodate ease in reading and to allow access to report information for specific areas or materials within the building. The report also addresses specific systems and products likely present in the building. The sections of the report are as follows:

2.0 Survey Information

3.0 ACM Survey Findings

4.0 LBP Survey Findings

1 The term friable is applied to a material that can be readily reduced to dust or powder by hand or moderate pressure. Friable ACM has a much greater potential to release airborne asbestos fibres when disturbed. The most common friable ACM used in the past are sprayed or trowelled materials (for fireproofing or thermal insulation), texture plaster (decorative or acoustic), and mechanical insulations.

2 Common non-friable ACM include vinyl floor tiles, ceiling tiles, gasket materials, asbestos cement pipe or board (transite), and asbestos textiles. Although a product may be considered non-friable when new, if the product releases fine dust due to deterioration or during removal, the free dust is considered friable. For example, most lay-in or glued on acoustic ceiling tiles release significant dust during removal of large quantities of these tiles.

5.0 Recommendations

2.0 SURVEY INFORMATION

The survey was conducted on between November 29th and November 30th, 2012. The survey, collection of representative bulk samples, and recording of information was performed by Mr. Trent Hardy of Pinchin. All accessible areas of the building were inspected for the presence of asbestos containing materials (ACM) and lead based paints (LBP).

A total of twenty-seven (27) representative bulk samples were collected for analysis for asbestos content and eight (8) bulk samples were collected for analysis of lead content.

3.0 ACM SURVEY FINDINGS

The ACM found during this survey are detailed in the location & data excel document provided to the client. The excel document serves as the clients active asbestos management plan. Quantities of materials identified, locations and friable or non-friable are also present in this excel file. Laboratory certificates for asbestos samples collected are presented in Appendix I and lead samples are presented in Appendix II. Sample location drawings are provided in Appendix III. A photographic record of the samples collected during the survey of the building is presented in Appendix IV. The following is summary of the findings for this building.

3.1 Sprayed or Trowelled Fireproofing and Thermal Insulation

Debris present on the ceiling and surfaces in room OS-2002 was sampled and contains 60% amosite asbestos (reference samples 02-02-900-S026). This DEBRIS is suspected to be associated with spray applied fireproofing previously located on the ceiling of this room. For locations and conditions of this material at the time of the building survey refer to location & data excel document.

3.2 Mechanical Insulation

Five (5) samples were collected of the parging cement used on the elbows and fittings in the site building and contains 25% Chrysotile asbestos in two (2) of the five (5) samples (reference sample 02-02-900-S075 and 02-02-900-S076). For locations and conditions of this material at the time of the building survey refer to location & data excel document.

3.2.1 Straight Run Pipe Insulations

Suspect asbestos containing straight pipe insulation was not observed in the Site Building. The majority of piping straight sections observed is insulated with non-asbestos fiberglass wrapped in canvas jacketing.

3.2.2 Pipe Elbows and Fittings

Friable insulating cement, commonly referred to as parging cement, is present on various elbows and fittings in the Site Building. A summary of the results for these samples is described below. For locations and conditions of this material at the time of the survey refer to location & data excel document.

- Parging cement present on 6" water lines in room AX-1001 was sampled, and contains 30% chrysotile asbestos (reference sample 02-02-900-S005).

- Parging cement present on 4" water lines in room AX-1001 was sampled, and contains 30% chrysotile asbestos (reference sample 02-02-900-S004).

- Parging cement present on 6" water lines near the eyewash station was sampled in room AX-1001. Analysis of this sample did not identify the presence of asbestos (reference sample 02-02-900-S003).

3.2.3 Tanks and Boilers

Suspect asbestos-containing materials present on tanks and boilers in the Site Building were collected. A summary of the results for these samples is provided below. For locations and conditions of this material at the time of the building survey refer to location & data excel document.

- Friable mechanical insulation present on the steam header in room AX1001 was sampled, and contains 15% amosite and 10% chrysotile asbestos (reference sample 02-02-900-S001).

- Friable mechanical insulation present on the boiler exhaust in room AX-1001 was sampled and contains 40% chrysotile asbestos (reference sample 02-02-900-S002).

- Friable mechanical insulation present on the tank in room AX-1000 was sampled, and contains 30% chrysotile asbestos (reference sample 02-02-900-S007).

- Non-friable textile cloth expansion joints present on ducting in room OS-2002 was sampled, and contains 50% chrysotile asbestos (reference sample 02-02-900-S027).

- Non-friable textile gaskets present on the heads of boilers #1 and #2 in room AX-1001 was sampled. Analysis of this sample did not identify the presence of asbestos (reference sample 02-02-900-S006).

3.3 Acoustic Ceiling Tiles

Two (2) types of acoustic ceiling tiles were observed in the Site Building. A summary of the results for these samples is provided below. For locations and conditions of this material at the time of the survey refer to location & data excel document.

- 2'x 4' acoustic ceiling tile distinguished with a longitudinal fissure and pinhole pattern were sampled in room AX-2S02. Analysis of this sample did not identify the presence of asbestos (reference sample 02-02-900-S014).
- 2'x 4' acoustic ceiling tile distinguished with a longitudinal fissure and pinhole pattern were sampled in room AX-3C01. Analysis of this sample did not identify the presence of asbestos (reference sample 02-02-900-S017).

3.4 Drywall, Plaster, and Texture Finishes

Drywall was used as a wall and ceiling finish throughout the building. Until the early to mid-1980s, drywall joint compound may have contained chrysotile asbestos. Drywall joint compound is considered a non-friable material. Most buildings of this type undergo constant renovation, including the removal and replacement of drywall partitions. Therefore extensive sampling of drywall compound is necessary to come to a reasonable conclusion regarding the extent of asbestos. Furthermore, any attempt to distinguish and delineate all asbestos-containing drywall compounds from new non-asbestos drywall compound is often unachievable. Therefore, drywall joint compound was sampled at walls, which were believed to be original to try to define the presence of asbestos content in the original drywall compound.

Six (6) samples, in total, of drywall joint compound were collected in the Site Building. Results from two (2) of the six (6) samples collected contain 3% chrysotile asbestos (reference samples, 02-02-900-S020, and 02-02-900-S022). For locations and conditions of this material at the time of the survey refer to location & data excel document.

Plaster was not observed in use as a wall and/or ceiling finish in the Site Building. It should be noted that plaster can at times be difficult to distinguish from other wall and ceiling finishes such as drywall and concrete. Should plaster be encountered during any demolition or renovation activities, it should be sampled for analysis for asbestos content.

3.5 Vinyl Flooring Materials

3.5.1 Vinyl Floor Tiles

Samples were collected of eight (8) types of vinyl floor tiles observed in the Site Building. A summary of the results for these samples is provided below. For locations and conditions of this material at the time of the survey refer to location & data excel document.

3.5.1.1 Asbestos Containing Vinyl Floor Tiles

- Beige with thick brown streak, 12"x 12" vinyl floor tiles were sampled in room OS-3C01 and contain 5% chrysotile asbestos (reference sample 02-02-900-S016).

- Beige with thick brown streak, 9"x 9" vinyl floor tiles were sampled in room OS-3016 and contain 6% chrysotile asbestos (reference sample 02-02-900-S023).

- Brown with thick brown streak, 12"x 12" vinyl floor tiles were sampled in room OS-2000/200A and contain 5% chrysotile asbestos (reference sample 02-02-900-S016).

3.5.1.2 Non-Asbestos Containing Vinyl Floor Tiles

- White with brown streak, 12"x 12" vinyl floor tiles were sampled in room AX-2002. Analysis of the sample and associated tar mastic adhesive did not identify the presence of asbestos (reference sample 02-02-900-S009).

- White with brown streak, 12"x 12" vinyl floor tiles were sampled in room AX-2003. Analysis of the sample did not identify the presence of asbestos (reference sample 02-02-900-S011).

- Beige with brown streak, 12"x 12" vinyl floor tiles were sampled in room AX-3C01. Analysis of the sample and associated tar mastic adhesive did not identify the presence of asbestos (reference sample 02-02-900-S015).

- Grey 12"x 12" vinyl floor tiles were sampled in room AX-3001B. Analysis of the sample and associated tar mastic adhesive did not identify the presence of asbestos (reference sample 02-02-900-S019).

- White with abundant blue fleck, 12"x 12" vinyl floor tiles were sampled in room AX-4013. Analysis of the sample and associated tar mastic adhesive did not identify the presence of asbestos (reference sample 02-02-900-S021).

3.6 Asbestos Cement Products

Transite present in room AX-2001B was sampled and contains 20% chrysotile asbestos (reference sample 02-02-900-S013). For locations and conditions of this material at the time of the building survey refer to location & data excel document.

3.7 Vermiculite Insulation

No vermiculite containing products were observed. Visual observations were made above the ceiling and through any hatches.

3.8 Other Asbestos Containing Building Materials

Tar roofing material present above the ceiling in room AX-2S02 was sampled. Analysis of this sample did not identify the presence of asbestos (reference sample 02-02-900-S010).

4.0 LBP SURVEY FINDINGS

Analytical results indicate that four (4) of the samples collected of painted surfaces would be considered a risk to worker exposure during construction or renovation activities (with lead concentrations exceeding 0.06%). The off-white paint in room AX-1001 (reference sample 02-02-900-L002), the yellow paint in room AX-1001 (reference sample 02-02-900-L003), the black paint in room AX-3C01 (reference sample 02-02-900-L004), and the blue paint in room AX-3C01 (reference sample 02-02-900-L005) and the same paint colours located elsewhere should be managed as lead containing.

Results indicate that were detected, all other paint samples containing less than 0.06% lead.

All paints observed inside the Site Building were observed in GOOD condition.

5.0 RECOMMENDATIONS

Asbestos containing materials have been identified in the Site Building. Listed below are a series of general recommendations for the Site Building. Recommendations provided in the Overview Report may also be reviewed and applied to this building.

Friable ACMs

Friable asbestos containing materials identified inside the Site Building include: spray fireproofing DEBRIS, parging cement on pipe elbows/fittings, tank insulation, and boiler exhaust insulation.

1. Any DEBRIS associated with friable asbestos containing materials should be abated as soon as reasonably possible to prevent worker exposure. Entry into these spaces should follow Type II (moderate risk) entry procedures until the hazard can be removed. Abatement of the DEBRIS and residual material would be completed using Type III (high risk) asbestos abatement procedures.

2. Type III (high risk) asbestos abatement procedures should be carried out for the scheduled removal of greater than 1 ft^2 of friable asbestos containing materials. Alternatively, Type II (moderate risk) glove bag abatement procedures may be applied where practical;

3. Type II (moderate risk) asbestos abatement procedures should be carried out for the scheduled repair or enclosure of friable ACMs or for the removal of less than 1ft^2 of material;

Potentially Friable Materials

Non-friable asbestos containing materials with the potential to become friable during renovation or construction activities have been identified inside the Site Building, specifically drywall joint compound.

1. Under the NL guidance documents for moderate and low risk asbestos abatement procedures, quantities of plaster within an enclosure exceeding 100 ft^2 should be removed using Type III (high risk) asbestos abatement procedures. Quantities less than 100 ft^2 but exceeding 10ft^2 should be removed using Type II (moderate risk) asbestos abatement procedures, while quantities less than 10 ft^2 should be removed using Type I (low risk) asbestos abatement procedures.

Non-Friable Materials

Non-friable asbestos containing materials identified inside the Site Building include: vinyl floor tiles, transite, and textile materials.

1. Type I (low risk) asbestos abatement procedures should be carried out for the scheduled disturbance of any non-friable materials provided the materials can be removed intact, and without the use of powered hand tools.

2. Should the use of powered hand tools or excessive breakage of the materials become necessary, Type II (moderate risk) asbestos abatement procedures should be adopted.

Lead Based Paints

Do not grind, sand, torch or cut lead materials without using proper procedures, as material poses a health hazard if disturbed by these methods.

Any painted surfaces visually matching the identified paint colors should be managed as lead containing and necessary precautions (i.e.: worker protection) should be employed prior to the disturbance to these materials.

Should there be any questions pertaining to the contents of this report, please do not hesitate to contact the undersigned at our office.

Pinchin LeBlanc Environmental Limited

Prepared by;

APPENDIX I

ASBESTOS ANALYTICAL REPORT

Bulk Asbestos Analysis

By Polarized Light Microscopy
EPA Method: 600/R-93/116 and 600/M4-82-020

NVLAP Lab Code: 200664-0

Customer: Pinchin LeBlanc Environmental
27 Austin St
2nd Flr
St Johns NL A1B 4C3

Attn: Paul Staeben
Dawn Benteau

Project: 02-02-00900 MUN Asbestos and Lead Survey - OSC Main Bulding and Annex

Lab Order ID: 1219843
Analysis ID: 1219843_PLM
Date Received: 12/10/2012
Date Reported: 12/14/2012
Date Amended: *3/22/2013*

Sample ID / *Lab Sample ID*	Description / *Lab Notes*	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes / Treatment
02-02-900-S001 / *1219843PLM_1*	Mechanical Insulation on Steam Header	15% Amosite 10% Chrysotile		75% Other	White Fibrous Homogeneous / Teased
02-02-900-S002 / *1219843PLM_2*	Mechanical Insulation on Boiler Exhaust	40% Chrysotile		60% Other	Gray Fibrous Homogeneous / Teased
02-02-900-S003 / *1219843PLM_3*	Parging Cement on 6" Water Lines	None Detected	30% Mineral Wool	70% Other	White Fibrous Homogeneous / Teased
02-02-900-S004 / *1219843PLM_4*	Parging Cement on 4" Water Lines	30% Chrysotile		70% Other	Gray Fibrous Homogeneous / Teased
02-02-900-S005 / *1219843PLM_5*	Parging Cement on 6" Water Lines	30% Chrysotile		70% Other	Gray Fibrous Homogeneous / Teased
02-02-900-S006 / *1219843PLM_6*	Textile Gasket on Boilers 1 and 2	None Detected	90% Cellulose	10% Other	Tan Fibrous Heterogeneous / Teased, Dissolved
02-02-900-S007 / *1219843PLM_7*	Tank Insulation	30% Chrysotile		70% Other	Gray, White Fibrous Heterogeneous / Teased
02-02-900-S008 / *1219843PLM_8*	Drywall Joint Compound	None Detected		100% Other	White Non Fibrous Homogeneous / Crushed

Sharon Donald (31)
Analyst

Approved Signatory

Bulk Asbestos Analysis

By Polarized Light Microscopy
EPA Method: 600/R-93/116 and 600/M4-82-020

NVLAP Lab Code 200664-0

Customer: Pinchin LeBlanc Environmental
27 Austin St
2nd Flr
St Johns NL A1B 4C3

Attn: Paul Staeben
Dawn Benteau

Project: 02-02-00900 MUN Asbestos and Lead Survey - OSC Main Bulding and Annex

Lab Order ID: 1219843
Analysis ID: 1219843_PLM
Date Received: 12/10/2012
Date Reported: 12/14/2012
Date Amended: *3/22/2013*

Sample ID / *Lab Sample ID*	Description / *Lab Notes*	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes / Treatment
02-02-900-S009 - A	12"x12" Vinyl Floor Tiles - White With Brown Streaks	None Detected		100% Other	Brown, White Non Fibrous Heterogeneous
1219843PLM_9	*tile*				Dissolved
02-02-900-S009 - B	12"x12" Vinyl Floor Tiles - White With Brown Streaks	None Detected	2% Cellulose	98% Other	Black Non Fibrous Homogeneous
1219843PLM_28	*mastic*				Dissolved
02-02-900-S010	Tar Roof Material	None Detected		100% Other	White Non Fibrous Homogeneous
1219843PLM_10					Crushed
02-02-900-S011	12"x 12" Vinyl Floor Tiles - White With Abundant Brown Flecks	None Detected		100% Other	Beige Non Fibrous Heterogeneous
1219843PLM_11					Dissolved
02-02-900-S012	Drywall Joint Compound	None Detected		100% Other	White Non Fibrous Homogeneous
1219843PLM_12					Crushed
02-02-900-S013	Transite	20% Chrysotile		80% Other	Gray Fibrous Heterogeneous
1219843PLM_13					Teased
02-02-900-S014	2'x4' Acoustic Ceiling Tiles - Longitudinal Fissure and Pinhole Pattern	None Detected	60% Mineral Wool 30% Cellulose	10% Other	Gray Fibrous Heterogeneous
1219843PLM_14					Teased
02-02-900-S015 - A	12"x 12" Vinyl Floor Tiles - Beige with Brown Streaks	None Detected		100% Other	Brown, Beige Non Fibrous Heterogeneous
1219843PLM_15	*tile*				Dissolved

Disclaimer: Due to the nature of the EPA 600 method, asbestos may not be detected in samples containing low levels of asbestos. We strongly recommended that analysis of floor tiles, vermiculite, and/or heterogeneous soil samples be conducted by TEM for confirmation of "None Detected" by PLM. This report relates only to the samples tested and may not be reproduced, except in full, without the written approval of SAI. This report may not be used by the client to claim product endorsement by NVLAP or any other agency of the U.S. government. Estimated MDL is 0.1%.

Sharon Donald (31)
Analyst

Approved Signatory

Bulk Asbestos Analysis

By Polarized Light Microscopy
EPA Method: 600/R-93/116 and 600/M4-82-020

NVLAP Lab Code: 200664-0

Customer: Pinchin LeBlanc Environmental
27 Austin St
2nd Flr
St Johns NL A1B 4C3

Attn: Paul Staeben
Dawn Benteau

Project: 02-02-00900 MUN Asbestos and Lead Survey - OSC Main Bulding and Annex

Lab Order ID: 1219843
Analysis ID: 1219843_PLM
Date Received: 12/10/2012
Date Reported: 12/14/2012
Date Amended: *3/22/2013*

Sample ID / *Lab Sample ID*	Description / *Lab Notes*	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes / Treatment
02-02-900-S015 - B *1219843PLM_29*	12"x 12" Vinyl Floor Tiles - Beige with Brown Streaks *mastic*	None Detected	2% Cellulose	98% Other	Black Non Fibrous Homogeneous Dissolved
02-02-900-S016 *1219843PLM_16*	12"x12" Vinyl Floor Tiles - Beige with Thick Brown Streaks *tile only*	5% Chrysotile		95% Other	Beige Non Fibrous Heterogeneous Dissolved
02-02-900-S017 *1219843PLM_17*	2'x4' Acoustic Ceiling Tiles - Pinhole and Fleck Pattern	None Detected	50% Cellulose 30% Mineral Wool	10% Perlite 10% Other	White Fibrous Heterogeneous Teased
02-02-900-S018 *1219843PLM_18*	Drywall Joint Compound	None Detected		100% Other	White Non Fibrous Homogeneous Crushed
02-02-900-S019 - A *1219843PLM_19*	12"x12" Vinyl Floor Tiles - Grey *tile*	None Detected		100% Other	Gray Non Fibrous Heterogeneous Dissolved
02-02-900-S019 - B *1219843PLM_30*	12"x12" Vinyl Floor Tiles - Grey *mastic-small sample*	None Detected	2% Cellulose	98% Other	Black Non Fibrous Homogeneous Dissolved
02-02-900-S020 *1219843PLM_20*	Drywall Joint Compound	3% Chrysotile		97% Other	Cream Non Fibrous Homogeneous Crushed
02-02-900-S021 - A *1219843PLM_21*	12"x 12" Vinyl Floor Tiles - White with Abundant Blue Flecks *tile*	None Detected		100% Other	White Non Fibrous Heterogeneous Dissolved

Sharon Donald (31)

Analyst

Approved Signatory

Bulk Asbestos Analysis

By Polarized Light Microscopy
EPA Method: 600/R-93/116 and 600/M4-82-020

NVLAP Lab Code 200664-0

Customer: Pinchin LeBlanc Environmental
27 Austin St
2nd Flr
St Johns NL A1B 4C3

Attn: Paul Staeben
Dawn Benteau

Project: 02-02-00900 MUN Asbestos and Lead Survey - OSC Main Bulding and Annex

Lab Order ID: 1219843
Analysis ID: 1219843_PLM
Date Received: 12/10/2012
Date Reported: 12/14/2012
Date Amended: *3/22/2013*

Sample ID / *Lab Sample ID*	Description / *Lab Notes*	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes / Treatment
02-02-900-S021 - B / *1219843PLM_31*	12"x 12" Vinyl Floor Tiles - White with Abundant Blue Flecks / *mastic-small sample*	None Detected		100% Other	Yellow, Non Fibrous, Homogeneous / Dissolved
02-02-900-S022 / *1219843PLM_22*	Drywall Joint Compound	3% Chrysotile		97% Other	Cream, Non Fibrous, Homogeneous / Crushed
02-02-900-S023 / *1219843PLM_23*	9"x9" Vinyl Floor Tiles - Beige with Thick Brown Streaks / *tile only*	6% Chrysotile		94% Other	Beige, Non Fibrous, Heterogeneous / Dissolved
02-02-900-S024 / *1219843PLM_24*	Drywall Joint Compound	None Detected		100% Other	White, Non Fibrous, Homogeneous / Crushed
02-02-900-S025 / *1219843PLM_25*	12"x12" Vinyl Floor Tiles - Brown with Thick Brown Streaks / *tile only*	5% Chrysotile		95% Other	Beige, Non Fibrous, Heterogeneous / Dissolved
02-02-900-S026 / *1219843PLM_26*	Sprayed Fireproofing	60% Amosite		40% Other	Gray, Fibrous, Homogeneous / Teased
02-02-900-S027 / *1219843PLM_27*	Textile Cloth on Ductwork	50% Chrysotile	20% Cellulose	30% Other	White, Green, Fibrous, Heterogeneous / Teased

Sharon Donald (31)
Analyst

Approved Signatory

APPENDIX II

LEAD PAINT ANALYTICAL REPORT

Analysis for Lead Concentration in Paint Chips

by Flame Atomic Absorption Spectroscopy
EPA SW-846 3rd Ed. Method No. 3050B/Method No. 7420

AIHA LAP, LLC ACCREDITED LABORATORY ENVIRONMENTAL LEAD ISO/IEC 17025:2005 www.aihaaccreditedlabs.org LAB #173100

Customer: Pinchin LeBlanc Environmental
27 Austin St
2nd Flr
St Johns NL A1B 4C3

Attn: Paul Staeben
Dawn Benteau

Lab Order ID: 1219842
Analysis ID: 1219842_PBP
Date Received: 12/10/2012
Date Reported: 12/18/2012

Project: 02-02-00900 MUN Asbestos and Lead Survey OSC Main Building and Annex

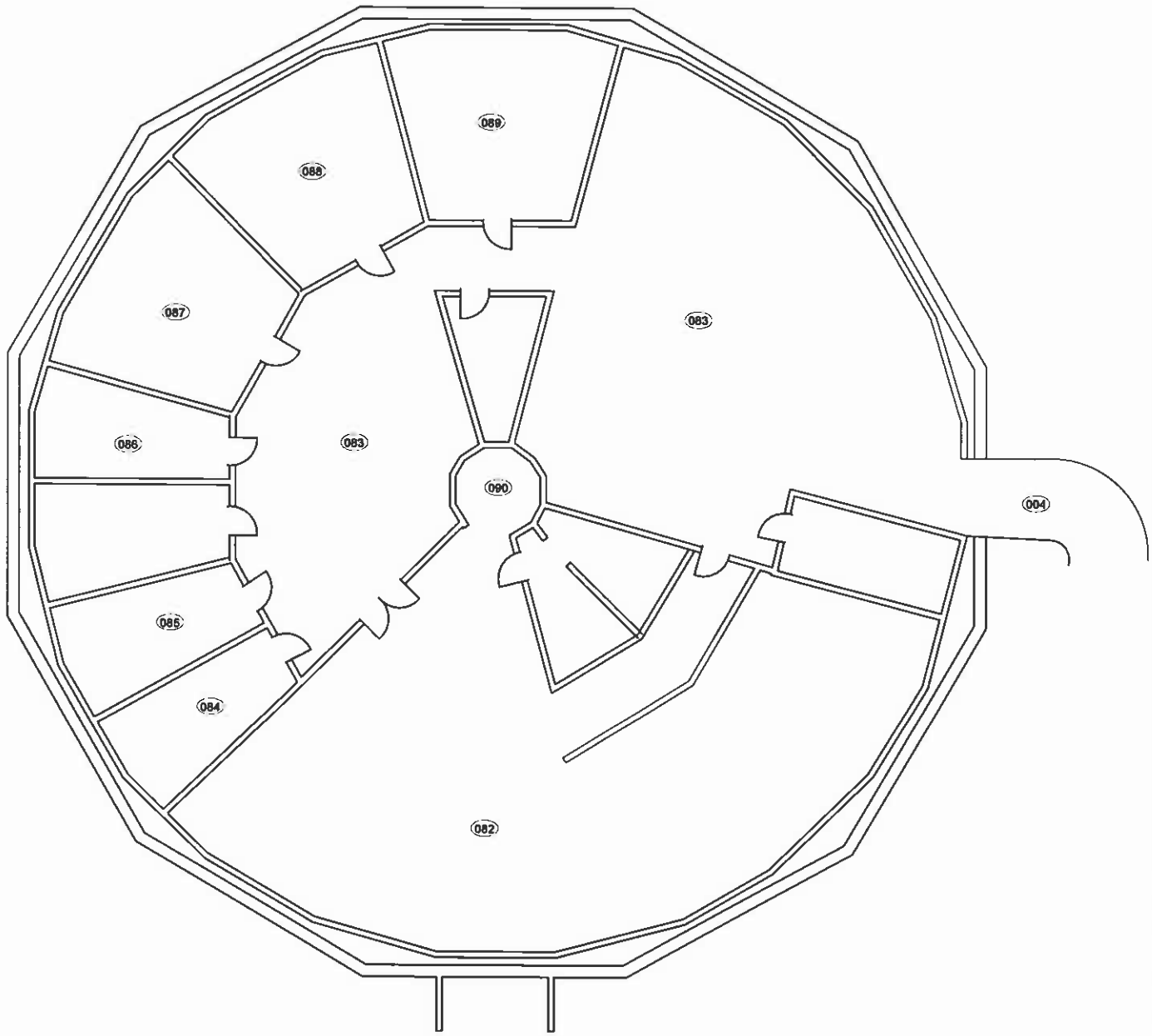
Sample ID / *Lab Sample ID*	Description / *Lab Notes*	Mass (g)	Analytical Sensitivity (% by weight)	Concentration (% by weight)
02-02-900-L001 / 1219842PBP_1	Grey- main boiler room	0.0453	0.003%	< 0.009%
02-02-900-L002 / 1219842PBP_2	Off white- main boiler room	0.0626	0.002%	0.12%
02-02-900-L003 / 1219842PBP_3	Yellow- main boiler room	0.0696	0.002%	0.12%
02-02-900-L004 / 1219842PBP_4	Black-3rd floor hallway	0.0477	0.003%	0.42%
02-02-900-L005 / 1219842PBP_5	Blue-3rd floor hallway	0.0440	0.003%	0.12%
02-02-900-L006 / 1219842PBP_6	Sky blue-OS-4000	0.0327	0.004%	< 0.012%
02-02-900-L007 / 1219842PBP_7	Tan-OS-2003	0.0778	0.002%	< 0.005%
02-02-900-L008 / 1219842PBP_8	Green-room OS-2002	0.0508	0.003%	0.009%

Robert Duke (8)
Analyst

Laboratory Director

APPENDIX III

SITE DRAWINGS



PINCHIN LEBLANC ENVIRONMENTAL

LEGEND:

(XXX) PINCHIN LOCATION NUMBER

CLIENT:

MEMORIAL UNIVERSITY OF NEWFOUNDLAND

PROJECT:

ASBESTOS AND LEAD PAINT BUILDING MATERIALS SURVEY

SITE ADDRESS:

OCEAN SCIENCES CENTER RESEARCH BUILDING, NEWFOUNDLAND AND LABRADOR

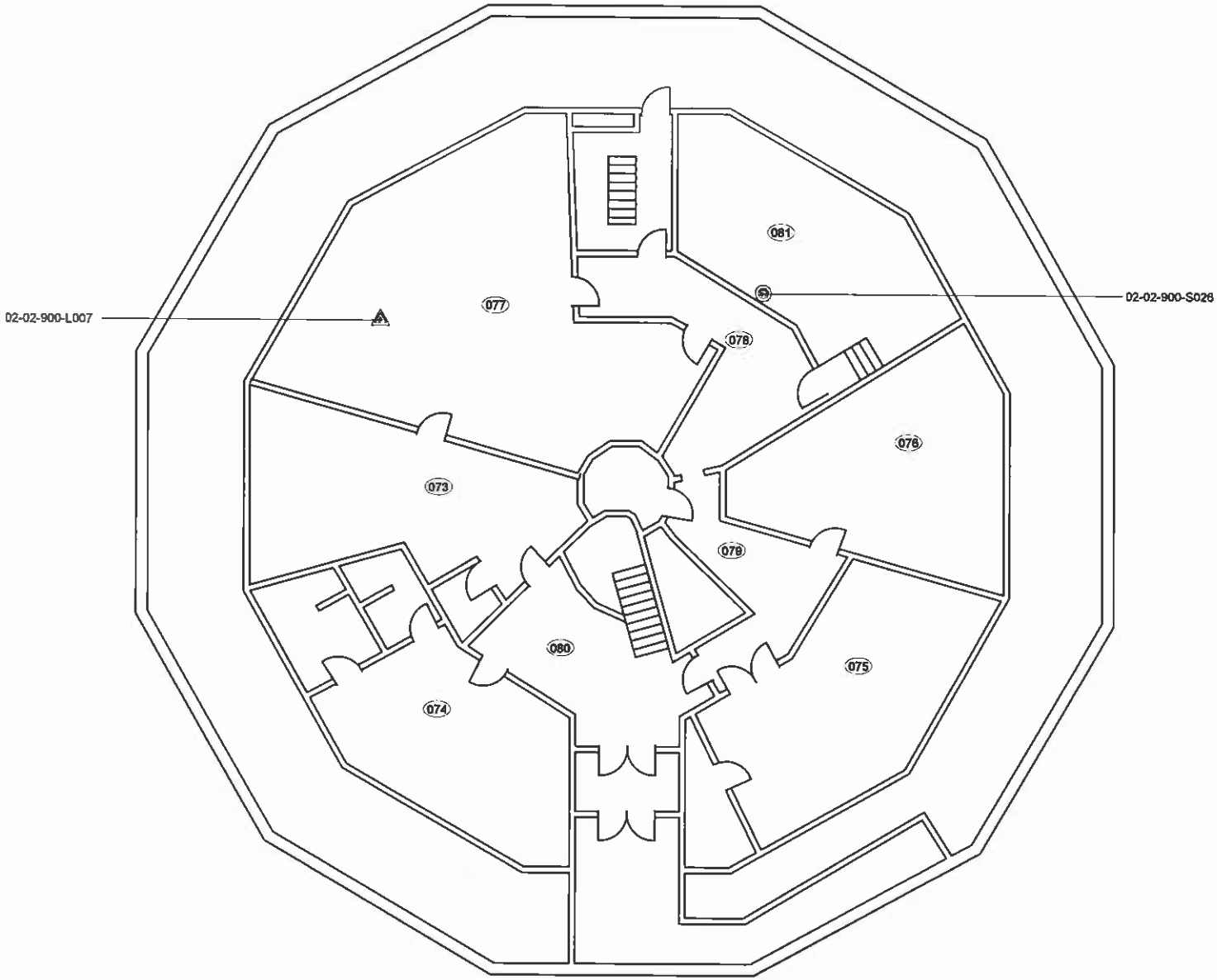
DRAWING NAME:

SAMPLE LOCATIONS LEVEL 1

REFERENCE:

PLEL SITE SURVEY

DATE:	PROJECT #:
MARCH 2013	02 - 02 - 00900
SCALE: N.T.S.	FIGURE #: 1
DRAWN BY: A. ANISCIKLI	
CHECKED BY: P. STAEBEN	



PINCHIN LEBLANC ENVIRONMENTAL

LEGEND:

- (XXX) PINCHIN LOCATION NUMBER
- ASBESTOS SAMPLE ID NUMBER
- LEAD SAMPLE ID NUMBER

CLIENT:

MEMORIAL UNIVERSITY OF NEWFOUNDLAND

PROJECT:

ASBESTOS AND LEAD PAINT BUILDING MATERIALS SURVEY

SITE ADDRESS:

OCEAN SCIENCES CENTER RESEARCH BUILDING, NEWFOUNDLAND AND LABRADOR

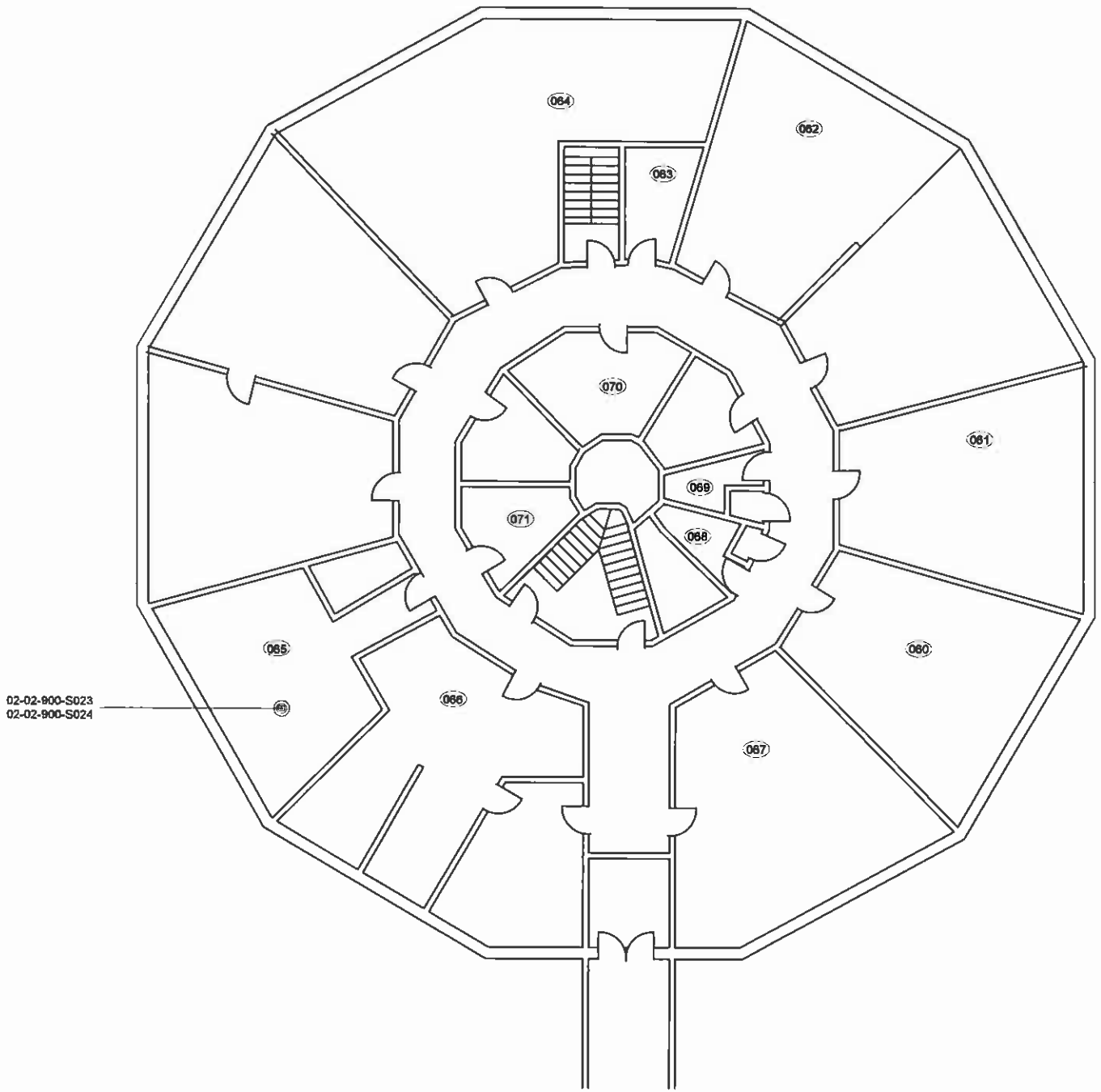
DRAWING NAME:

SAMPLE LOCATIONS LEVEL 2

REFERENCE:

PLEL SITE SURVEY

DATE:	PROJECT #:
MARCH 2013	02 - 02 - 00900
SCALE: N.T.S.	FIGURE #: 2
DRAWN BY: A. ANISCIKLI	
CHECKED BY: P. STAEBEN	



PINCHIN LEBLANC ENVIRONMENTAL

LEGEND:

XXX PINCHIN LOCATION NUMBER

ASBESTOS SAMPLE ID NUMBER

N

CLIENT:

MEMORIAL UNIVERSITY OF NEWFOUNDLAND

PROJECT:

ASBESTOS AND LEAD PAINT BUILDING MATERIALS SURVEY

SITE ADDRESS:

OCEAN SCIENCES CENTER RESEARCH BUILDING, NEWFOUNDLAND AND LABRADOR

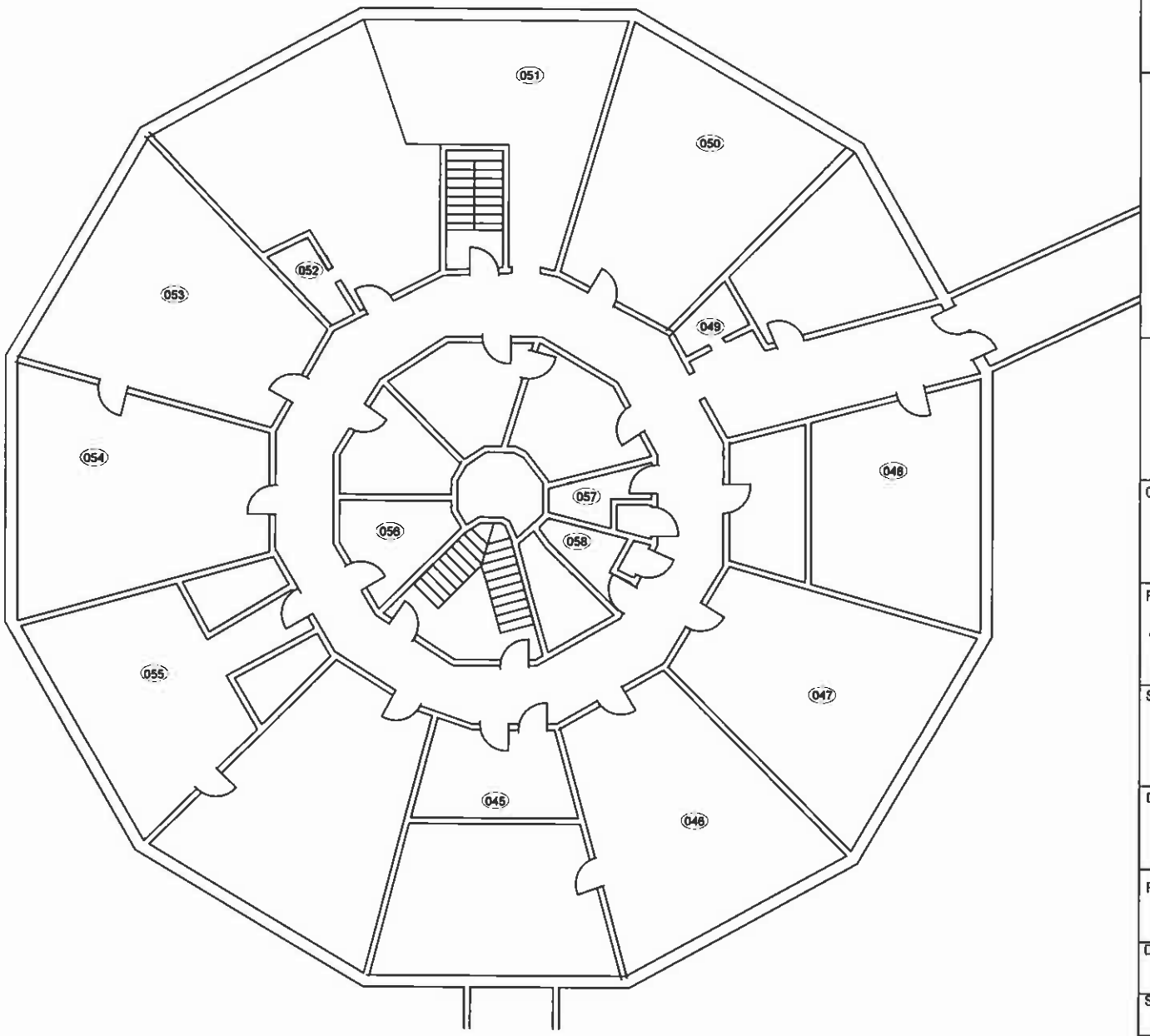
DRAWING NAME:

SAMPLE LOCATIONS LEVEL 3

REFERENCE:

PLEL SITE SURVEY

DATE:	PROJECT #:
MARCH 2013	02 - 02 - 00900
SCALE: N.T.S.	FIGURE #: 3
DRAWN BY: A. ANISCIKLI	
CHECKED BY: P. STAEBEN	



PINCHIN LEBLANC ENVIRONMENTAL

LEGEND:

XXX PINCHIN LOCATION NUMBER

CLIENT:

MEMORIAL UNIVERSITY OF NEWFOUNDLAND

PROJECT:

ASBESTOS AND LEAD PAINT BUILDING MATERIALS SURVEY

SITE ADDRESS:

OCEAN SCIENCES CENTER RESEARCH BUILDING, NEWFOUNDLAND AND LABRADOR

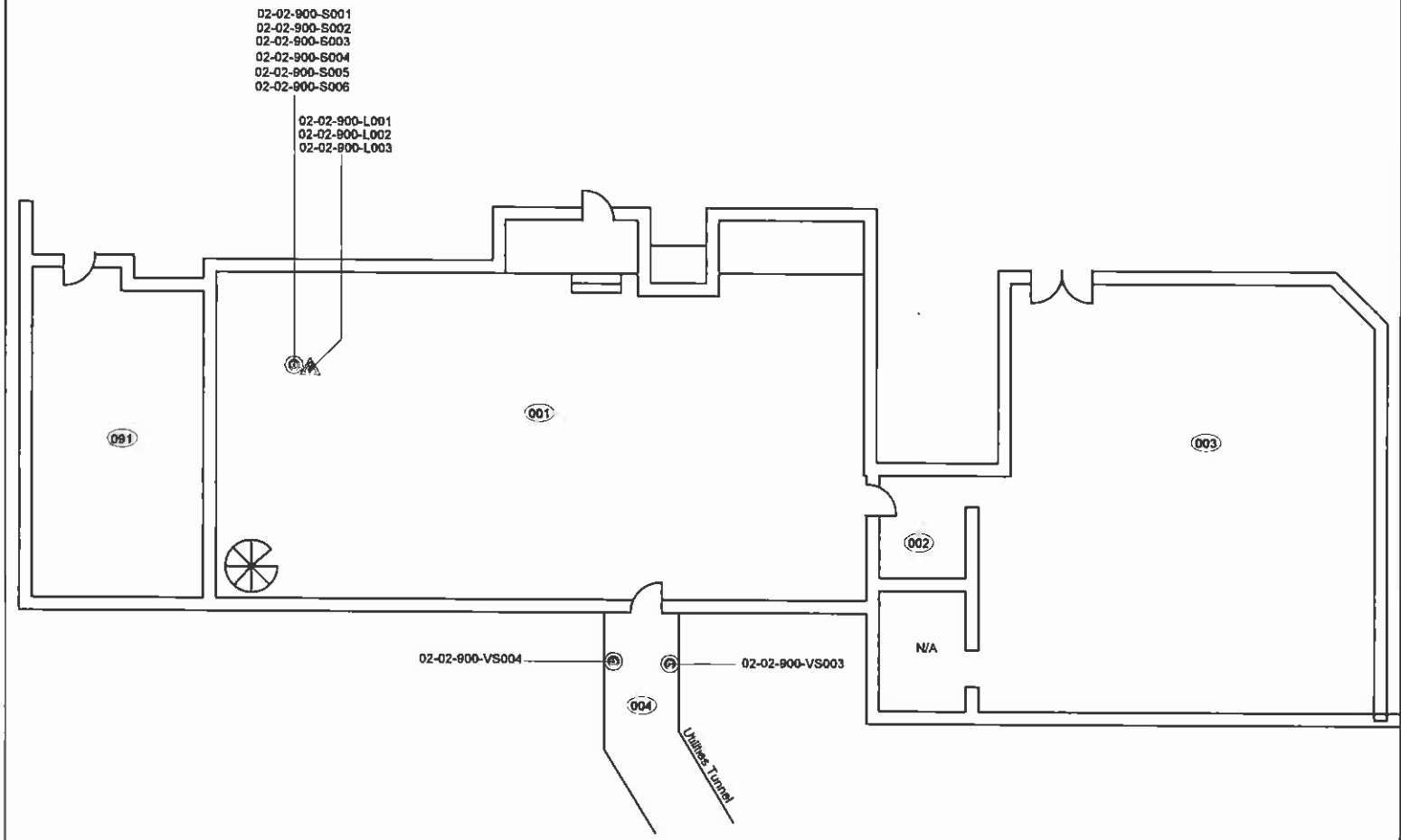
DRAWING NAME:

SAMPLE LOCATIONS LEVEL 4

REFERENCE:

PLEL SITE SURVEY

DATE:	PROJECT #:
MARCH 2013	02 - 02 - 00900
SCALE: N.T.S.	FIGURE #: 4
DRAWN BY: A. ANISCIKLI	
CHECKED BY: P. STAEBEN	



PINCHIN LEBLANC ENVIRONMENTAL

LEGEND:

- XXX — PINCHIN LOCATION NUMBER
- ASBESTOS SAMPLE ID NUMBER
- LEAD SAMPLE ID NUMBER
- N/A — NOT ACCESSIBLE

CLIENT:
MEMORIAL UNIVERSITY OF NEWFOUNDLAND

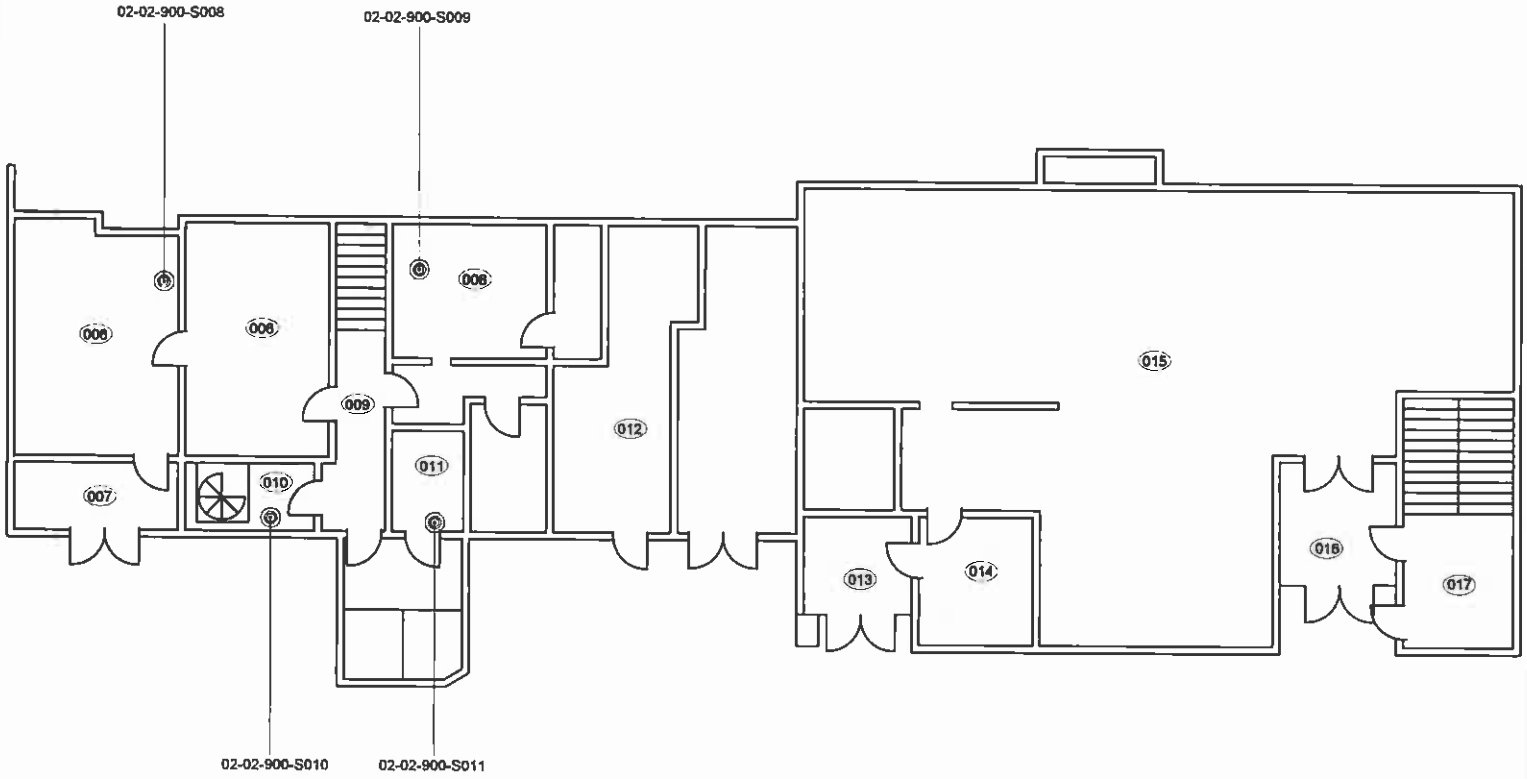
PROJECT:
ASBESTOS AND LEAD PAINT BUILDING MATERIALS SURVEY

SITE ADDRESS:
OCEAN SCIENCES CENTER ANNEX BUILDING, NEWFOUNDLAND AND LABRADOR

DRAWING NAME:
SAMPLE LOCATIONS LEVEL 1

REFERENCE:
PLEL SITE SURVEY

DATE:	PROJECT #:
MARCH 2013	02 - 02 - 00900
SCALE: N.T.S.	FIGURE #: 1
DRAWN BY: A. ANISCIKLI	
CHECKED BY: P. STAEBEN	



PINCHIN LEBLANC ENVIRONMENTAL

LEGEND:

XXX PINCHIN LOCATION NUMBER

ASBESTOS SAMPLE ID NUMBER

CLIENT:

MEMORIAL UNIVERSITY OF NEWFOUNDLAND

PROJECT:

ASBESTOS AND LEAD PAINT BUILDING MATERIALS SURVEY

SITE ADDRESS:

OCEAN SCIENCES CENTER ANNEX BUILDING, NEWFOUNDLAND AND LABRADOR

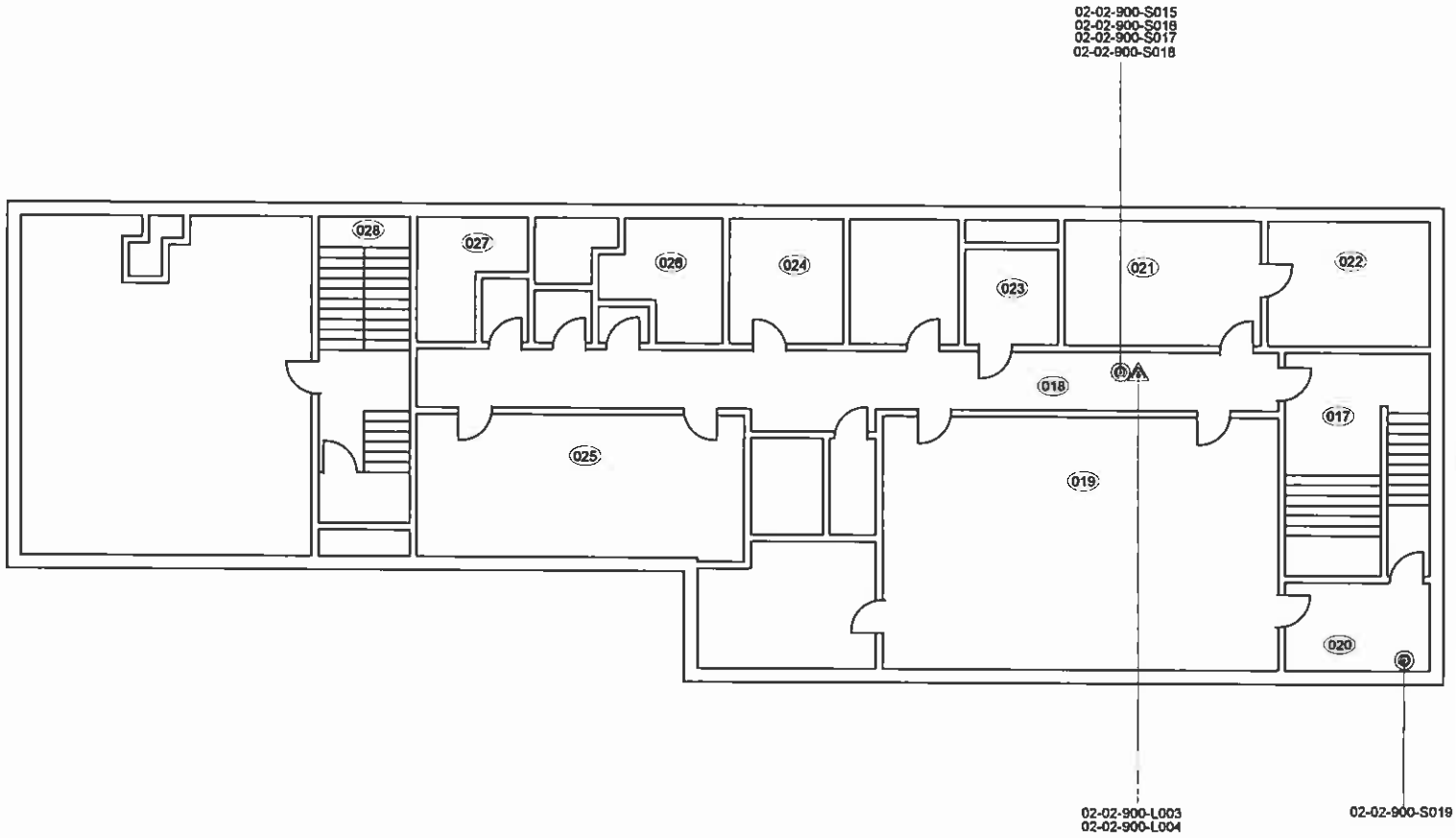
DRAWING NAME:

SAMPLE LOCATIONS LEVEL 2

REFERENCE:

PLEL SITE SURVEY

DATE: MARCH 2013	PROJECT #: 02 - 02 - 00900
SCALE: N.T.S.	FIGURE #: 2
DRAWN BY: A. ANISCIKLI	
CHECKED BY: P. STAEBEN	



PINCHIN LEBLANC ENVIRONMENTAL

LEGEND:

XXX PINCHIN LOCATION NUMBER

ASBESTOS SAMPLE ID NUMBER

LEAD SAMPLE ID NUMBER

CLIENT:

MEMORIAL UNIVERSITY OF NEWFOUNDLAND

PROJECT:

ASBESTOS AND LEAD PAINT BUILDING MATERIALS SURVEY

SITE ADDRESS:

OCEAN SCIENCES CENTER ANNEX BUILDING, NEWFOUNDLAND AND LABRADOR

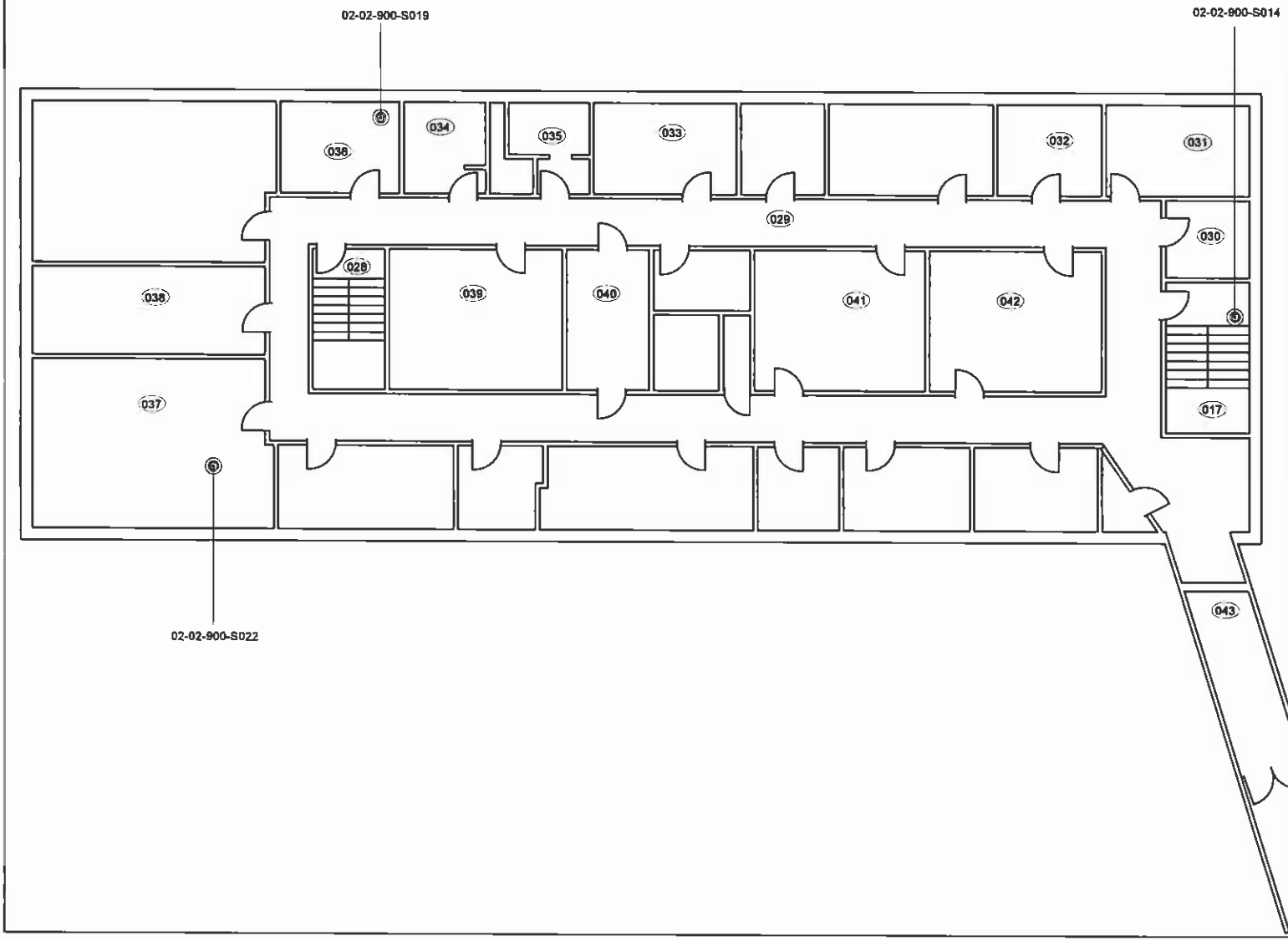
DRAWING NAME:

SAMPLE LOCATIONS LEVEL 3

REFERENCE:

PLEL SITE SURVEY

DATE: MARCH 2013	PROJECT #: 02 - 02 - 00900
SCALE: N.T.S.	FIGURE #: 3
DRAWN BY: A. ANISCIKLI	
CHECKED BY: P. STAEBEN	



PINCHIN LEBLANC ENVIRONMENTAL

LEGEND:

(XXX) PINCHIN LOCATION NUMBER

ASBESTOS SAMPLE ID NUMBER

CLIENT:

MEMORIAL UNIVERSITY OF NEWFOUNDLAND

PROJECT:

ASBESTOS AND LEAD PAINT BUILDING MATERIALS SURVEY

SITE ADDRESS:

OCEAN SCIENCES CENTER
ANNEX BUILDING,
NEWFOUNDLAND AND LABRADOR

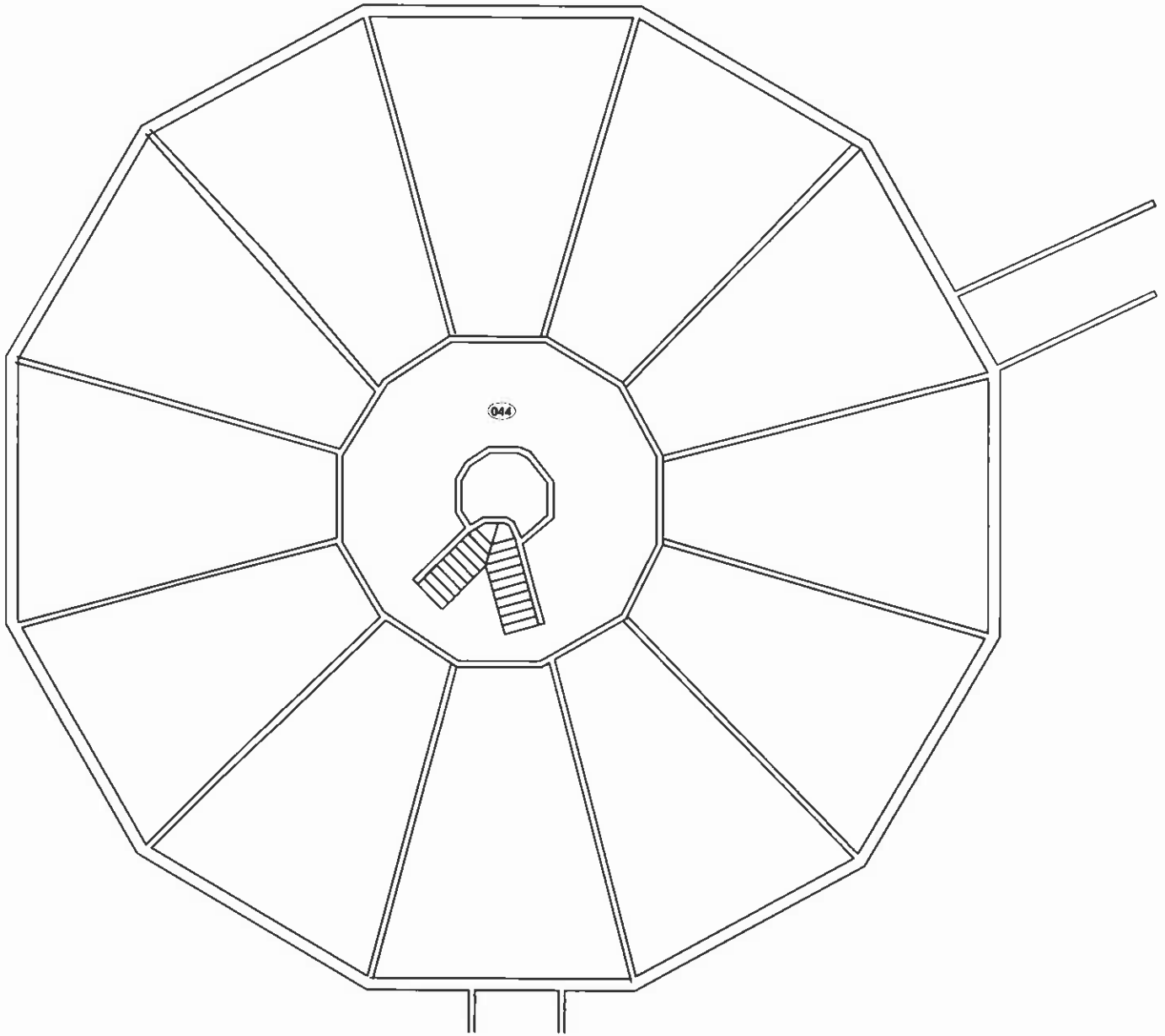
DRAWING NAME:

SAMPLE LOCATIONS
LEVEL 4

REFERENCE:

PLEL SITE SURVEY

DATE:	PROJECT #:
MARCH 2013	02 - 02 - 00900
SCALE: N.T.S.	FIGURE #: 4
DRAWN BY: A. ANISCIKLI	
CHECKED BY: P. STAEBEN	



PINCHIN LEBLANC ENVIRONMENTAL

LEGEND:

(XXX) PINCHIN LOCATION NUMBER

CLIENT:

MEMORIAL UNIVERSITY OF NEWFOUNDLAND

PROJECT:

ASBESTOS AND LEAD PAINT BUILDING MATERIALS SURVEY

SITE ADDRESS:

OCEAN SCIENCES CENTER RESEARCH BUILDING, NEWFOUNDLAND AND LABRADOR

DRAWING NAME:

SAMPLE LOCATIONS LEVEL 5

REFERENCE:

PLEL SITE SURVEY

DATE:	PROJECT #:
MARCH 2013	02 - 02 - 00900
SCALE: N.T.S.	FIGURE #: 5
DRAWN BY: A. ANISCIKLI	
CHECKED BY: P. STAEBEN	

APPENDIX IV

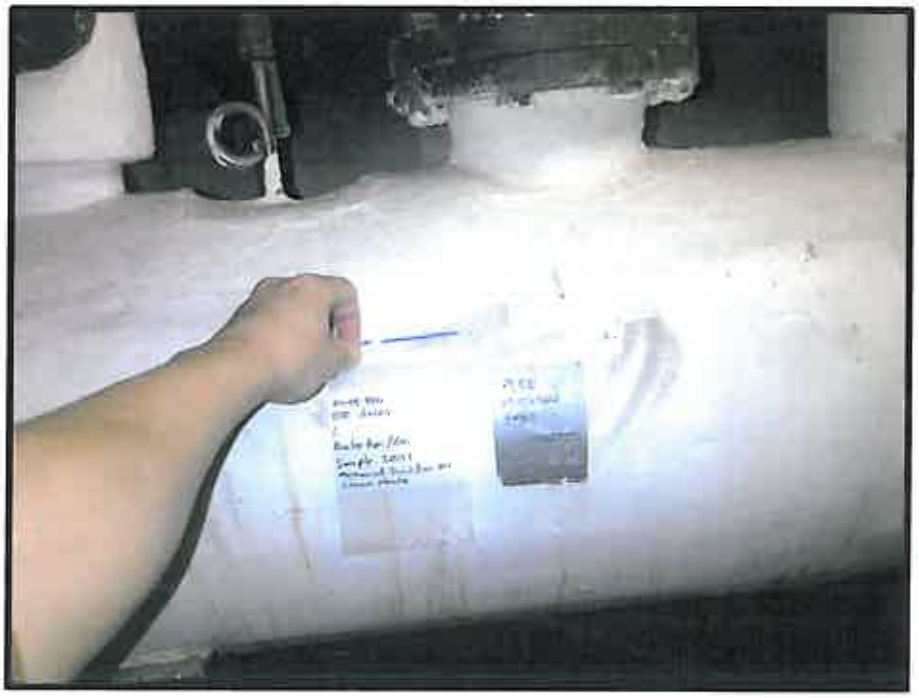
SAMPLE LOG

ASBESTOS BULK SAMPLING FORM

Sample #:	S001	**Date Sampled:**	November 29, 2012
Building :	OSC Main BLDG and Annex	**Sampler:**	Trent Hardy
Location:	001, room AX1001	**Analysis:**	SAI - PLM
MUN Project #:	02-02-900	**Work Order #:**	

Bulk Sampling Parameters

Pipe/Tank	Flooring	Ceiling	Roofing	Location
X Insulation	☐12'x12' Tile	☐ Textured	☐ Shingle	☐ Floor
☐ Elbow	☐ 9'x9'Tile	☐ Stucco	☐ Rolled	☐ Wall Orientation
☐ Fitting	☐ Vinyl Sheet	☐ Popcorn	☐ Felt	☐ Ceiling
☐ Transite Pipe	☐ Mastic	☐ DWJC	☐ Tar	☐ Above Ceiling
☐ Gasket	**Wall**	☐ Plaster		X Other (steam header)
☐ Tank Insulation	☐ Transite Panel	☐ Acoustic Tile (Dropped)		
☐ Pipe Wrap	☐ Textured Wall	☐ Acoustic Tile (Glued-on)		
HVAC	☐ Plaster	☐ Mastic	Miscellaneous: _____	
☐ Insulation	☐ DWJC	**Structural**		
☐ Tape		☐ Steel F. P. ing	No. of Phases: _____	
☐ Paper Wrap		☐ Deck F. P. ing	Colour: _____	



ASBESTOS BULK SAMPLING FORM

Sample #:	S002	**Date Sampled:**	November 29, 2012
Building :	OSC Main BLDG and Annex	**Sampler:**	Trent Hardy
Location:	001, room AX1001	**Analysis:**	SAI - PLM
MUN Project #:	02-02-900	**Work Order #:**	

Bulk Sampling Parameters

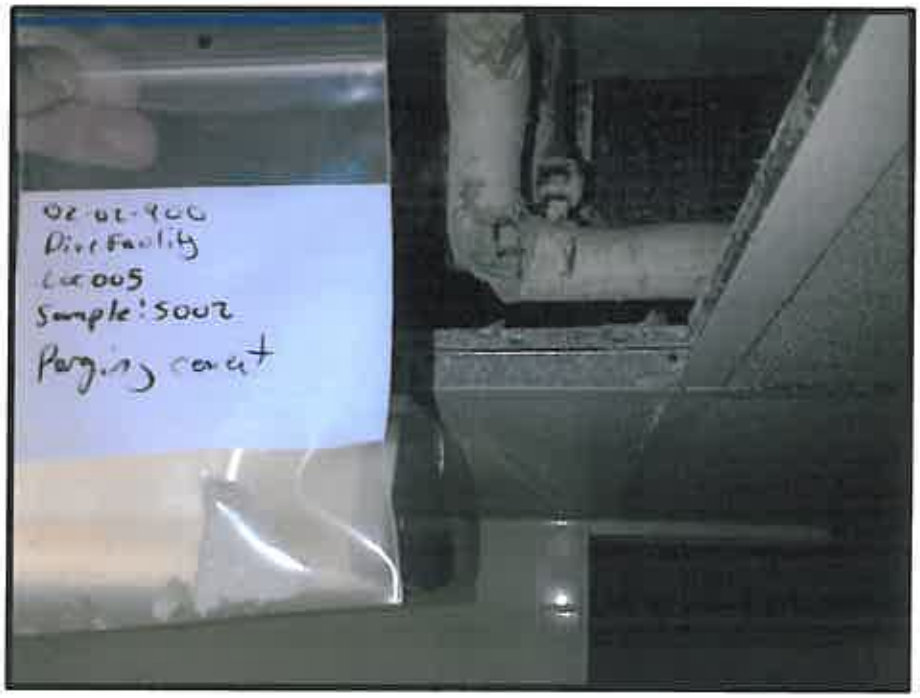
Pipe/Tank	Flooring	Ceiling	Roofing	Location
X Insulation	☐12'x12' Tile	☐ Textured	☐ Shingle	☐ Floor
☐ Elbow	☐ 9'x9'Tile	☐ Stucco	☐ Rolled	☐ Wall Orientation
☐ Fitting	☐ Vinyl Sheet	☐ Popcorn	☐ Felt	☐ Ceiling
☐ Transite Pipe	☐ Mastic	☐ DWJC	☐ Tar	☐ Above Ceiling
☐ Gasket	**Wall**	☐ Plaster		X Other (boiler exhaust)
☐ Tank Insulation	☐ Transite Panel	☐ Acoustic Tile (Dropped)		
☐ Pipe Wrap	☐ Textured Wall	☐ Acoustic Tile (Glued-on)		
HVAC	☐ Plaster	☐ Mastic	Miscellaneous: _____	
☐ Insulation	☐ DWJC	**Structural**		
☐ Tape		☐ Steel F. P. ing	No. of Phases: _____	
☐ Paper Wrap		☐ Deck F. P. ing	Colour: _____	

ASBESTOS BULK SAMPLING FORM

Sample #:	S002	**Date Sampled:**	November 30, 2012
Building :	OSC Main BLDG and Annex	**Sampler:**	Trent Hardy
Location:	005, room DV1001	**Analysis:**	SAI - PLM
MUN Project #:	02-02-900	**Work Order #:**	

Bulk Sampling Parameters

Pipe/Tank	Flooring	Ceiling	Roofing	Location
☐ Insulation	☐ 12'x12' Tile	☐ Textured	☐ Shingle	☐ Floor
X Elbow	☐ 9'x9'Tile	☐ Stucco	☐ Rolled	☐ Wall Orientation
☐ Fitting	☐ Vinyl Sheet	☐ Popcorn	☐ Felt	☐ Ceiling
☐ Transite Pipe	☐ Mastic	☐ DWJC	☐ Tar	X Above Ceiling
☐ Gasket	**Wall**	☐ Plaster		☐ Other
☐ Tank Insulation	☐ Transite Panel	☐ Acoustic Tile (Dropped)		
☐ Pipe Wrap	☐ Textured Wall	☐ Acoustic Tile (Glued-on)		
HVAC	☐ Plaster	☐ Mastic	Miscellaneous: _____	
☐ Insulation	☐ DWJC	**Structural**		
☐ Tape		☐ Steel F. P. ing	No. of Phases: _____	
☐ Paper Wrap		☐ Deck F. P. ing	Colour: _____	

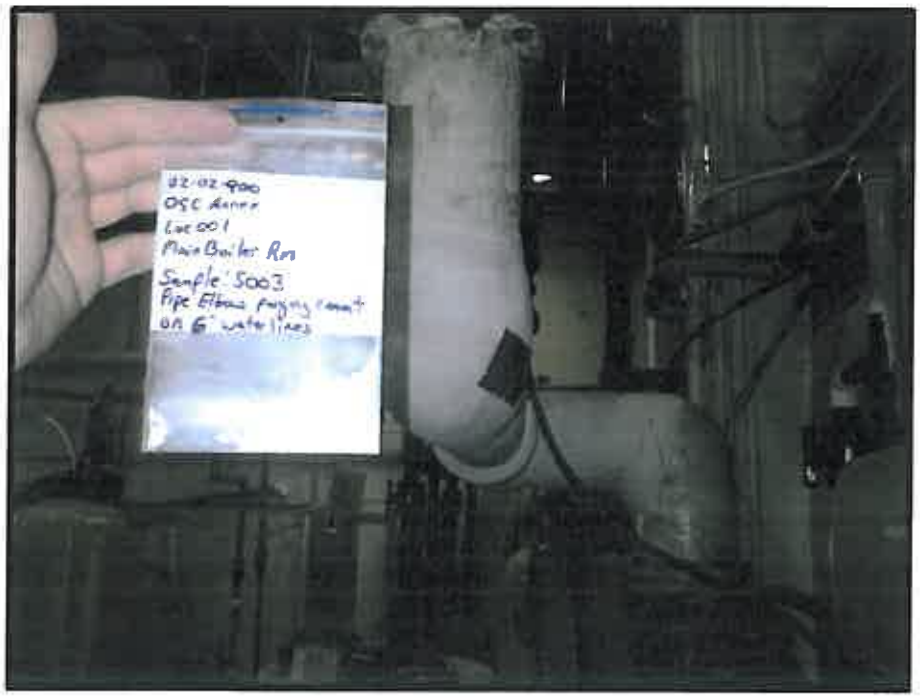


ASBESTOS BULK SAMPLING FORM

Sample #:	S003	**Date Sampled:**	November 29, 2012
Building :	OSC Main BLDG and Annex	**Sampler:**	Trent Hardy
Location:	001, room AX1001	**Analysis:**	SAI - PLM
MUN Project #:	02-02-900	**Work Order #:**	

Bulk Sampling Parameters

Pipe/Tank	Flooring	Ceiling	Roofing	Location
☐ Insulation	☐12'x12' Tile	☐ Textured	☐ Shingle	☐ Floor
X Elbow	☐ 9'x9'Tile	☐ Stucco	☐ Rolled	☐ Wall Orientation
☐ Fitting	☐ Vinyl Sheet	☐ Popcorn	☐ Felt	☐ Ceiling
☐ Transite Pipe	☐ Mastic	☐ DWJC	☐ Tar	☐ Above Ceiling
☐ Gasket	**Wall**	☐ Plaster		X Other (6" waterlines)
☐ Tank Insulation	☐ Transite Panel	☐ Acoustic Tile (Dropped)		
☐ Pipe Wrap	☐ Textured Wall	☐ Acoustic Tile (Glued-on)		
HVAC	☐ Plaster	☐ Mastic	Miscellaneous: _____	
☐ Insulation	☐ DWJC	**Structural**		
☐ Tape		☐ Steel F. P. ing	No. of Phases: _____	
☐ Paper Wrap		☐ Deck F. P. ing	Colour: _____	



ASBESTOS BULK SAMPLING FORM

Sample #:	S004	**Date Sampled:**	November 29, 2012
Building :	OSC Main BLDG and Annex	**Sampler:**	Trent Hardy
Location:	001, room AX1001	**Analysis:**	SAI - PLM
MUN Project #:	02-02-900	**Work Order #:**	

Bulk Sampling Parameters

Pipe/Tank	Flooring	Ceiling	Roofing	Location
☐ Insulation	☐12'x12' Tile	☐ Textured	☐ Shingle	☐ Floor
X Elbow	☐ 9'x9'Tile	☐ Stucco	☐ Rolled	☐ Wall Orientation
☐ Fitting	☐ Vinyl Sheet	☐ Popcorn	☐ Felt	☐ Ceiling
☐ Transite Pipe	☐ Mastic	☐ DWJC	☐ Tar	☐ Above Ceiling
☐ Gasket	**Wall**	☐ Plaster		X Other (4" waterlines)
☐ Tank Insulation	☐ Transite Panel	☐ Acoustic Tile (Dropped)		
☐ Pipe Wrap	☐ Textured Wall	☐ Acoustic Tile (Glued-on)		
HVAC	☐ Plaster	☐ Mastic	Miscellaneous: _____	
☐ Insulation	☐ DWJC	**Structural**		
☐ Tape		☐ Steel F. P. ing	No. of Phases: _____	
☐ Paper Wrap		☐ Deck F. P. ing	Colour: _____	

ASBESTOS BULK SAMPLING FORM

Sample #:	S005	**Date Sampled:**	November 29, 2012
Building :	OSC Main BLDG and Annex	**Sampler:**	Trent Hardy
Location:	001, room AX1001	**Analysis:**	SAI - PLM
MUN Project #:	02-02-900	**Work Order #:**	

Bulk Sampling Parameters

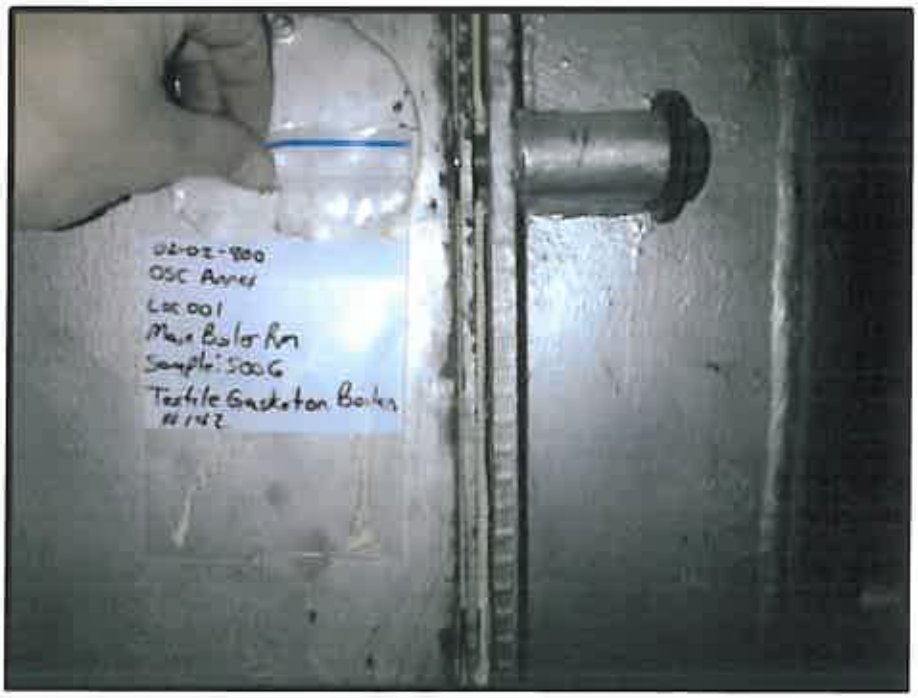
Pipe/Tank	Flooring	Ceiling	Roofing	Location
☐ Insulation	☐ 12'x12' Tile	☐ Textured	☐ Shingle	☐ Floor
X Elbow	☐ 9'x9'Tile	☐ Stucco	☐ Rolled	☐ Wall Orientation
☐ Fitting	☐ Vinyl Sheet	☐ Popcorn	☐ Felt	☐ Ceiling
☐ Transite Pipe	☐ Mastic	☐ DWJC	☐ Tar	☐ Above Ceiling
☐ Gasket	**Wall**	☐ Plaster		X Other (6" pipes)
☐ Tank Insulation	☐ Transite Panel	☐ Acoustic Tile (Dropped)		
☐ Pipe Wrap	☐ Textured Wall	☐ Acoustic Tile (Glued-on)		
HVAC	☐ Plaster	☐ Mastic	Miscellaneous: _____	
☐ Insulation	☐ DWJC	**Structural**		
☐ Tape		☐ Steel F. P. ing	No. of Phases: _____	
☐ Paper Wrap		☐ Deck F. P. ing	Colour: _____	

ASBESTOS BULK SAMPLING FORM

Sample #:	S006	**Date Sampled:**	November 29, 2012
Building :	OSC Main BLDG and Annex	**Sampler:**	Trent Hardy
Location:	001, room AX1001	**Analysis:**	SAI - PLM
MUN Project #:	02-02-900	**Work Order #:**	

Bulk Sampling Parameters

Pipe/Tank	Flooring	Ceiling	Roofing	Location
☐ Insulation	☐12'x12' Tile	☐ Textured	☐ Shingle	☐ Floor
☐ Elbow	☐ 9'x9'Tile	☐ Stucco	☐ Rolled	☐ Wall Orientation
☐ Fitting	☐ Vinyl Sheet	☐ Popcorn	☐ Felt	☐ Ceiling
☐ Transite Pipe	☐ Mastic	☐ DWJC	☐ Tar	☐ Above Ceiling
☐ Gasket	**Wall**	☐ Plaster		X Other (boilers 1 & 2)
☐ Tank Insulation	☐ Transite Panel	☐ Acoustic Tile (Dropped)		
☐ Pipe Wrap	☐ Textured Wall	☐ Acoustic Tile (Glued-on)		
HVAC	☐ Plaster	☐ Mastic	Miscellaneous: Textile gasket	
☐ Insulation	☐ DWJC	**Structural**		
☐ Tape		☐ Steel F. P. ing	No. of Phases: _____	
☐ Paper Wrap		☐ Deck F. P. ing	Colour: _____	



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ASBESTOS BULK SAMPLING FORM

Sample #:	S007	**Date Sampled:**	November 29, 2012
Building :	OSC Main BLDG and Annex	**Sampler:**	Trent Hardy
Location:	003, room AX1000	**Analysis:**	SAI - PLM
MUN Project #:	02-02-900	**Work Order #:**	

Bulk Sampling Parameters

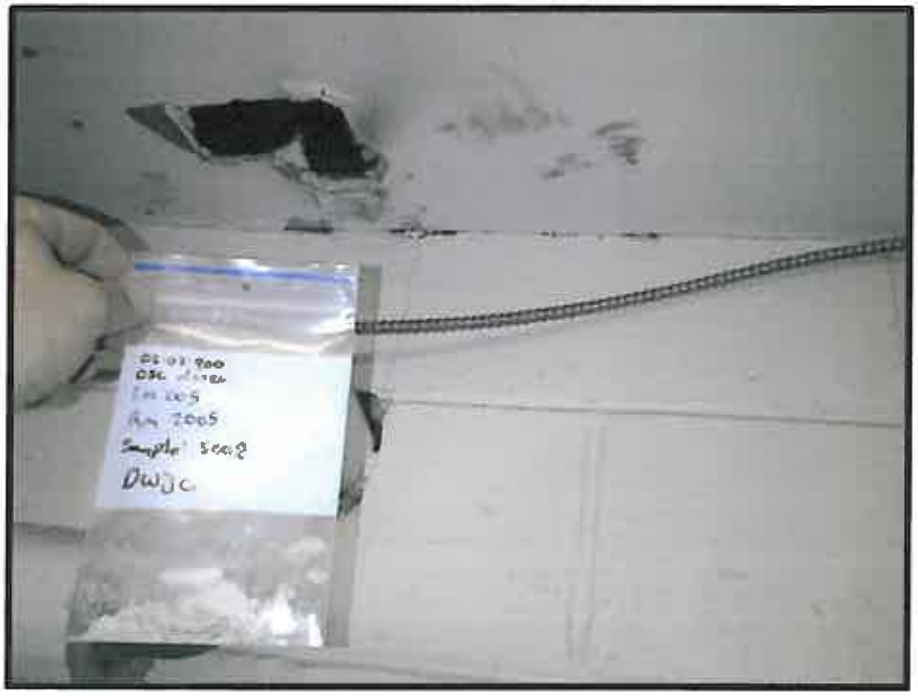
Pipe/Tank	Flooring	Ceiling	Roofing	Location
X Insulation	☐12'x12' Tile	☐ Textured	☐ Shingle	☐ Floor
☐ Elbow	☐ 9'x9'Tile	☐ Stucco	☐ Rolled	☐ Wall Orientation
☐ Fitting	☐ Vinyl Sheet	☐ Popcorn	☐ Felt	☐ Ceiling
☐ Transite Pipe	☐ Mastic	☐ DWJC	☐ Tar	☐ Above Ceiling
☐ Gasket	**Wall**	☐ Plaster		X Other (tank)
☐ Tank Insulation	☐ Transite Panel	☐ Acoustic Tile (Dropped)		
☐ Pipe Wrap	☐ Textured Wall	☐ Acoustic Tile (Glued-on)		
HVAC	☐ Plaster	☐ Mastic	Miscellaneous: _____	
☐ Insulation	☐ DWJC	**Structural**		
☐ Tape		☐ Steel F. P. ing	No. of Phases: _____	
☐ Paper Wrap		☐ Deck F. P. ing	Colour: _____	

ASBESTOS BULK SAMPLING FORM

Sample #:	S008	**Date Sampled:**	November 29, 2012
Building :	OSC Main BLDG and Annex	**Sampler:**	Trent Hardy
Location:	005, room AX2005A	**Analysis:**	SAI - PLM
MUN Project #:	02-02-900	**Work Order #:**	

Bulk Sampling Parameters

Pipe/Tank	Flooring	Ceiling	Roofing	Location
☐ Insulation	☐12'x12' Tile	☐ Textured	☐ Shingle	☐ Floor
☐ Elbow	☐ 9'x9'Tile	☐ Stucco	☐ Rolled	☐ Wall Orientation
☐ Fitting	☐ Vinyl Sheet	☐ Popcorn	☐ Felt	X Ceiling
☐ Transite Pipe	☐ Mastic	X DWJC	☐ Tar	☐ Above Ceiling
☐ Gasket	**Wall**	☐ Plaster		☐ Other
☐ Tank Insulation	☐ Transite Panel	☐ Acoustic Tile (Dropped)		
☐ Pipe Wrap	☐ Textured Wall	☐ Acoustic Tile (Glued-on)		
HVAC	☐ Plaster	☐ Mastic	Miscellaneous: _____	
☐ Insulation	☐ DWJC	**Structural**		
☐ Tape		☐ Steel F. P. ing	No. of Phases: _____	
☐ Paper Wrap		☐ Deck F. P. ing	Colour: _____	



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ASBESTOS BULK SAMPLING FORM

Sample #:	S009	**Date Sampled:**	November 29, 2012
Building :	OSC Main BLDG and Annex	**Sampler:**	Trent Hardy
Location:	009, hallway 2C01	**Analysis:**	SAI - PLM
MUN Project #:	02-02-900	**Work Order #:**	

Bulk Sampling Parameters

Pipe/Tank	Flooring	Ceiling	Roofing	Location
☐ Insulation	X12'x12' Tile	☐ Textured	☐ Shingle	X Floor
☐ Elbow	☐ 9'x9'Tile	☐ Stucco	☐ Rolled	☐ Wall Orientation
☐ Fitting	☐ Vinyl Sheet	☐ Popcorn	☐ Felt	☐ Ceiling
☐ Transite Pipe	☐ Mastic	☐ DWJC	☐ Tar	☐ Above Ceiling
☐ Gasket	**Wall**	☐ Plaster		☐ Other
☐ Tank Insulation	☐ Transite Panel	☐ Acoustic Tile (Dropped)		
☐ Pipe Wrap	☐ Textured Wall	☐ Acoustic Tile (Glued-on)		
HVAC	☐ Plaster	☐ Mastic	Miscellaneous: _____	
☐ Insulation	☐ DWJC	**Structural**		
☐ Tape		☐ Steel F. P. ing	No. of Phases: _____	
☐ Paper Wrap		☐ Deck F. P. ing	Colour: White with brown streaks	

ASBESTOS BULK SAMPLING FORM

Sample #:	S010	**Date Sampled:**	November 29, 2012
Building :	OSC Main BLDG and Annex	**Sampler:**	Trent Hardy
Location:	010, hallway AX2S02	**Analysis:**	SAI - PLM
MUN Project #:	02-02-900	**Work Order #:**	

Bulk Sampling Parameters

Pipe/Tank	Flooring	Ceiling	Roofing	Location
☐ Insulation	☐ 12'x12' Tile	☐ Textured	☐ Shingle	☐ Floor
☐ Elbow	☐ 9'x9'Tile	☐ Stucco	☐ Rolled	☐ Wall Orientation
☐ Fitting	☐ Vinyl Sheet	☐ Popcorn	☐ Felt	☐ Ceiling
☐ Transite Pipe	☐ Mastic	☐ DWJC	X Tar	X Above Ceiling
☐ Gasket	**Wall**	☐ Plaster		☐ Other
☐ Tank Insulation	☐ Transite Panel	☐ Acoustic Tile (Dropped)		
☐ Pipe Wrap	☐ Textured Wall	☐ Acoustic Tile (Glued-on)		
HVAC	☐ Plaster	☐ Mastic	Miscellaneous: _____	
☐ Insulation	☐ DWJC	**Structural**		
☐ Tape		☐ Steel F. P. ing	No. of Phases: _____	
☐ Paper Wrap		☐ Deck F. P. ing	Colour: _____	

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ASBESTOS BULK SAMPLING FORM

Sample #:	S011	**Date Sampled:**	November 29, 2012
Building :	OSC Main BLDG and Annex	**Sampler:**	Trent Hardy
Location:	011, room AX2003	**Analysis:**	SAI - PLM
MUN Project #:	02-02-900	**Work Order #:**	

Bulk Sampling Parameters

Pipe/Tank	Flooring	Ceiling	Roofing	Location
☐ Insulation	X12'x12' Tile	☐ Textured	☐ Shingle	X Floor
☐ Elbow	☐ 9'x9'Tile	☐ Stucco	☐ Rolled	☐ Wall Orientation
☐ Fitting	☐ Vinyl Sheet	☐ Popcorn	☐ Felt	☐ Ceiling
☐ Transite Pipe	☐ Mastic	☐ DWJC	☐ Tar	☐ Above Ceiling
☐ Gasket	**Wall**	☐ Plaster		☐ Other
☐ Tank Insulation	☐ Transite Panel	☐ Acoustic Tile (Dropped)		
☐ Pipe Wrap	☐ Textured Wall	☐ Acoustic Tile (Glued-on)		
HVAC	☐ Plaster	☐ Mastic	Miscellaneous: _____	
☐ Insulation	☐ DWJC	**Structural**		
☐ Tape		☐ Steel F. P. ing	No. of Phases: _____	
☐ Paper Wrap		☐ Deck F. P. ing	Colour: White with abundant brown flecks	

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ASBESTOS BULK SAMPLING FORM

Sample #:	S012	**Date Sampled:**	November 29, 2012
Building :	OSC Main BLDG and Annex	**Sampler:**	Trent Hardy
Location:	012, room AX2001B	**Analysis:**	SAI - PLM
MUN Project #:	02-02-900	**Work Order #:**	

Bulk Sampling Parameters

Pipe/Tank	Flooring	Ceiling	Roofing	Location
☐ Insulation	☐12'x12' Tile	☐ Textured	☐ Shingle	☐ Floor
☐ Elbow	☐ 9'x9'Tile	☐ Stucco	☐ Rolled	X Wall Orientation
☐ Fitting	☐ Vinyl Sheet	☐ Popcorn	☐ Felt	☐ Ceiling
☐ Transite Pipe	☐ Mastic	☐ DWJC	☐ Tar	☐ Above Ceiling
☐ Gasket	**Wall**	☐ Plaster		☐ Other
☐ Tank Insulation	☐ Transite Panel	☐ Acoustic Tile (Dropped)		
☐ Pipe Wrap	☐ Textured Wall	☐ Acoustic Tile (Glued-on)		
HVAC	☐ Plaster	☐ Mastic	Miscellaneous: _____	
☐ Insulation	X DWJC	**Structural**		
☐ Tape		☐ Steel F. P. ing	No. of Phases: _____	
☐ Paper Wrap		☐ Deck F. P. ing	Colour: _____	

ASBESTOS BULK SAMPLING FORM

Sample #:	S013	**Date Sampled:**	November 29, 2012
Building :	OSC Main BLDG and Annex	**Sampler:**	Trent Hardy
Location:	012, room AX2001B	**Analysis:**	SAI - PLM
MUN Project #:	02-02-900	**Work Order #:**	

Bulk Sampling Parameters

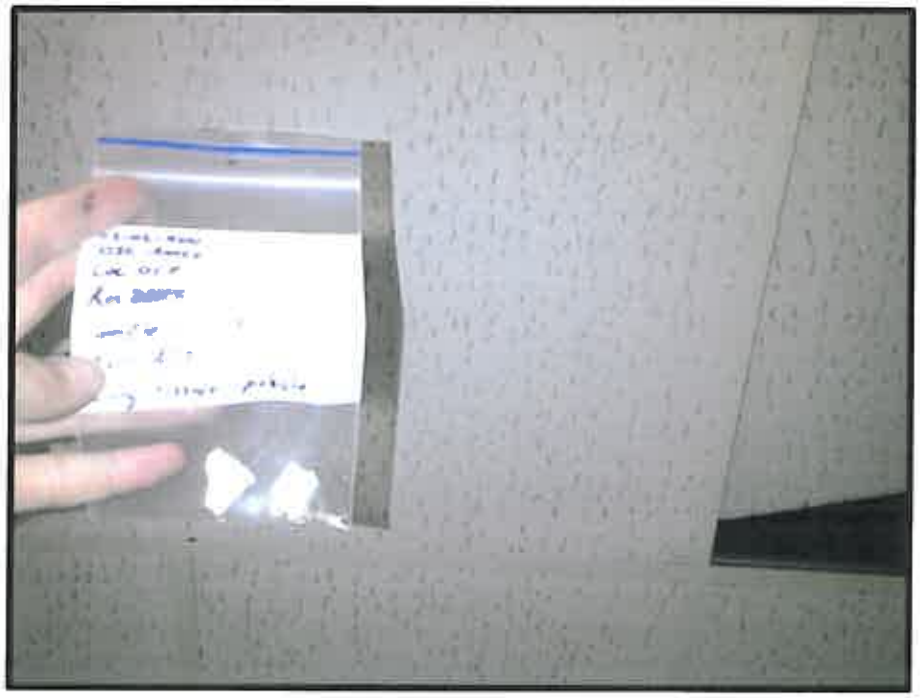
Pipe/Tank	Flooring	Ceiling	Roofing	Location
☐ Insulation	☐ 12'x12' Tile	☐ Textured	☐ Shingle	☐ Floor
☐ Elbow	☐ 9'x9'Tile	☐ Stucco	☐ Rolled	X Wall Orientation
☐ Fitting	☐ Vinyl Sheet	☐ Popcorn	☐ Felt	☐ Ceiling
☐ Transite Pipe	☐ Mastic	☐ DWJC	☐ Tar	☐ Above Ceiling
☐ Gasket	**Wall**	☐ Plaster		☐ Other
☐ Tank Insulation	X Transite Panel	☐ Acoustic Tile (Dropped)		
☐ Pipe Wrap	☐ Textured Wall	☐ Acoustic Tile (Glued-on)		
HVAC	☐ Plaster	☐ Mastic	Miscellaneous: _____	
☐ Insulation	☐ DWJC	**Structural**		
☐ Tape		☐ Steel F. P. ing	No. of Phases: _____	
☐ Paper Wrap		☐ Deck F. P. ing	Colour: _____	

ASBESTOS BULK SAMPLING FORM

Sample #:	S014	**Date Sampled:**	November 29, 2012
Building :	OSC Main BLDG and Annex	**Sampler:**	Trent Hardy
Location:	017, stairwell 2S01	**Analysis:**	SAI - PLM
MUN Project #:	02-02-900	**Work Order #:**	

Bulk Sampling Parameters

Pipe/Tank	Flooring	Ceiling	Roofing	Location
☐ Insulation	☐ 12'x12' Tile	☐ Textured	☐ Shingle	☐ Floor
☐ Elbow	☐ 9'x9'Tile	☐ Stucco	☐ Rolled	☐ Wall Orientation
☐ Fitting	☐ Vinyl Sheet	☐ Popcorn	☐ Felt	X Ceiling
☐ Transite Pipe	☐ Mastic	☐ DWJC	☐ Tar	☐ Above Ceiling
☐ Gasket	**Wall**	☐ Plaster		☐ Other
☐ Tank Insulation	☐ Transite Panel	X Acoustic Tile (Dropped)		
☐ Pipe Wrap	☐ Textured Wall	☐ Acoustic Tile (Glued-on)		
HVAC	☐ Plaster	☐ Mastic	Miscellaneous: 2' x 4' longitudinal fissure and pinhole	
☐ Insulation	☐ DWJC	**Structural**		
☐ Tape		☐ Steel F. P. ing	No. of Phases: _____	
☐ Paper Wrap		☐ Deck F. P. ing	Colour: _____	



ASBESTOS BULK SAMPLING FORM

Sample #:	S015	**Date Sampled:**	November 29, 2012
Building :	OSC Main BLDG and Annex	**Sampler:**	Trent Hardy
Location:	017, stairwell 2S01	**Analysis:**	SAI - PLM
MUN Project #:	02-02-900	**Work Order #:**	

Bulk Sampling Parameters

Pipe/Tank	Flooring	Ceiling	Roofing	Location
☐ Insulation	X12'x12' Tile	☐ Textured	☐ Shingle	X Floor
☐ Elbow	☐ 9'x9'Tile	☐ Stucco	☐ Rolled	☐ Wall Orientation
☐ Fitting	☐ Vinyl Sheet	☐ Popcorn	☐ Felt	☐ Ceiling
☐ Transite Pipe	☐ Mastic	☐ DWJC	☐ Tar	☐ Above Ceiling
☐ Gasket	**Wall**	☐ Plaster		☐ Other
☐ Tank Insulation	☐ Transite Panel	☐ Acoustic Tile (Dropped)		
☐ Pipe Wrap	☐ Textured Wall	☐ Acoustic Tile (Glued-on)		
HVAC	☐ Plaster	☐ Mastic	Miscellaneous: _____	
☐ Insulation	☐ DWJC	**Structural**		
☐ Tape		☐ Steel F. P. ing	No. of Phases: _____	
☐ Paper Wrap		☐ Deck F. P. ing	Colour: Beige with brown streaks	

ASBESTOS BULK SAMPLING FORM

Sample #:	S016	**Date Sampled:**	November 29, 2012
Building :	OSC Main BLDG and Annex	**Sampler:**	Trent Hardy
Location:	017, stairwell 2S01	**Analysis:**	SAI - PLM
MUN Project #:	02-02-900	**Work Order #:**	

Bulk Sampling Parameters

Pipe/Tank	Flooring	Ceiling	Roofing	Location
☐ Insulation	X12'x12' Tile	☐ Textured	☐ Shingle	X Floor
☐ Elbow	☐ 9'x9'Tile	☐ Stucco	☐ Rolled	☐ Wall Orientation
☐ Fitting	☐ Vinyl Sheet	☐ Popcorn	☐ Felt	☐ Ceiling
☐ Transite Pipe	☐ Mastic	☐ DWJC	☐ Tar	☐ Above Ceiling
☐ Gasket	**Wall**	☐ Plaster		☐ Other
☐ Tank Insulation	☐ Transite Panel	☐ Acoustic Tile (Dropped)		
☐ Pipe Wrap	☐ Textured Wall	☐ Acoustic Tile (Glued-on)		
HVAC	☐ Plaster	☐ Mastic	Miscellaneous: _____	
☐ Insulation	☐ DWJC	**Structural**		
☐ Tape		☐ Steel F. P. ing	No. of Phases: _____	
☐ Paper Wrap		☐ Deck F. P. ing	Colour: Beige with thick brown streaks	

ASBESTOS BULK SAMPLING FORM

Sample #:	S017	**Date Sampled:**	November 29, 2012
Building :	OSC Main BLDG and Annex	**Sampler:**	Trent Hardy
Location:	017, stairwell 2S01	**Analysis:**	SAI - PLM
MUN Project #:	02-02-900	**Work Order #:**	

Bulk Sampling Parameters

Pipe/Tank	Flooring	Ceiling	Roofing	Location
☐ Insulation	☐ 12'x12' Tile	☐ Textured	☐ Shingle	☐ Floor
☐ Elbow	☐ 9'x9'Tile	☐ Stucco	☐ Rolled	☐ Wall Orientation
☐ Fitting	☐ Vinyl Sheet	☐ Popcorn	☐ Felt	X Ceiling
☐ Transite Pipe	☐ Mastic	☐ DWJC	☐ Tar	☐ Above Ceiling
☐ Gasket	**Wall**	☐ Plaster		☐ Other
☐ Tank Insulation	☐ Transite Panel	X Acoustic Tile (Dropped)		
☐ Pipe Wrap	☐ Textured Wall	☐ Acoustic Tile (Glued-on)		
HVAC	☐ Plaster	☐ Mastic	Miscellaneous: 2' x 4' pinhole and fleck	
☐ Insulation	☐ DWJC	**Structural**		
☐ Tape		☐ Steel F. P. ing	No. of Phases: _____	
☐ Paper Wrap		☐ Deck F. P. ing	Colour: _____	

ASBESTOS BULK SAMPLING FORM

Sample #:	S018	**Date Sampled:**	November 29, 2012
Building :	OSC Main BLDG and Annex	**Sampler:**	Trent Hardy
Location:	017, stairwell 2S01	**Analysis:**	SAI - PLM
MUN Project #:	02-02-900	**Work Order #:**	

Bulk Sampling Parameters

Pipe/Tank	Flooring	Ceiling	Roofing	Location
☐ Insulation	☐12'x12' Tile	☐ Textured	☐ Shingle	☐ Floor
☐ Elbow	☐ 9'x9'Tile	☐ Stucco	☐ Rolled	X Wall Orientation
☐ Fitting	☐ Vinyl Sheet	☐ Popcorn	☐ Felt	☐ Ceiling
☐ Transite Pipe	☐ Mastic	☐ DWJC	☐ Tar	☐ Above Ceiling
☐ Gasket	**Wall**	☐ Plaster		☐ Other
☐ Tank Insulation	☐ Transite Panel	☐ Acoustic Tile (Dropped)		
☐ Pipe Wrap	☐ Textured Wall	☐ Acoustic Tile (Glued-on)		
HVAC	☐ Plaster	☐ Mastic	Miscellaneous: _____	
☐ Insulation	X DWJC	**Structural**		
☐ Tape		☐ Steel F. P. ing	No. of Phases: _____	
☐ Paper Wrap		☐ Deck F. P. ing	Colour: _____	

ASBESTOS BULK SAMPLING FORM

Sample #:	S019	**Date Sampled:**	November 29, 2012
Building :	OSC Main BLDG and Annex	**Sampler:**	Trent Hardy
Location:	020, room 3001B	**Analysis:**	SAI - PLM
MUN Project #:	02-02-900	**Work Order #:**	

Bulk Sampling Parameters

Pipe/Tank	Flooring	Ceiling	Roofing	Location
☐ Insulation	X12'x12' Tile	☐ Textured	☐ Shingle	X Floor
☐ Elbow	☐ 9'x9'Tile	☐ Stucco	☐ Rolled	☐ Wall Orientation
☐ Fitting	☐ Vinyl Sheet	☐ Popcorn	☐ Felt	☐ Ceiling
☐ Transite Pipe	☐ Mastic	☐ DWJC	☐ Tar	☐ Above Ceiling
☐ Gasket	**Wall**	☐ Plaster		☐ Other
☐ Tank Insulation	☐ Transite Panel	☐ Acoustic Tile (Dropped)		
☐ Pipe Wrap	☐ Textured Wall	☐ Acoustic Tile (Glued-on)		
HVAC	☐ Plaster	☐ Mastic	Miscellaneous: _____	
☐ Insulation	☐ DWJC	**Structural**		
☐ Tape		☐ Steel F. P. ing	No. of Phases: _____	
☐ Paper Wrap		☐ Deck F. P. ing	Colour: Grey	

ASBESTOS BULK SAMPLING FORM

Sample #:	S020	**Date Sampled:**	November 29, 2012
Building :	OSC Main BLDG and Annex	**Sampler:**	Trent Hardy
Location:	031, room AX4001	**Analysis:**	SAI - PLM
MUN Project #:	02-02-900	**Work Order #:**	

Bulk Sampling Parameters

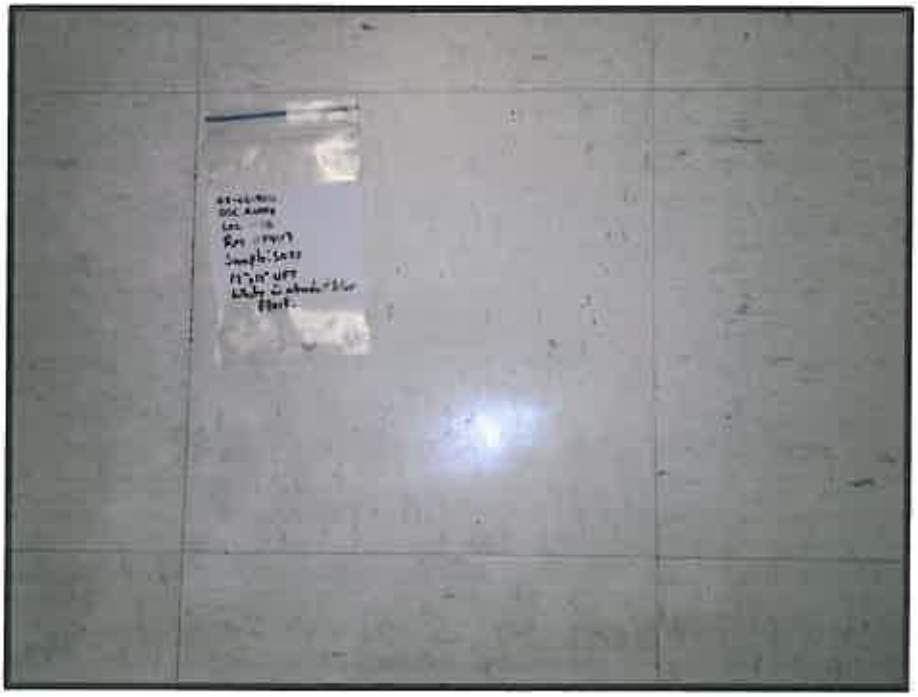
Pipe/Tank	Flooring	Ceiling	Roofing	Location
☐ Insulation	☐ 12'x12' Tile	☐ Textured	☐ Shingle	☐ Floor
☐ Elbow	☐ 9'x9'Tile	☐ Stucco	☐ Rolled	X Wall Orientation
☐ Fitting	☐ Vinyl Sheet	☐ Popcorn	☐ Felt	☐ Ceiling
☐ Transite Pipe	☐ Mastic	☐ DWJC	☐ Tar	☐ Above Ceiling
☐ Gasket	**Wall**	☐ Plaster		☐ Other
☐ Tank Insulation	☐ Transite Panel	☐ Acoustic Tile (Dropped)		
☐ Pipe Wrap	☐ Textured Wall	☐ Acoustic Tile (Glued-on)		
HVAC	☐ Plaster	☐ Mastic	Miscellaneous: _____	
☐ Insulation	X DWJC	**Structural**		
☐ Tape		☐ Steel F. P. ing	No. of Phases: _____	
☐ Paper Wrap		☐ Deck F. P. ing	Colour: _____	

ASBESTOS BULK SAMPLING FORM

Sample #:	S021	**Date Sampled:**	November 29, 2012
Building :	OSC Main BLDG and Annex	**Sampler:**	Trent Hardy
Location:	036, room 4013	**Analysis:**	SAI - PLM
MUN Project #:	02-02-900	**Work Order #:**	

Bulk Sampling Parameters

Pipe/Tank	Flooring	Ceiling	Roofing	Location
☐ Insulation	X12'x12' Tile	☐ Textured	☐ Shingle	X Floor
☐ Elbow	☐ 9'x9'Tile	☐ Stucco	☐ Rolled	☐ Wall Orientation
☐ Fitting	☐ Vinyl Sheet	☐ Popcorn	☐ Felt	☐ Ceiling
☐ Transite Pipe	☐ Mastic	☐ DWJC	☐ Tar	☐ Above Ceiling
☐ Gasket	**Wall**	☐ Plaster		☐ Other
☐ Tank Insulation	☐ Transite Panel	☐ Acoustic Tile (Dropped)		
☐ Pipe Wrap	☐ Textured Wall	☐ Acoustic Tile (Glued-on)		
HVAC	☐ Plaster	☐ Mastic	Miscellaneous: _____	
☐ Insulation	☐ DWJC	**Structural**		
☐ Tape		☐ Steel F. P. ing	No. of Phases: _____	
☐ Paper Wrap		☐ Deck F. P. ing	Colour: White with abundant blue flecks	



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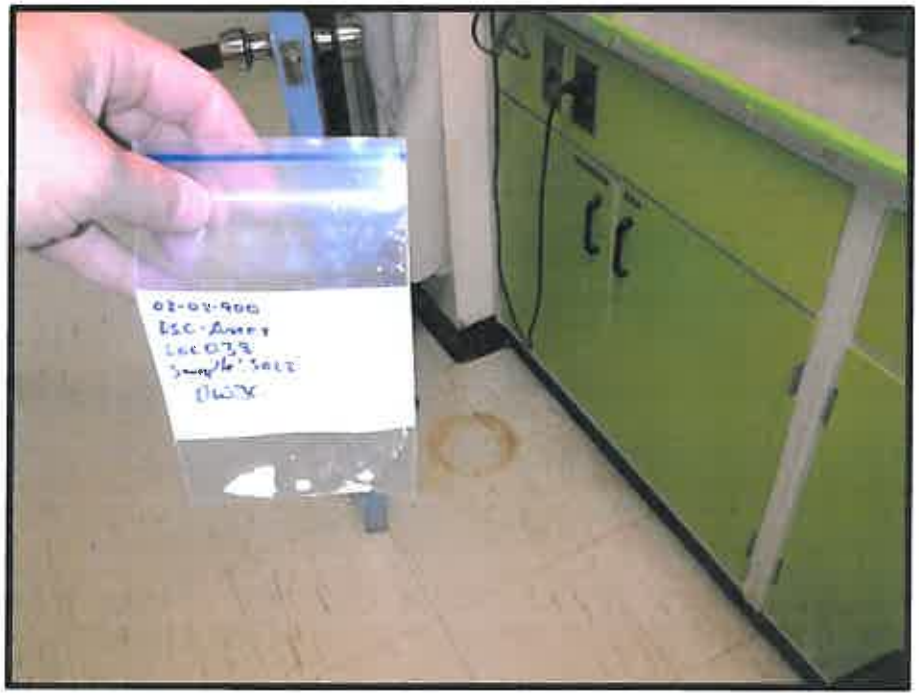
ASBESTOS BULK SAMPLING FORM

Sample #:	S022	**Date Sampled:**	November 29, 2012
Building :	OSC Main BLDG and Annex	**Sampler:**	Trent Hardy
Location:	037, room 4016	**Analysis:**	SAI - PLM
MUN Project #:	02-02-900	**Work Order #:**	

Bulk Sampling Parameters

Pipe/Tank	Flooring	Ceiling	Roofing	Location
☐ Insulation	☐ 12'x12' Tile	☐ Textured	☐ Shingle	☐ Floor
☐ Elbow	☐ 9'x9'Tile	☐ Stucco	☐ Rolled	X Wall Orientation
☐ Fitting	☐ Vinyl Sheet	☐ Popcorn	☐ Felt	☐ Ceiling
☐ Transite Pipe	☐ Mastic	☐ DWJC	☐ Tar	☐ Above Ceiling
☐ Gasket	**Wall**	☐ Plaster		☐ Other
☐ Tank Insulation	☐ Transite Panel	☐ Acoustic Tile (Dropped)		
☐ Pipe Wrap	☐ Textured Wall	☐ Acoustic Tile (Glued-on)		
HVAC	☐ Plaster	☐ Mastic	Miscellaneous: _____	
☐ Insulation	X DWJC	**Structural**		
☐ Tape		☐ Steel F. P. ing	No. of Phases: _____	
☐ Paper Wrap		☐ Deck F. P. ing	Colour: _____	



ASBESTOS BULK SAMPLING FORM

Sample #:	S023	**Date Sampled:**	November 29, 2012
Building :	OSC Main BLDG and Annex	**Sampler:**	Trent Hardy
Location:	065, room OS3016	**Analysis:**	SAI - PLM
MUN Project #:	02-02-900	**Work Order #:**	

Bulk Sampling Parameters

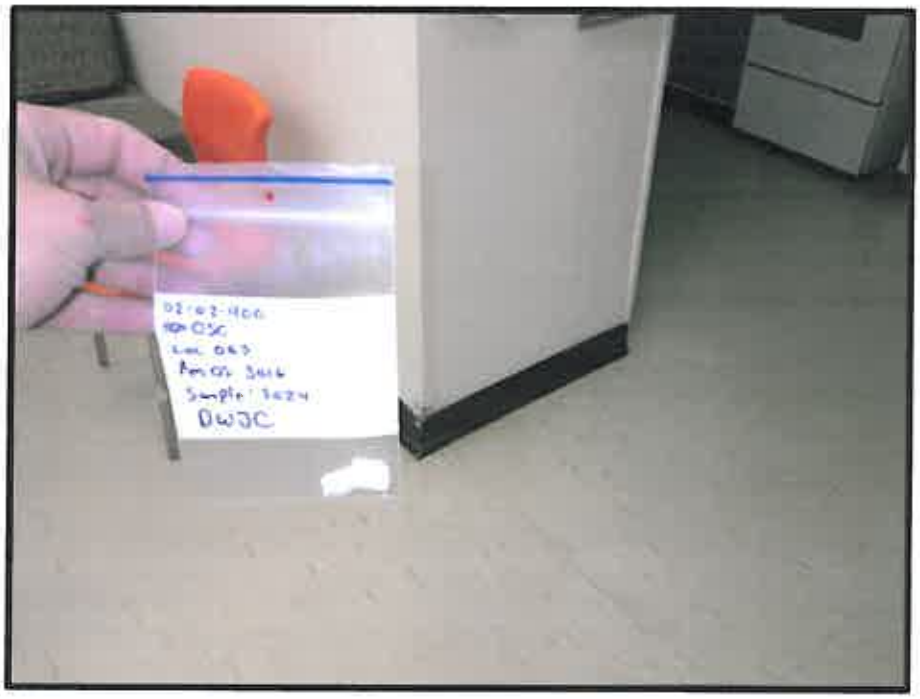
Pipe/Tank	Flooring	Ceiling	Roofing	Location
☐ Insulation	☐12'x12' Tile	☐ Textured	☐ Shingle	X Floor
☐ Elbow	X 9'x9'Tile	☐ Stucco	☐ Rolled	☐ Wall Orientation
☐ Fitting	☐ Vinyl Sheet	☐ Popcorn	☐ Felt	☐ Ceiling
☐ Transite Pipe	☐ Mastic	☐ DWJC	☐ Tar	☐ Above Ceiling
☐ Gasket	**Wall**	☐ Plaster		☐ Other
☐ Tank Insulation	☐ Transite Panel	☐ Acoustic Tile (Dropped)		
☐ Pipe Wrap	☐ Textured Wall	☐ Acoustic Tile (Glued-on)		
HVAC	☐ Plaster	☐ Mastic	Miscellaneous: _____	
☐ Insulation	☐ DWJC	**Structural**		
☐ Tape		☐ Steel F. P. ing	No. of Phases: _____	
☐ Paper Wrap		☐ Deck F. P. ing	Colour: Beige with thick brown streaks	

ASBESTOS BULK SAMPLING FORM

Sample #:	S024	**Date Sampled:**	November 29, 2012
Building :	OSC Main BLDG and Annex	**Sampler:**	Trent Hardy
Location:	065, room OS3016	**Analysis:**	SAI - PLM
MUN Project #:	02-02-900	**Work Order #:**	

Bulk Sampling Parameters

Pipe/Tank	Flooring	Ceiling	Roofing	Location
☐ Insulation	☐12'x12' Tile	☐ Textured	☐ Shingle	☐ Floor
☐ Elbow	☐ 9'x9'Tile	☐ Stucco	☐ Rolled	X Wall Orientation
☐ Fitting	☐ Vinyl Sheet	☐ Popcorn	☐ Felt	☐ Ceiling
☐ Transite Pipe	☐ Mastic	☐ DWJC	☐ Tar	☐ Above Ceiling
☐ Gasket	**Wall**	☐ Plaster		☐ Other
☐ Tank Insulation	☐ Transite Panel	☐ Acoustic Tile (Dropped)		
☐ Pipe Wrap	☐ Textured Wall	☐ Acoustic Tile (Glued-on)		
HVAC	☐ Plaster	☐ Mastic	Miscellaneous: _____	
☐ Insulation	X DWJC	**Structural**		
☐ Tape		☐ Steel F. P. ing	No. of Phases: _____	
☐ Paper Wrap		☐ Deck F. P. ing	Colour: _____	



MEMORIAL UNIVERSITY

ASBESTOS BULK SAMPLING FORM

Sample #:	S025	**Date Sampled:**	November 29, 2012
Building :	OSC Main BLDG and Annex	**Sampler:**	Trent Hardy
Location:	075, room OS2000	**Analysis:**	SAI - PLM
MUN Project #:	02-02-900	**Work Order #:**	

Bulk Sampling Parameters

Pipe/Tank	Flooring	Ceiling	Roofing	Location
☐ Insulation	X12'x12' Tile	☐ Textured	☐ Shingle	X Floor
☐ Elbow	☐ 9'x9'Tile	☐ Stucco	☐ Rolled	☐ Wall Orientation
☐ Fitting	☐ Vinyl Sheet	☐ Popcorn	☐ Felt	☐ Ceiling
☐ Transite Pipe	☐ Mastic	☐ DWJC	☐ Tar	☐ Above Ceiling
☐ Gasket	**Wall**	☐ Plaster		☐ Other
☐ Tank Insulation	☐ Transite Panel	☐ Acoustic Tile (Dropped)		
☐ Pipe Wrap	☐ Textured Wall	☐ Acoustic Tile (Glued-on)		
HVAC	☐ Plaster	☐ Mastic	Miscellaneous: _____	
☐ Insulation	☐ DWJC	**Structural**		
☐ Tape		☐ Steel F. P. ing	No. of Phases: _____	
☐ Paper Wrap		☐ Deck F. P. ing	Colour: Brown with thick dark brown streaks	

ASBESTOS BULK SAMPLING FORM

Sample #:	S026	**Date Sampled:**	November 29, 2012
Building :	OSC Main BLDG and Annex	**Sampler:**	Trent Hardy
Location:	081, room OS2002	**Analysis:**	SAI - PLM
MUN Project #:	02-02-900	**Work Order #:**	

Bulk Sampling Parameters

Pipe/Tank	Flooring	Ceiling	Roofing	Location
☐ Insulation	☐ 12'x12' Tile	☐ Textured	☐ Shingle	☐ Floor
☐ Elbow	☐ 9'x9'Tile	☐ Stucco	☐ Rolled	☐ Wall Orientation
☐ Fitting	☐ Vinyl Sheet	☐ Popcorn	☐ Felt	☐ Ceiling
☐ Transite Pipe	☐ Mastic	☐ DWJC	☐ Tar	☐ Above Ceiling
☐ Gasket	**Wall**	☐ Plaster		☐ Other
☐ Tank Insulation	☐ Transite Panel	☐ Acoustic Tile (Dropped)		
☐ Pipe Wrap	☐ Textured Wall	☐ Acoustic Tile (Glued-on)		
HVAC	☐ Plaster	☐ Mastic	Miscellaneous: _____	
☐ Insulation	☐ DWJC	**Structural**		
☐ Tape		☐ Steel F. P. ing	No. of Phases: _____	
☐ Paper Wrap		X Deck F. P. ing	Colour: _____	

ASBESTOS BULK SAMPLING FORM

Sample #:	S027	**Date Sampled:**	November 29, 2012
Building :	OSC Main BLDG and Annex	**Sampler:**	Trent Hardy
Location:	081, room OS2002	**Analysis:**	SAI - PLM
MUN Project #:	02-02-900	**Work Order #:**	

Bulk Sampling Parameters

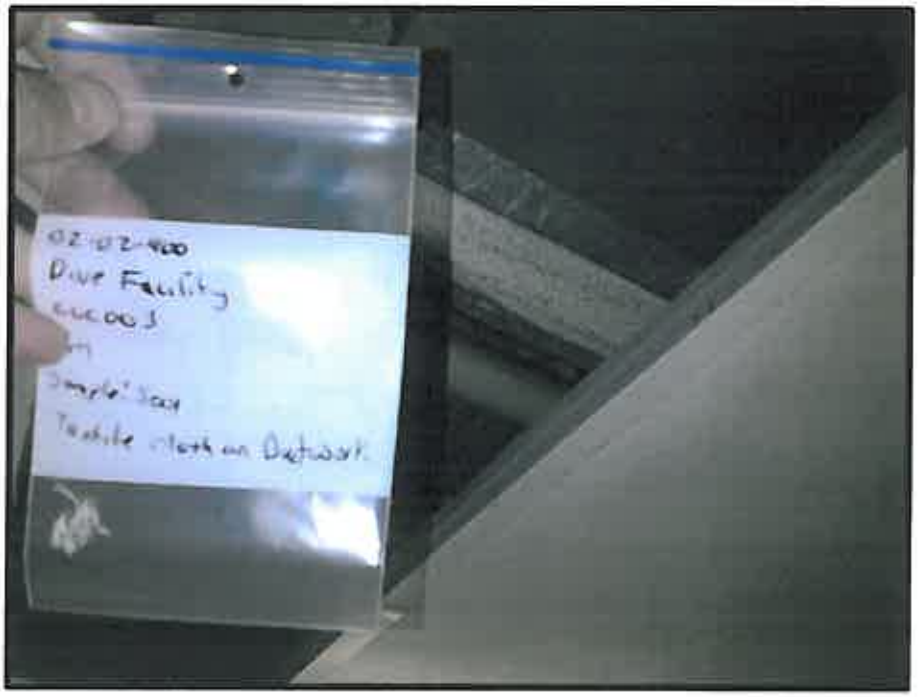
Pipe/Tank	Flooring	Ceiling	Roofing	Location
☐ Insulation	☐12'x12' Tile	☐ Textured	☐ Shingle	☐ Floor
☐ Elbow	☐ 9'x9'Tile	☐ Stucco	☐ Rolled	☐ Wall Orientation
☐ Fitting	☐ Vinyl Sheet	☐ Popcorn	☐ Felt	☐ Ceiling
☐ Transite Pipe	☐ Mastic	☐ DWJC	☐ Tar	☐ Above Ceiling
☐ Gasket	**Wall**	☐ Plaster		X Other (ducts)
☐ Tank Insulation	☐ Transite Panel	☐ Acoustic Tile (Dropped)		
☐ Pipe Wrap	☐ Textured Wall	☐ Acoustic Tile (Glued-on)		
HVAC	☐ Plaster	☐ Mastic	Miscellaneous: Textile cloth	
☐ Insulation	☐ DWJC	**Structural**		
☐ Tape		☐ Steel F. P. ing	No. of Phases: _____	
☐ Paper Wrap		☐ Deck F. P. ing	Colour: Green	

ASBESTOS BULK SAMPLING FORM

Sample #:	S001	**Date Sampled:**	November 30, 2012
Building :	OSC Main BLDG and Annex	**Sampler:**	Trent Hardy
Location:	001, room DV1000B	**Analysis:**	SAI - PLM
MUN Project #:	02-02-900	**Work Order #:**	

Bulk Sampling Parameters

Pipe/Tank	Flooring	Ceiling	Roofing	Location
☐ Insulation	☐12'x12' Tile	☐ Textured	☐ Shingle	☐ Floor
☐ Elbow	☐ 9'x9'Tile	☐ Stucco	☐ Rolled	☐ Wall Orientation
☐ Fitting	☐ Vinyl Sheet	☐ Popcorn	☐ Felt	☐ Ceiling
☐ Transite Pipe	☐ Mastic	☐ DWJC	☐ Tar	X Above Ceiling
☐ Gasket	**Wall**	☐ Plaster		☐ Other
☐ Tank Insulation	☐ Transite Panel	☐ Acoustic Tile (Dropped)		
☐ Pipe Wrap	☐ Textured Wall	☐ Acoustic Tile (Glued-on)		
HVAC	☐ Plaster	☐ Mastic	Miscellaneous: Textile cloth	
☐ Insulation	☐ DWJC	**Structural**		
☐ Tape		☐ Steel F. P. ing	No. of Phases: _____	
☐ Paper Wrap		☐ Deck F. P. ing	Colour: _____	



ASBESTOS BULK SAMPLING FORM

Sample #:	S003	**Date Sampled:**	November 30, 2012
Building :	OSC Main BLDG and Annex	**Sampler:**	Trent Hardy
Location:	006, room DV2003	**Analysis:**	SAI - PLM
MUN Project #:	02-02-900	**Work Order #:**	

Bulk Sampling Parameters

Pipe/Tank	Flooring	Ceiling	Roofing	Location
☐ Insulation	☐12'x12' Tile	☐ Textured	☐ Shingle	☐ Floor
☐ Elbow	☐ 9'x9'Tile	☐ Stucco	☐ Rolled	X Wall Orientation
☐ Fitting	☐ Vinyl Sheet	☐ Popcorn	☐ Felt	☐ Ceiling
☐ Transite Pipe	☐ Mastic	☐ DWJC	☐ Tar	☐ Above Ceiling
☐ Gasket	**Wall**	☐ Plaster		☐ Other
☐ Tank Insulation	☐ Transite Panel	☐ Acoustic Tile (Dropped)		
☐ Pipe Wrap	☐ Textured Wall	☐ Acoustic Tile (Glued-on)		
HVAC	☐ Plaster	☐ Mastic	Miscellaneous: _____	
☐ Insulation	X DWJC	**Structural**		
☐ Tape		☐ Steel F. P. ing	No. of Phases: _____	
☐ Paper Wrap		☐ Deck F. P. ing	Colour: _____	

ASBESTOS BULK SAMPLING FORM

Sample #:	S004	**Date Sampled:**	November 30, 2012
Building :	OSC Main BLDG and Annex	**Sampler:**	Trent Hardy
Location:	008, room DV2001	**Analysis:**	SAI - PLM
MUN Project #:	02-02-900	**Work Order #:**	

Bulk Sampling Parameters

Pipe/Tank	Flooring	Ceiling	Roofing	Location
☐ Insulation	☐12'x12' Tile	☐ Textured	☐ Shingle	X Floor
☐ Elbow	☐ 9'x9'Tile	☐ Stucco	☐ Rolled	☐ Wall Orientation
☐ Fitting	X Vinyl Sheet	☐ Popcorn	☐ Felt	☐ Ceiling
☐ Transite Pipe	☐ Mastic	☐ DWJC	☐ Tar	☐ Above Ceiling
☐ Gasket	**Wall**	☐ Plaster		☐ Other
☐ Tank Insulation	☐ Transite Panel	☐ Acoustic Tile (Dropped)		
☐ Pipe Wrap	☐ Textured Wall	☐ Acoustic Tile (Glued-on)		
HVAC	☐ Plaster	☐ Mastic	Miscellaneous: _____	
☐ Insulation	☐ DWJC	**Structural**		
☐ Tape		☐ Steel F. P. ing	No. of Phases: _____	
☐ Paper Wrap		☐ Deck F. P. ing	Colour: Grey and white specks	

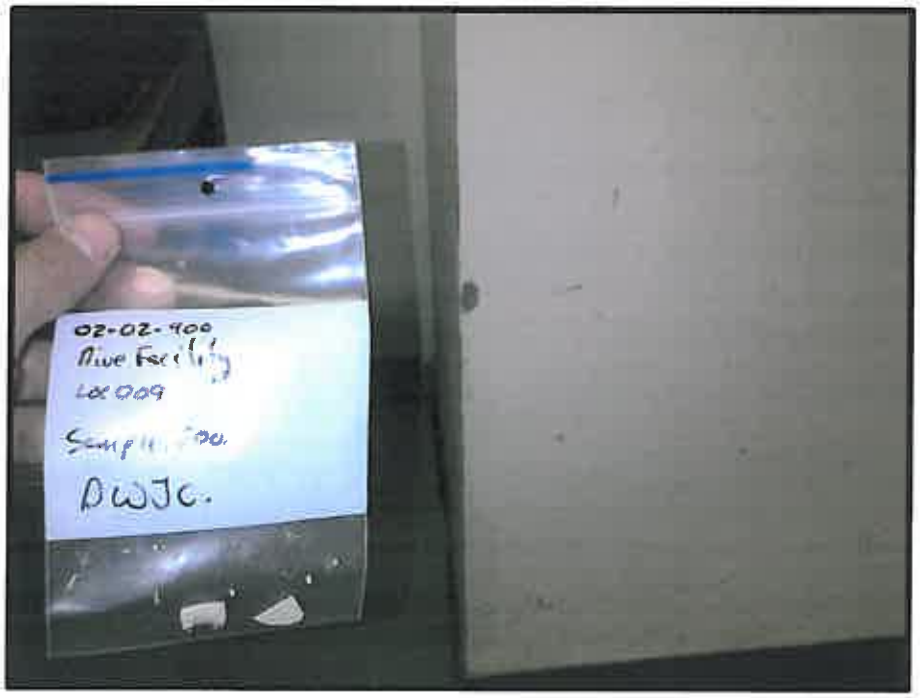
MEMORIAL UNIVERSITY

ASBESTOS BULK SAMPLING FORM

Sample #:	S005	**Date Sampled:**	November 30, 2012
Building :	OSC Main BLDG and Annex	**Sampler:**	Trent Hardy
Location:	009, room DV2000	**Analysis:**	SAI - PLM
MUN Project #:	02-02-900	**Work Order #:**	

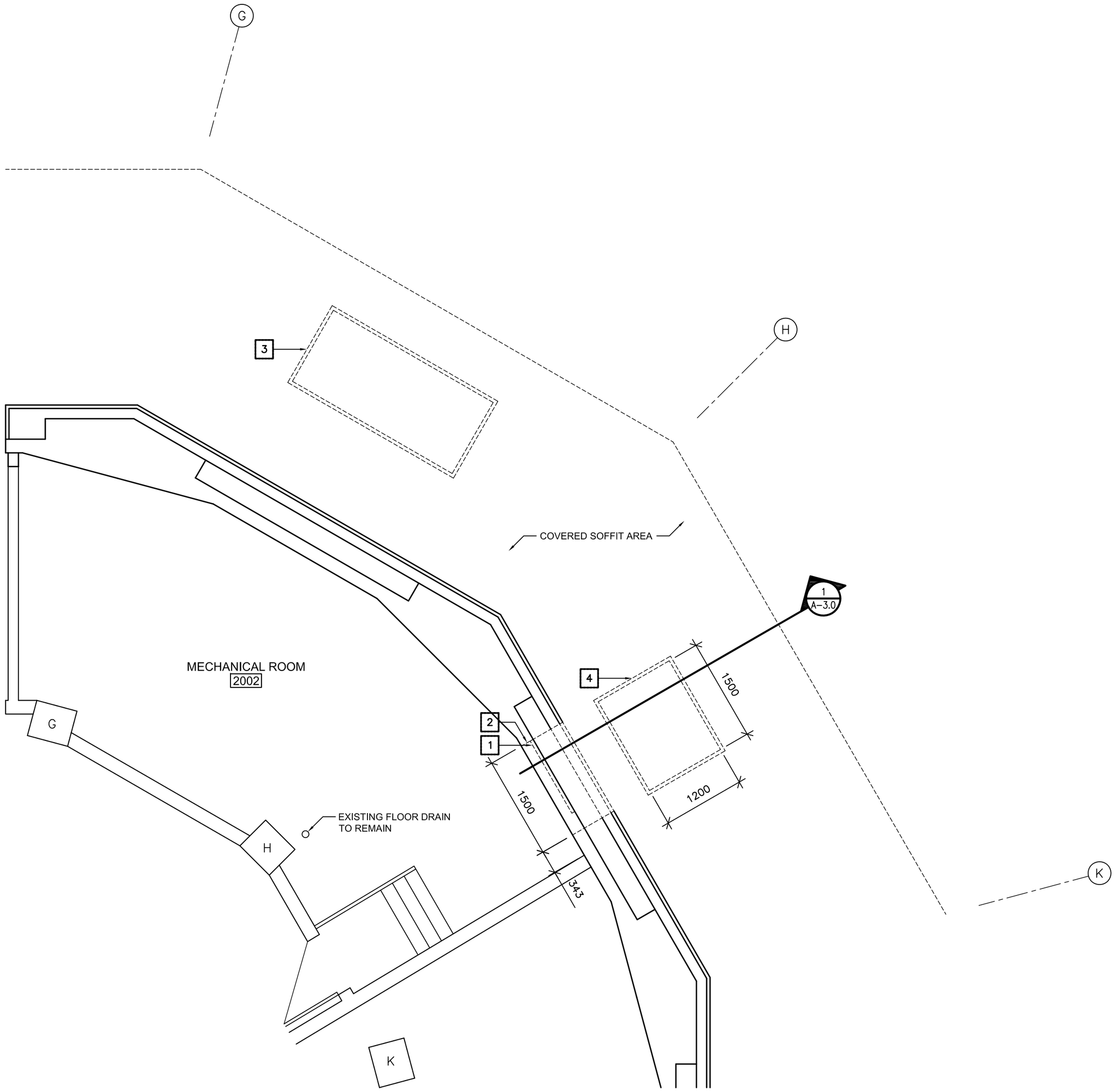
Bulk Sampling Parameters

Pipe/Tank	Flooring	Ceiling	Roofing	Location
☐ Insulation	☐12'x12' Tile	☐ Textured	☐ Shingle	☐ Floor
☐ Elbow	☐ 9'x9'Tile	☐ Stucco	☐ Rolled	X Wall Orientation
☐ Fitting	☐ Vinyl Sheet	☐ Popcorn	☐ Felt	☐ Ceiling
☐ Transite Pipe	☐ Mastic	☐ DWJC	☐ Tar	☐ Above Ceiling
☐ Gasket	**Wall**	☐ Plaster		☐ Other
☐ Tank Insulation	☐ Transite Panel	☐ Acoustic Tile (Dropped)		
☐ Pipe Wrap	☐ Textured Wall	☐ Acoustic Tile (Glued-on)		
HVAC	☐ Plaster	☐ Mastic	Miscellaneous: _____	
☐ Insulation	X DWJC	**Structural**		
☐ Tape		☐ Steel F. P. ing	No. of Phases: _____	
☐ Paper Wrap		☐ Deck F. P. ing	Colour: _____	



ARCHITECTURAL DEMOLITION NOTES: #

1. REMOVE EXISTING SEMI RIGID INSULATION FROM EXISTING MECHANICAL OPENING AND DISPOSE.
2. CUT EXISTING CONCRETE WALL AS REQUIRED TO FACILITATE THE INSTALLATION OF A NEW PLENUM AND NEW 1500mm(W) BY 1200mm(H) MECHANICAL OPENING.
3. REMOVE EXISTING AIR IN-TAKE LOUVER AND DISPOSE. REMOVE EXISTING TRANSITE PANELS AS NEEDED TO REMOVE LOUVER. TRANSITE PANELS ARE ASBESTOS CONTAINING. PANELS TO BE ABATED IN ACCORDANCE WITH MUN SAFETY PROCEDURES, REFER TO SPECIFICATION.
4. REMOVE EXISTING EXHAUST LOUVER AND DISPOSE. REMOVE EXISTING TRANSITE PANELS AS NEEDED TO REMOVE LOUVER. TRANSITE PANELS ARE ASBESTOS CONTAINING. PANELS TO BE ABATED IN ACCORDANCE WITH MUN SAFETY PROCEDURES, REFER TO SPECIFICATION.



DEMOLITION PLAN OSC-2002

SCALE: 1:50

1
A-1.0

No.	REVISION	DATE
R0	ISSUED FOR TENDER	APRIL, 2026

GENERAL NOTES

1. DRAWINGS TO BE READ AS A SET.
2. DO NOT SCALE FROM DRAWINGS.
3. THE CONTRACTOR IS TO VERIFY ALL DIMENSIONS AND SITE CONDITIONS. PRIOR TO SUBMISSION OF TENDERS.
4. ALL DISCREPANCIES FOUND IN THESE DRAWINGS TO BE BROUGHT TO THE ATTENTION OF STRATEGIC PROCUREMENT MANAGEMENT PRIOR TO SUBMISSION OF TENDERS.

STAMP:

MEMORIAL UNIVERSITY
FACILITIES MANAGEMENT

This University was raised by the people of Newfoundland as a memorial to the fallen in the great wars, 1914-1918, 1939-1945, that in freedom of learning, their cause and sacrifice might not be forgotten.

- Dedication plaque, Arts & Administration Building, St. John's Campus

PROJECT TITLE:

OCEAN SCIENCE CENTER: AIR HANDLING UNIT 2 REPLACEMENT

DRAWING TITLE:

DEMOLITION PLANS

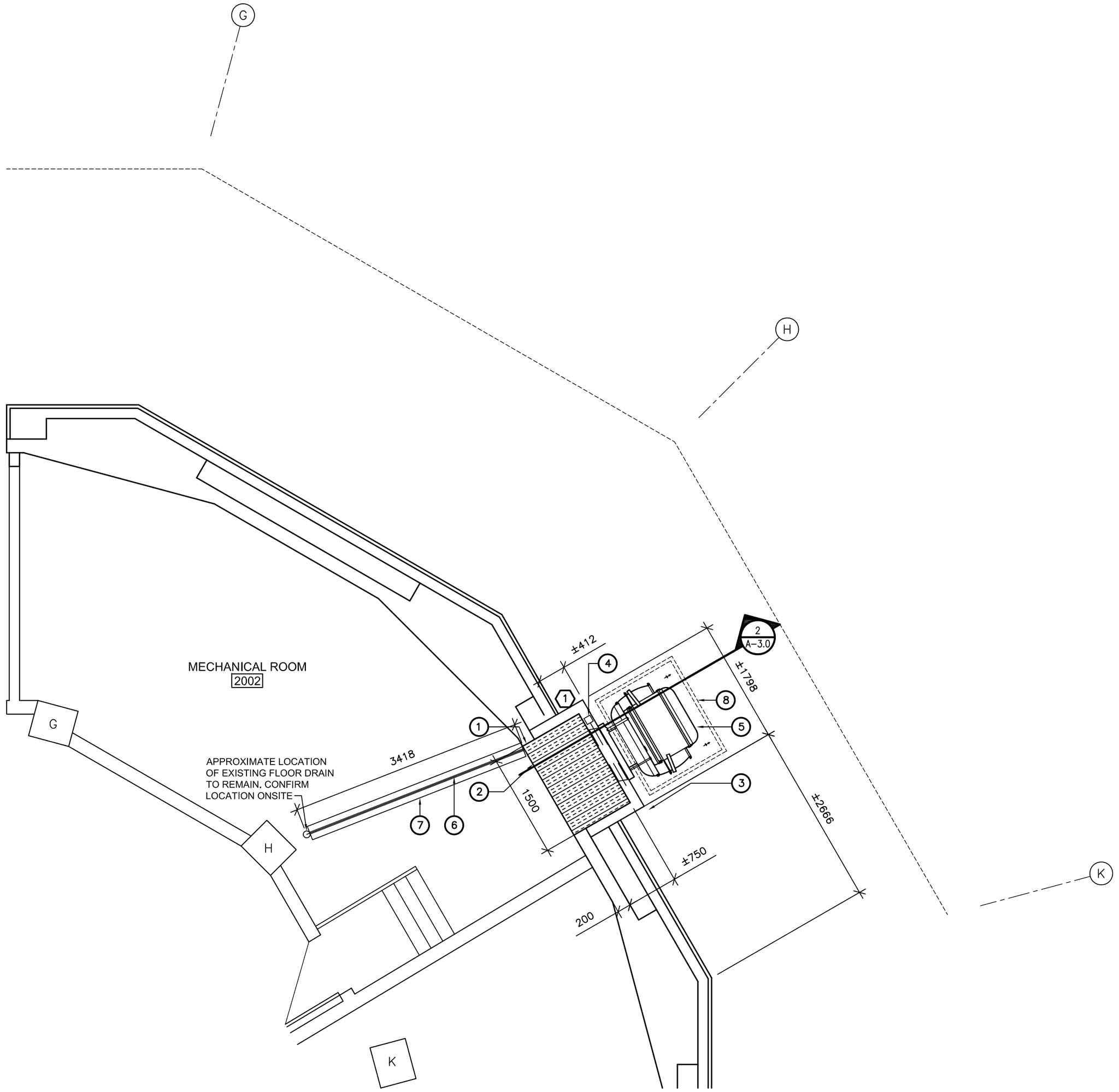
REVIEWED:	DRAWN:
J.A.	D.C.
SCALE: 1:50	DATE: APRIL, 2026
MUN PROJECT No. **OSC-506-23**	DRAWING No. **A-1.0**

ARCHITECTURAL NEW NOTES: (#)

1. NEW 1500mm(W) BY 1200mm(H) MECHANICAL OPENING IN CONCRETE WALL. WRAP TOP OF CONCRETE WALL AND DOWN EXTERIOR WALL WITH MEMBRANE. REPLACE ANY DISTURBED INSULATION ON EXTERIOR OF CONCRETE WALL. COORDINATE LOCATION OF OPEN WITH MECHANICAL CONTRACTOR ONSITE.
2. NEW AIR TIGHT MECHANICAL PLENUM ENCLOSURE WITH SLOPED BASE. CONSTRUCTED WITH NON COMBUSTIBLE MATERIALS WITH A FLAME AND SMOKE SPREAD RATING OF 25/50. MATERIALS TO BE SUITABLE FOR A MARINE ENVIRONMENT. COORDINATE ONSITE WITH MECHANICAL CONTRACTOR.
3. NEW EXTERIOR WALL CONSTRUCTION TO MATCH EXISTING EXTERIOR WALL CONSTRUCTION.
4. NEW EXHAUST DAMPER FAN. SEE MECHANICAL DRAWINGS.
5. NEW EXHAUST FAN. SEE MECHANICAL DRAWINGS.
6. 25mm Ø PIPE TO DRAIN FROM BOTTOM EDGE OF PLENUM TO FLOOR DRAIN.
7. CABLE/PIPE PROTECTOR RAMP TO ENCLOSE AND PROTECT DRAINAGE PIPE ALONG FLOOR.
8. NEW SOFFIT CONSTRUCTION TO INFILL VOID LEFT FROM EXISTING EXHAUST LOUVER. REPLACE WITH 13mm EXTERIOR GRADE GYPSUM BOARD. EXISTING TRANSITE PANELS IN SOFFIT AREA ARE ASBESTOS CONTAINING.

WALL TYPES: (#)

WALL TYPE 1:
- 2" X 5" WOOD BATTENS AT 10" O.C.
- 10" VERTICAL WOOD SIDING 10" WIDE
- 2" X 4" NAILING STRIP AT 16" O.C.
- 2" FIBERGLASS INSULATION
- ¼" PLAYWOOD
- WALL STRUCTURE SUPPORT (FAN WEIGHT 222LBS)



NEW PLAN OSC-2002

SCALE: 1:50

1
A-2.0

No.	REVISION	DATE
R0	ISSUED FOR TENDER	APRIL, 2026

GENERAL NOTES

1. DRAWINGS TO BE READ AS A SET.
2. DO NOT SCALE FROM DRAWINGS.
3. THE CONTRACTOR IS TO VERIFY ALL DIMENSIONS AND SITE CONDITIONS. PRIOR TO SUBMISSION OF TENDERS.
4. ALL DISCREPANCIES FOUND IN THESE DRAWINGS TO BE BROUGHT TO THE ATTENTION OF STRATEGIC PROCUREMENT MANAGEMENT PRIOR TO SUBMISSION OF TENDERS.

STAMP:

MEMORIAL UNIVERSITY

FACILITIES MANAGEMENT

This University was raised by the people of Newfoundland as a memorial to the fallen in the great wars, 1914-1918, 1939-1945, that in freedom of learning, their cause and sacrifice might not be forgotten.

- Dedication plaque, Arts & Administration Building, St. John's Campus

PROJECT TITLE:

OCEAN SCIENCE CENTER: AIR HANDLING UNIT 2 REPLACEMENT

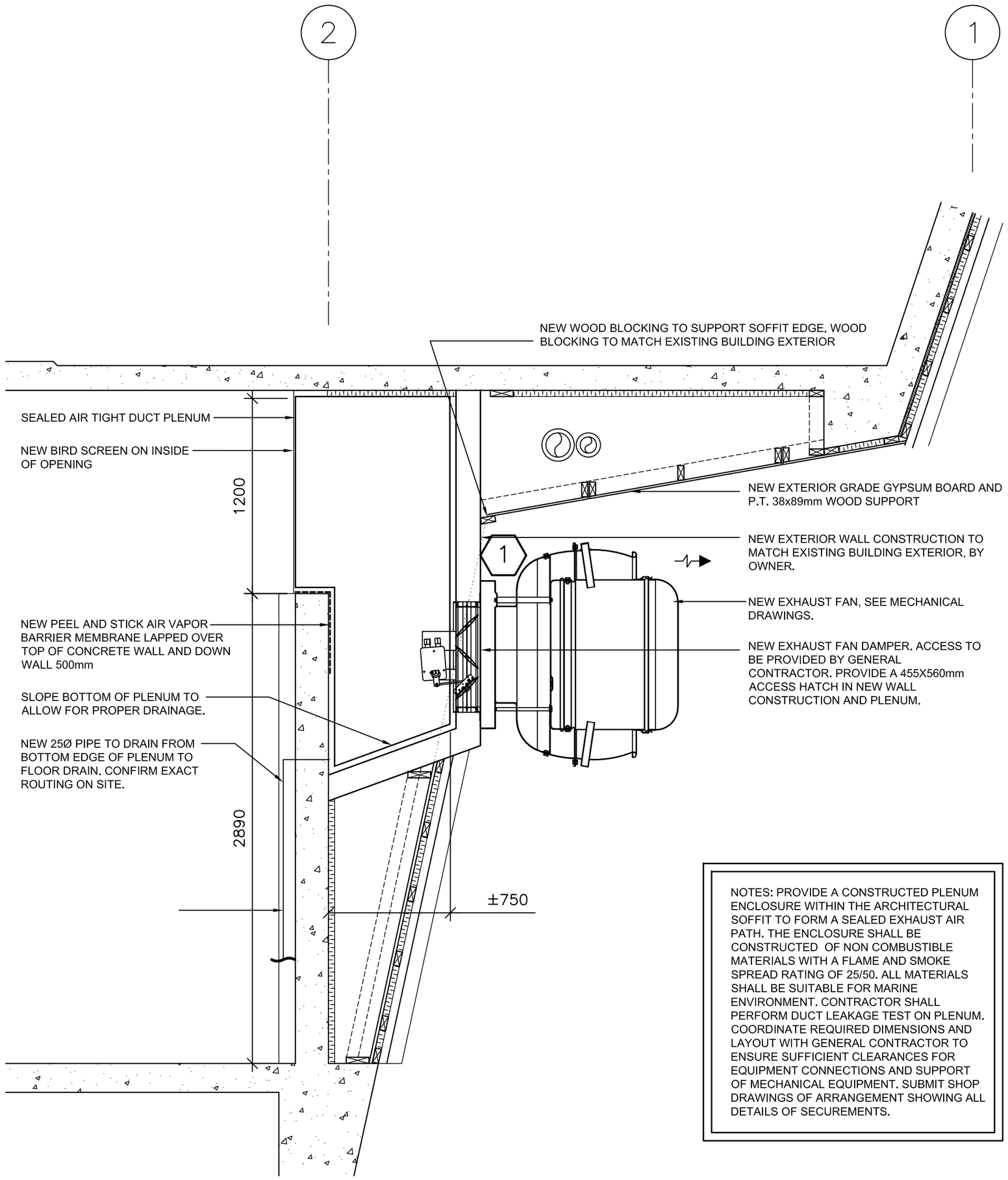
DRAWING TITLE:

NEW PLANS

REVIEWED:	DRAWN:
J.A.	D.C.
SCALE: 1:50	DATE: APRIL, 2026
MUN PROJECT No. **OSC-506-23**	DRAWING No. **A-2.0**

WALL TYPES: (#)

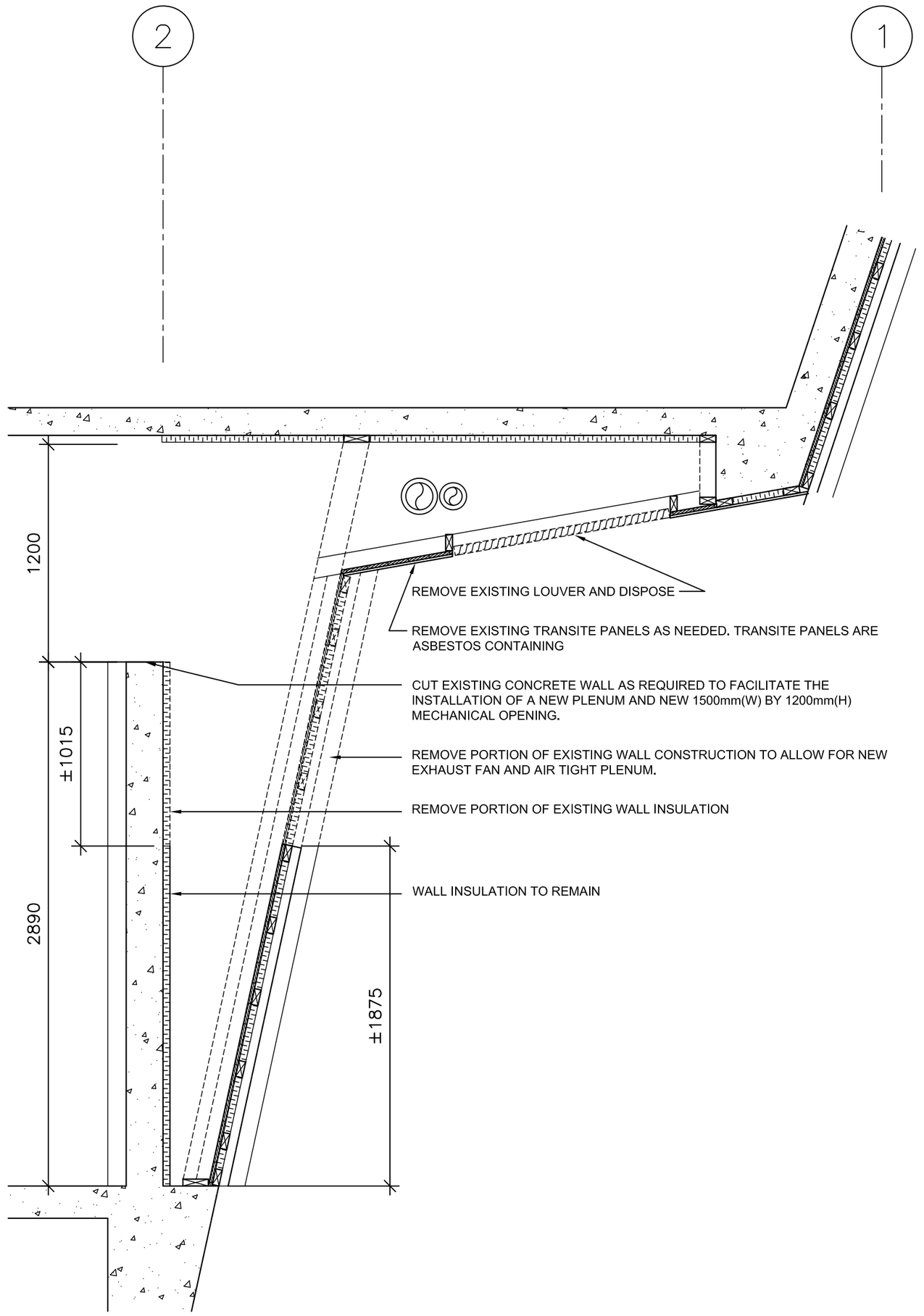
WALL TYPE 1:
- 2" X 5" WOOD BATTENS AT 10" O.C.
- 10" VERTICAL WOOD SIDING 10" WIDE
- 2" X 4" NAILING STRIP AT 16" O.C.
- 2" FIBERGLASS INSULATION
- ¼" PLAYWOOD
- WALL STRUCTURE SUPPORT (FAN WEIGHT 222LBS)



NOTES: PROVIDE A CONSTRUCTED PLENUM ENCLOSURE WITHIN THE ARCHITECTURAL SOFFIT TO FORM A SEALED EXHAUST AIR PATH. THE ENCLOSURE SHALL BE CONSTRUCTED OF NON COMBUSTIBLE MATERIALS WITH A FLAME AND SMOKE SPREAD RATING OF 25/50. ALL MATERIALS SHALL BE SUITABLE FOR MARINE ENVIRONMENT. CONTRACTOR SHALL PERFORM DUCT LEAKAGE TEST ON PLENUM. COORDINATE REQUIRED DIMENSIONS AND LAYOUT WITH GENERAL CONTRACTOR TO ENSURE SUFFICIENT CLEARANCES FOR EQUIPMENT CONNECTIONS AND SUPPORT OF MECHANICAL EQUIPMENT. SUBMIT SHOP DRAWINGS OF ARRANGEMENT SHOWING ALL DETAILS OF SECUREMENTS.

NEW WALL SECTION OSC–2002
SCALE: 1:25

2
A–3.0



DEMO WALL SECTION OSC–2002
SCALE: 1:25

1
A–3.0

No.	REVISION	DATE
R0	ISSUED FOR TENDER	APRIL, 2026

GENERAL NOTES

1. DRAWINGS TO BE READ AS A SET.
2. DO NOT SCALE FROM DRAWINGS.
3. THE CONTRACTOR IS TO VERIFY ALL DIMENSIONS AND SITE CONDITIONS. PRIOR TO SUBMISSION OF TENDERS.
4. ALL DISCREPANCIES FOUND IN THESE DRAWINGS TO BE BROUGHT TO THE ATTENTION OF STRATEGIC PROCUREMENT MANAGEMENT PRIOR TO SUBMISSION OF TENDERS.

STAMP:

MEMORIAL UNIVERSITY
FACILITIES MANAGEMENT

This University was raised by the people of Newfoundland as a memorial to the fallen in the great wars, 1914-1918, 1939-1945, that in freedom of learning, their cause and sacrifice might not be forgotten.

- Dedication plaque, Arts & Administration Building, St. John's Campus

PROJECT TITLE:

OCEAN SCIENCE CENTER: AIR HANDLING UNIT 2 REPLACEMENT

DRAWING TITLE:

WALL SECTIONS

REVIEWED:	DRAWN:
J.A.	D.C.
SCALE: AS SHOWN	DATE: APRIL, 2026
MUN PROJECT No. **OSC-506-23**	DRAWING No. **A-3.0**

Memorial University of Newfoundland

AIR HANDLER REPLACEMENT (OS-AHU-03)

OCEAN SCIENCES CENTRE

APRIL 02, 2026

ISSUED FOR TENDER

LIST OF MECHANICAL DRAWINGS

0S-506-23 ISSUED FOR TENDER

DEPARTMENT OF
FACILITIES MANAGEMENT

This University was raised by the people of Newfoundland as a memorial to the fallen in the great wars, 1914-1918, 1939-1945, that in freedom of learning, their cause and sacrifice might not be forgotten.

- Dedication plaque, Arts & Administration Building, St. John's Campus

MEMORIAL
UNIVERSITY

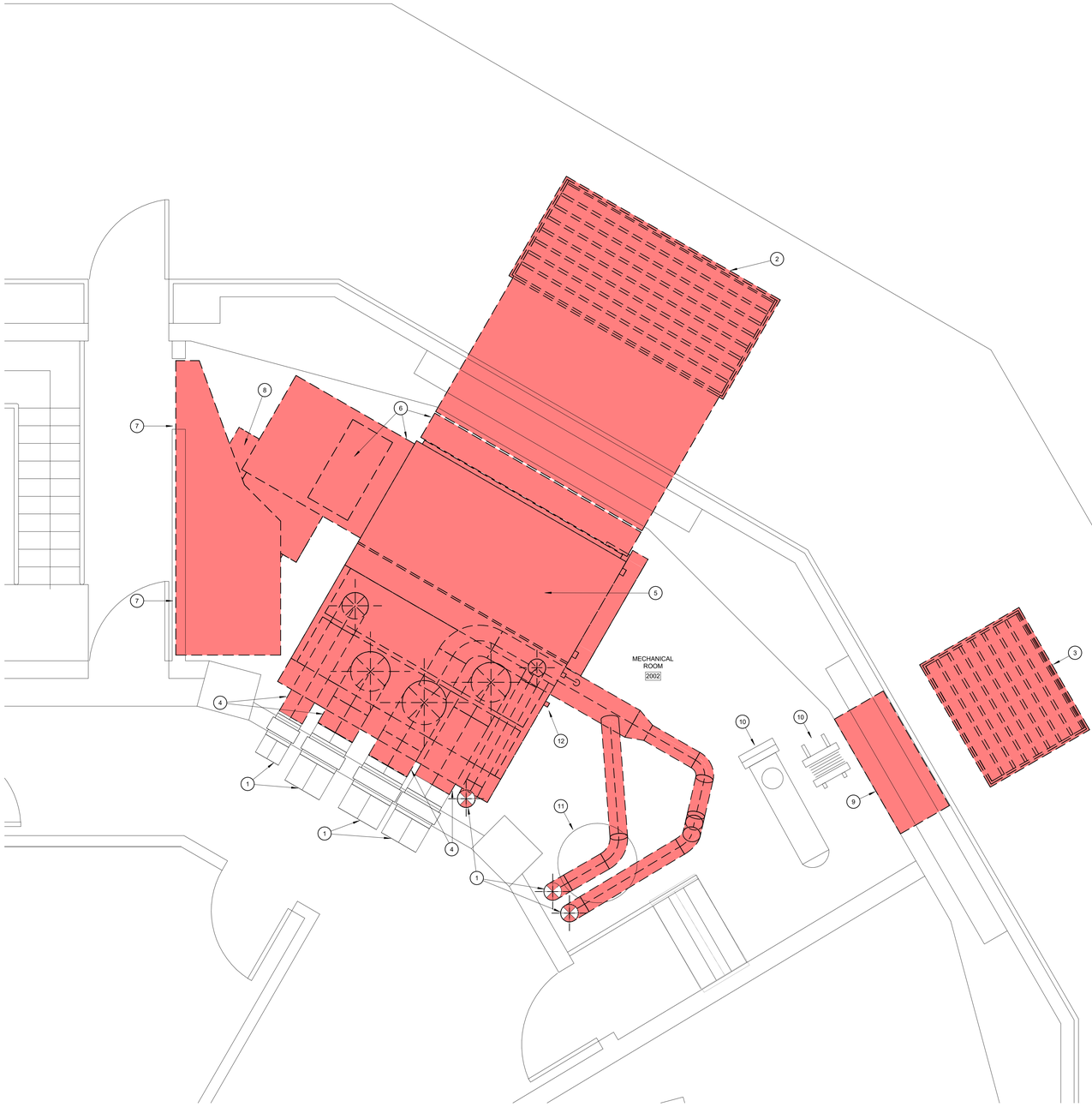
LEAD PRESENCE

ALL PAINTED SURFACES ARE TO BE CONSIDERED AS LEAD CONTANING. ALL PAINT HAS BEEN DETERMINED TO BE LEAD-CONTAINING AS THEY ARE ABOVE 0.009% LEAD CONCETRATION (90PPM).
REFER TO SPECIFICATION FOR SUMMARIES AND AVAILABLE REPORTS.

ASBESTOS PRESENCE

-PARGING CEMENT ON PIPE ELBOWS AND FITTINGS
-MECHANICAL INSULATION ON TANKS AND BOILERS
-DRYWALL JOINT FILL COMPOUND
-TEXTILE CLOTH EXPANSION JOINTS ON DUCTING

REFER TO SPECIFICATION FOR SUMMARIES AND AVAILABLE REPORTS.



PARTIAL GROUND FLOOR PLAN - VENTILATION DEMOLITION LAYOUT

SCALE : 1 : 25

0mm 500mm 1000mm 2000mm 1500mm 2500mm

GENERAL NOTES

1. PRIOR TO DEMOLITION AND SHOP DRAWING SUBMISSION THE CONTRACTOR IS TO THOROUGHLY REVIEW AND DOCUMENT THE EXISTING INSTALLATION AS THE SPACE IS EXTREMELY LIMITED AND THE NEW INSTALLATION IS TO FOLLOW A SIMILAR ARRANGEMENT. CONTRACTOR TO CONFIRM IN WRITING THAT THE NEW EQUIPMENT WILL FIT WITHIN THE FOOT PRINT AND VOLUME OF THE AVAILABLE SPACE. THE CONTRACTOR IS NOT TO PROCEED UNTIL THIS EXERCISE IS COMPLETED AND SUBMITTED TO THE OWNER AND ENGINEER FOR RECORD.
2. CONTRACTOR TO CONFIRM EXACT EQUIPMENT AND DUCTWORK LAYOUS ON SITE PRIOR TO COMMENCING ANY DEMOLITION. CONTRACTOR SHALL BE RESPONSIBLE FOR IDENTIFYING ALL EXISTING SYSTEMS WHICH MAY BE AFFECTED BY THE WORK, AND REMOVE/MODIFY IN AN APPROVED MANNER TO ALLOW FOR A COMPLETE WORKING SYSTEM.
3. DUCTWORK BEING REMOVED TO INCLUDE ALL ASSOCIATED HANGERS, SUPPORTS, COILS, INSULATION, FITTINGS, GRILLES, EQUIPMENT, DAMPERS, ETC.
4. CONTRACTOR SHALL PROTECT EXISTING SYSTEMS FROM ANY DUST/DEBRIS. SEAL AND CAP ANY OPENINGS.
5. NOT ALL DUCT/VENTILATION SYSTEMS SHOWN FOR REMOVAL AND CONTRACTOR SHALL BE RESPONSIBLE TO REMOVE ALL DUCT/EQUIPMENT WHICH SERVES THE NOTED AREAS OF WORK AND WHICH WILL BE OBSOLETE IN THE NEW REDEVELOPMENT.
6. WALLS, CEILINGS AND MECHANICAL INSULATION KNOWN TO CONTAIN ASBESTOS AND/OR LEAD BASED PAINT. ALL ABATEMENT SHALL BE COMPLETED BY CONTRACTOR PRIOR TO STARTING WORK. REFER TO ASBESTOS SURVEY REPORT.
7. DOORWAYS TO GAIN ACCESS TO LEVEL 1 MECHANICAL ROOM ARE APPROXIMATELY 863MM WIDE, CONFIRM ON SITE. CONTRACTOR TO MAKE PROVISIONS TO ENSURE ALL NEW MATERIALS CAN BE TRANSPORTED INTO SPACE THROUGH THE EXISTING DOOR SPACE.

DRAWING NOTES

1. EXISTING SUPPLY DUCTWORK TO REMAIN. PROTECT FROM DUST , DIRT AND DEBRIS FOR THE DURATION OF THE PROJECT. SEE NEW LAYOUT FOR NEW DUCTWORK.
2. EXISTING OUTDOOR AIR LOUVER AND OA DUCTWORK TO BE REMOVED.
3. EXISTING EXHAUST AIR LOUVER AND EA DUCTWORK TO BE REMOVED.
4. EXISTING SUPPLY DUCTWORK TO BE REMOVED.
5. EXISTING AIR HANDLING UNIT TO BE REMOVED. CONTRACTOR TO BREAK DOWN INTO PIECES TO PERMIT REMOVAL WITHOUT IMPACTING OTHER SYSTEMS OR STRUCTURE OF THE BUILDING. REMOVE ASSOCIATED DISCONNECT & VFD. CONTRACTOR TO MARK OUTLINE OF EXISTING AHU ON FLOOR PRIOR TO DEMOLITION. ALLOW OWNER FIRST RIGHT OF REFUSAL ON EXISTING VFD'S.
6. EXISTING MOTORIZED DAMPERS AND PNEUMATIC ACTUATORS WITH TUBING TO BE REMOVED. COORDINATE WITH CONTROLS WORK.
7. EXISTING RETURN AIR PLENUM AND DUCTWORK TO BE REMOVED. EXISTING RETURN AIR GRILLES COMPLETE WITH FIRE DAMPER TO REMAIN. VERIFY OPERATION OF DAMPERS AND REPLACE LINKAGES
8. EXISTING RETURN AIR FAN "OS-RF-01" TO BE REMOVED. REMOVE ASSOCIATED DISCONNECT & VFD. ALLOW OWNER FIRST RIGHT OF REFUSAL ON EXISTING VFD'S.
9. EXISTING EXHAUST AIR PENETRATION THROUGH WALL TO REMAIN.
10. EXISTING HEAT EXCHANGERS TO REMAIN.
11. EXISTING HOT WATER TANK TO REMAIN.
12. EXISTING STEAM COIL. ALLOW OWNER FIRST RIGHT OF REFUSAL.

A - DETAIL
B - LOCATION/DRAWING No.
C - DRAWING No.

No.	REVISION	DATE (Y/M/D)
R0	ISSUED FOR TENDER	2026/04/02

GENERAL NOTES

1. DRAWINGS TO BE READ AS A SET.
2. DO NOT SCALE FROM DRAWINGS.
3. THE CONTRACTOR IS TO VERIFY ALL DIMENSIONS AND SITE CONDITIONS PRIOR TO SUBMISSION OF TENDERS
4. ALL DEFICIENCIES FOUND IN THIS DRAWING IS TO BE BROUGHT TO THE ATTENTION OF THE FACILITIES ENGINEERING AND DEVELOPMENT OFFICE OF THE DEPARTMENT OF FACILITIES MANAGEMENT, MEMORIAL UNIVERSITY OF NEWFOUNDLAND, PRIOR TO THE THE SUBMISSION OF THE TENDERS

REGISTERED PROFESSIONAL ENGINEER
PEGNL Newfoundland and Labrador
DAVE ENNIS
SIGNATURE
2026 Apr 02
DATE
PROVINCE OF NEWFOUNDLAND

PROVINCE OF NEWFOUNDLAND
pegnl
PERMIT HOLDER
This Permit Allows
CORE ENGINEERING INC.
MIRC: 03823
To practice Professional Engineering in Newfoundland and Labrador.
Permit No. as issued by PEGNL D0209
which is valid for the year 2026.

PRIME, MECHANICAL & ELECTRICAL CONSULTANT:

CORE ENGINEERING INC.
A MEMBER OF BPA

PERMIT:

MEMORIAL UNIVERSITY
Department of Facilities Management
This University was raised by the people of Newfoundland as a memorial to the fallen in the great wars, 1914-1918, 1939-1945, that in freedom of learning, their cause and sacrifice might not be forgotten.
- Dedication plaque, Arts & Administration Building, St. John's Campus

PROJECT NAME:

OCEAN SCIENCES CENTRE MAIN BUILDING
(FACULTY OF ENGINEERING
& APPLIED SCIENCE)
AIR HANDLER REPLACEMENT (OS-AHU-04)
Project #: OS-506-23

DRAWING TITLE:

PARTIAL GROUND FLOOR PLAN -
VENTILATION DEMOLITION LAYOUT

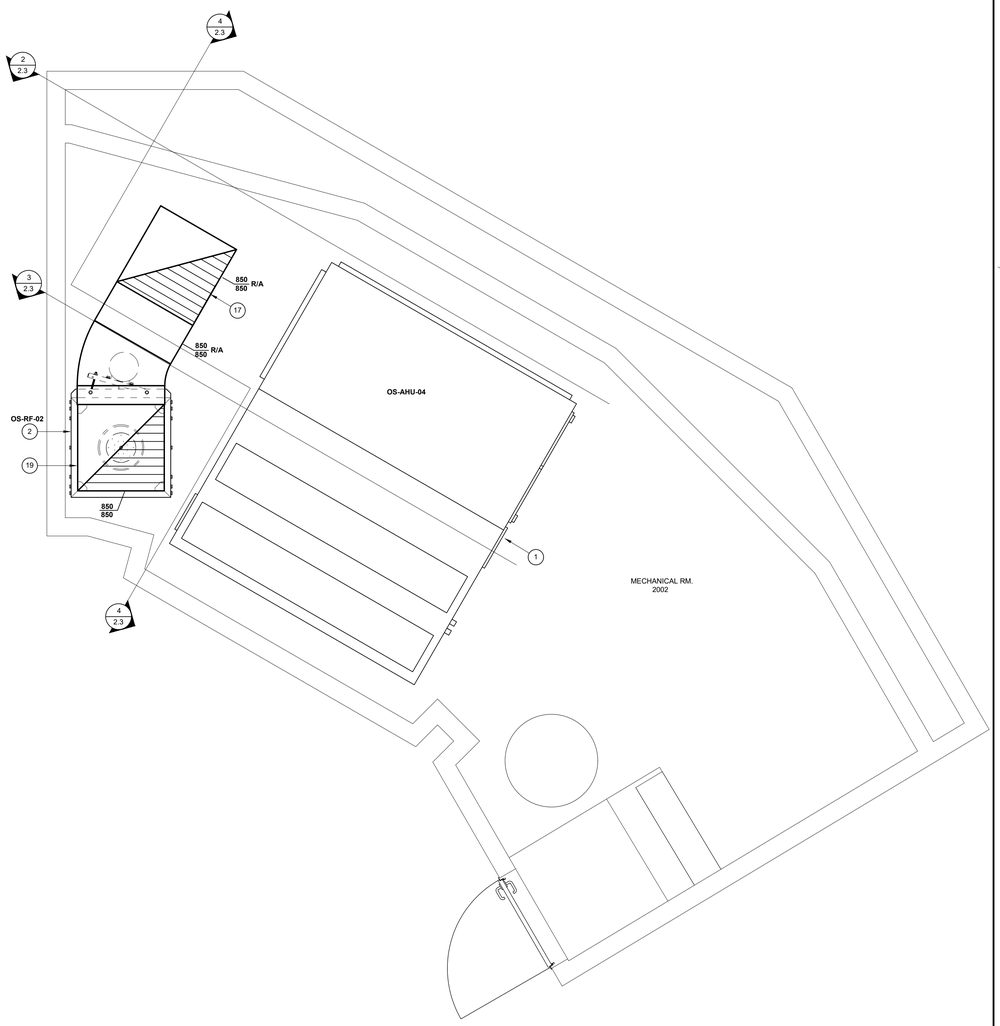
DESIGNED:	DRAWN:
D.E.	J.S.
REVIEWED:	APPROVED:
D.E.	D.E.
SCALE:	DATE:
AS NOTED	APRIL, 2026
PROJECT No.	DRAWING No.
OS-506-23	M-1.1

GENERAL NOTES:

1. PRIOR TO DEMOLITION AND SHOP DRAWING SUBMISSION THE CONTRACTOR IS TO THOROUGHLY REVIEW AND DOCUMENT THE EXISTING INSTALLATION AS THE SPACE IS EXTREMELY LIMITED AND THE NEW INSTALLATION IS TO FOLLOW A SIMILAR ARRANGEMENT. CONTRACTOR TO CONFIRM IN WRITING THAT THE NEW EQUIPMENT WILL FIT WITHIN THE FOOT PRINT AND VOLUME OF THE AVAILABLE SPACE. THE CONTRACTOR IS NOT TO PROCEED UNTIL THIS EXERCISE IS COMPLETED AND SUBMITTED TO THE OWNER AND ENGINEER FOR RECORD.
2. ALL OUTSIDE AIR DUCTWORK TO BE THERMALLY INSULATED.
3. COORDINATE ALL DUCT ROUTING TO AVOID INTERFERENCES. RE-ROUTE AS REQUIRED.
4. PROVIDE OFFSETS TO AVOID STRUCTURAL BEAMS, PIPING, OTHER DUCT, ETC. WHERE REQUIRED.
5. REFER TO SPECIFICATION FOR ACCESS DOOR REQUIREMENTS.
6. DOORWAYS TO GAIN ACCESS TO GROUND LEVEL MECHANICAL ROOM ARE APPROXIMATELY 863MM WIDE, CONFIRM ON SITE. CONTRACTOR TO MAKE PROVISIONS TO ENSURE ALL NEW MATERIALS CAN BE TRANSPORTED INTO SPACE THROUGH EXISTING DOOR SPACE.

DRAWING NOTES:

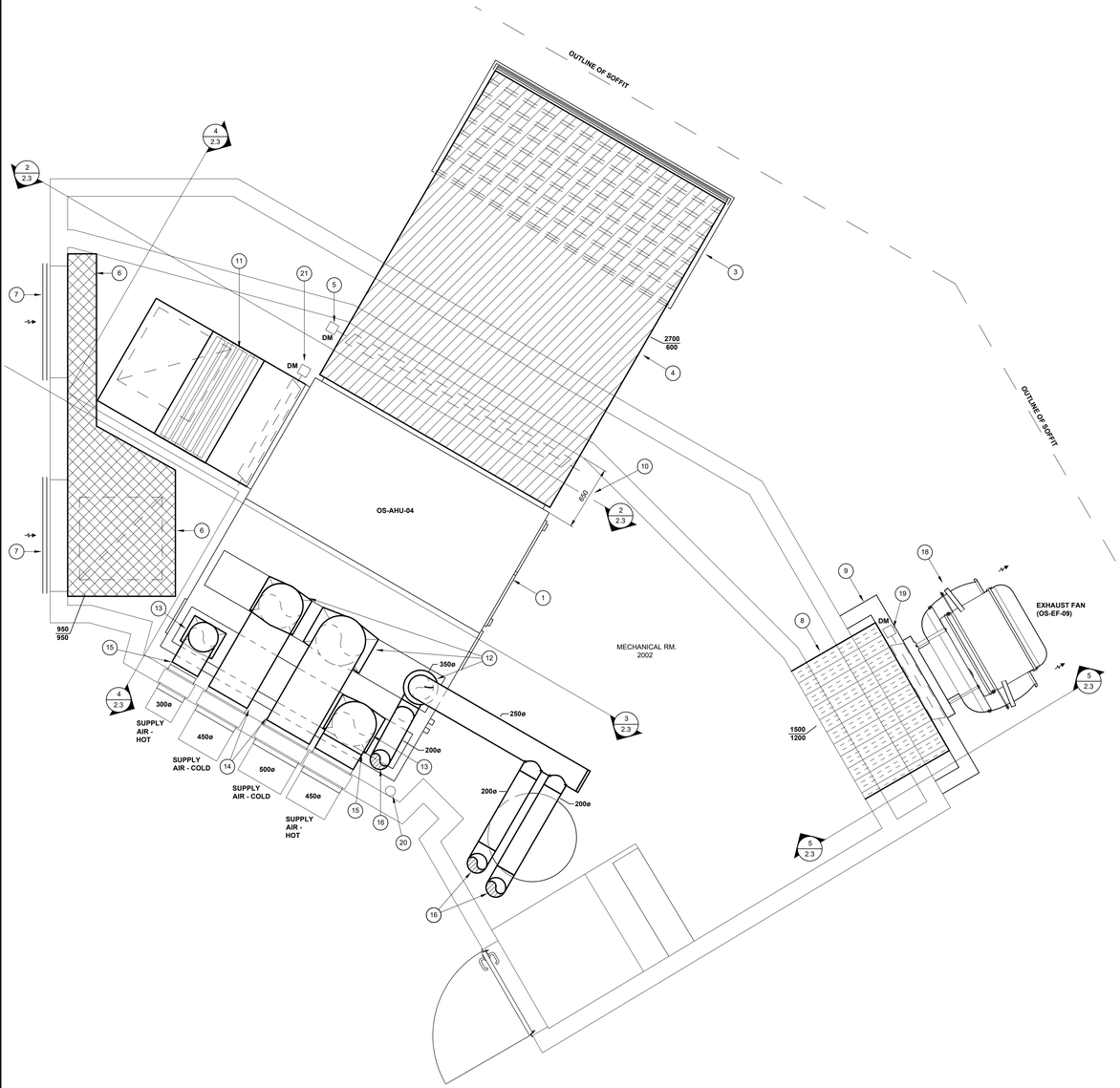
1. NEW AIR HANDLING UNIT (OS-AHU-04) REFER TO SCHEDULE AND DETAIL 1/2.3
2. NEW INLINE RETURN AIR FAN (OS-RF-02) PROVIDE SUPPORTS FROM FLOOR. REFER TO SCHEDULE.
3. NEW 2700X1200 OUTSIDE AIR INTAKE LOUVER INSTALLED IN CEILING OF SOFFIT SPACE, "VENTEX" MODEL 2630. DURANAR (AAMA2605) FINISH C/W STAINLESS STEEL FASTENERS , 316 STAINLESS BIRD SCREEN. LOUVER WILL BE INSTALLED IN THE UNDERSIDE OF A SLIGHTLY SLOPED SOFFIT.
4. NEW OUTSIDE AIR DUCT RUNNING IN SOFFIT SPACE TO BE 316 STAINLESS STEEL.
5. NEW OUTSIDE AIR CONTROL DAMPER INSTALLED IN DUCT PENETRATION ON FACE OF EXTERIOR WALL.
6. NEW 3400mm LONG X 1200mm HIGH RETURN AIR PLENUM C/W ACOUSTIC INSULATION TO BE CONNECTED TO EXISTING DUCT THROUGH WALL TO EXISTING RETURN AIR GRILLES ON STAIRWELL SIDE OF WALL. DEPTH OF PLENUM TO VARY TO ALLOW SPACE FOR RETURN AIR PLENUM CONNECTED TO AHU. CONTRACTOR TO FIELD FABRICATE PLENUM TO MAXIMIZE AVAILABLE SPACE.
7. EXISTING RETURN AIR GRILLE IN STAIRWELL TO REMAIN. CONNECT TO NEW RETURN AIR PLENUM.
8. DUCT PLENUM ENCLOSURE WITHIN THE ARCHITECTURAL SOFFIT. INSTALL STAINLESS PLENUM DUCTING.
9. NEW EXTERIOR WALL SECTION CONSTRUCTED TO SUPPORT SOFFIT PLENUM AND EXHAUST AIR FAN, REFER TO ARCHITECTURAL DRAWINGS.
10. FREE SPACE BETWEEN AHU AND EXTERIOR WALL IS TO BE MAXIMIZED TO PROVIDE ACCESS ON BOTH SIDES OF THE MECHANICAL ROOM. THE CONTRACTOR SHALL PLACE THE UNIT WITHIN THE DESIGNATED FOOTPRINT AND OFFSET IT AS REQUIRED TO ACHIEVE THE GREATEST POSSIBLE CLEAR SPACE WITHIN THE ALLOWABLE AREA. PRIOR TO DEMOLITION AND SHOP DRAWING SUBMISSION, THE CONTRACTOR SHALL VERIFY SITE DIMENSIONS AND PLAN THE INSTALLATION TO MAXIMIZE AVAILABLE CLEARANCE AT THIS LOCATION. IDENTIFY THE ANTICIPATED CLEAR SPACE ON THE SHOP DRAWINGS.
11. NEW EXHAUST AIR BYPASS DAMPER INSTALLED ON TOP OF RETURN AIR PLENUM.
12. NEW COLD DECK DUCT TO CONNECT TO TOP OF NEW AHU COLD DECK PLENUM. PROVIDE ROUND TO SQUARE TRANSITION AT UNIT.
13. NEW HOT DECK DUCT TO CONNECT TO TOP OF NEW AHU HOT DECK PLENUM. PROVIDE ROUND TO SQUARE TRANSITION AT UNIT.
14. CONNECT NEW COLD DECK DUCT TO EXISTING COLD DECK DUCT.
15. CONNECT NEW HOT DECK DUCT TO EXISTING HOT DECK DUCT.
16. CONNECT NEW COLD DECK DUCT TO EXISTING COLD DECK DUCT AT EXISTING DUCT PENETRATION THROUGH MECHANICAL ROOM CEILING.
17. RETURN AIR DUCT FROM DISCHARGE OF RETURN AIR FAN UP INTO BOTTOM OF RETURN AIR PLENUM CONNECTED TO AHU.
18. NEW EXAUST FAN MOUNTED ON SIDEWALL ARRANGEMENT BELOW SOFFIT SPACE. REFER TO SCHEDULE AND DETAIL 5/2.3
19. NEW EXHAUST AIR DAMPER INSTALLED ON SUCTION SIDE OF EXHAUST AIR FAN.
20. EXISTING SANITARY PIPE ROUTED ALONG WALL AT THIS LOCATION. PLACE END/EDGE OF AHU AS CLOSE TO PIPE WHILE LEAVING ENOUGH ROOM FOR FUTURE REPLACEMENT.
21. NEW RETURN AIR CONTROL DAMPER AT RETURN AIR CONNECTION AT UNIT.



PARTIAL LEVEL GROUND FLOOR PLAN - NEW LOWER VENTILATION LAYOUT

SCALE: 1:25

0mm 500mm 1000mm 1500mm 2000mm 2500mm



PARTIAL LEVEL GROUND FLOOR PLAN - NEW UPPER VENTILATION LAYOUT

SCALE: 1:25

0mm 500mm 1000mm 1500mm 2000mm 2500mm

A - DETAIL.
B - LOCATION/DRAWING No.
C - DRAWING No.

No.	REVISION	DATE (Y/M/D)
R0	ISSUED FOR TENDER	2026/04/02

GENERAL NOTES

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REGISTERED PROFESSIONAL ENGINEER
PROVINCE OF NEWFOUNDLAND
PEGNL Newfoundland and Labrador
DAVE ENNIS
SIGNATURE
2026 Apr 02
DATE

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CORE PROJECT #24-3536

PERMIT:

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Department of Facilities Management
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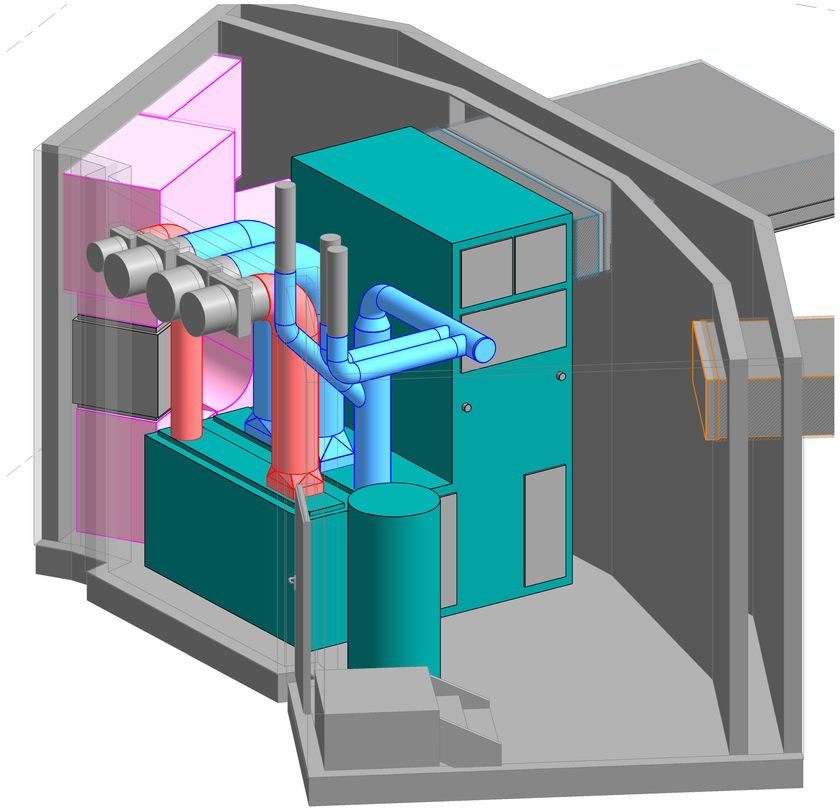
- Dedication plaque, Arts & Administration Building, St. John's Campus

PROJECT NAME:
OCEAN SCIENCES CENTRE MAIN BUILDING
(FACULTY OF ENGINEERING
& APPLIED SCIENCE)
AIR HANDLER REPLACEMENT (OS-AHU-03)
Project #: OS-506-23

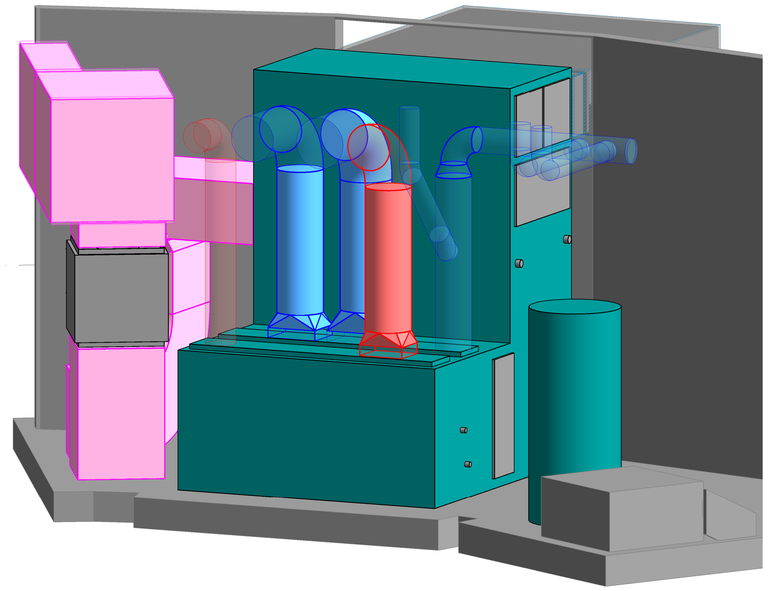
DRAWING TITLE:
PARTIAL GROUND FLOOR PLAN - NEW VENTILATION LAYOUT

DESIGNED:	DRAWN:
D.E.	J.S.
REVIEWED:	APPROVED:
D.E.	D.E.
SCALE:	DATE:
AS NOTED	APRIL, 2026
PROJECT No.	DRAWING No.
OS-506-23	**M-2.1**



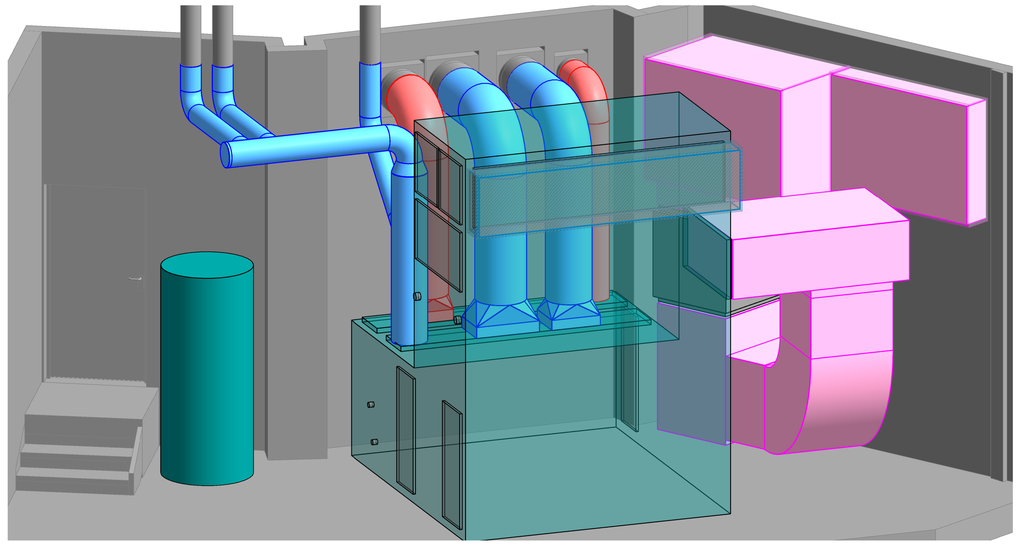
AHU ISOMETRIC VIEW 1

1
M-2.2



AHU ISOMETRIC VIEW 2

2
M-2.2



AHU ISOMETRIC VIEW 3

3
M-2.2

A - DETAIL
B - LOCATION/DRAWING No.
C - DRAWING No.

No.	REVISION	DATE (Y/M/D)
R0	ISSUED FOR TENDER	2026/04/02

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REGISTERED PROFESSIONAL ENGINEER
PEGNL Newfoundland and Labrador
DAVE ENNIS
SIGNATURE
2026 Apr 02
DATE
PROVINCE OF NEWFOUNDLAND

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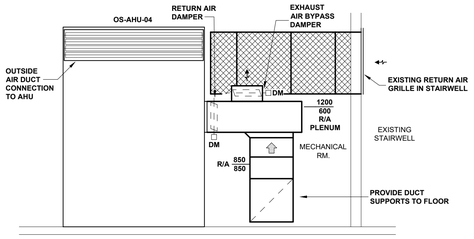
OCEAN SCIENCES CENTRE MAIN BUILDING
(FACULTY OF ENGINEERING
& APPLIED SCIENCE)
AIR HANDLER REPLACEMENT (OS-AHU-04)
Project #: OS-506-23

DRAWING TITLE:

NEW AHU 3D VIEWS

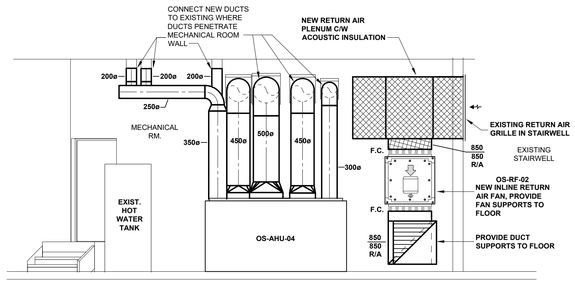
DESIGNED:	DRAWN:
D.E.	J.S.
REVIEWED:	APPROVED:
D.E.	D.E.
SCALE:	DATE:
AS NOTED	APRIL, 2026
PROJECT No.	DRAWING No.
OS-506-23	M-2.2



VENTILATION SECTION DETAIL

SCALE: N.T.S.

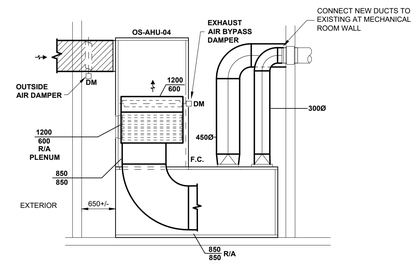
2 / 2.3



VENTILATION SECTION DETAIL

SCALE: N.T.S.

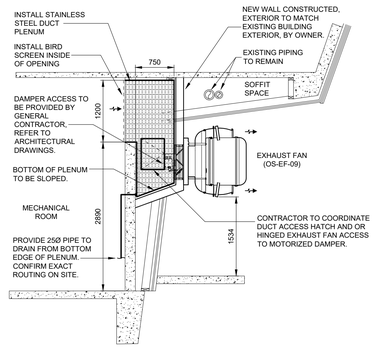
3 / 2.3



VENTILATION SECTION DETAIL

SCALE: N.T.S.

4 / 2.3



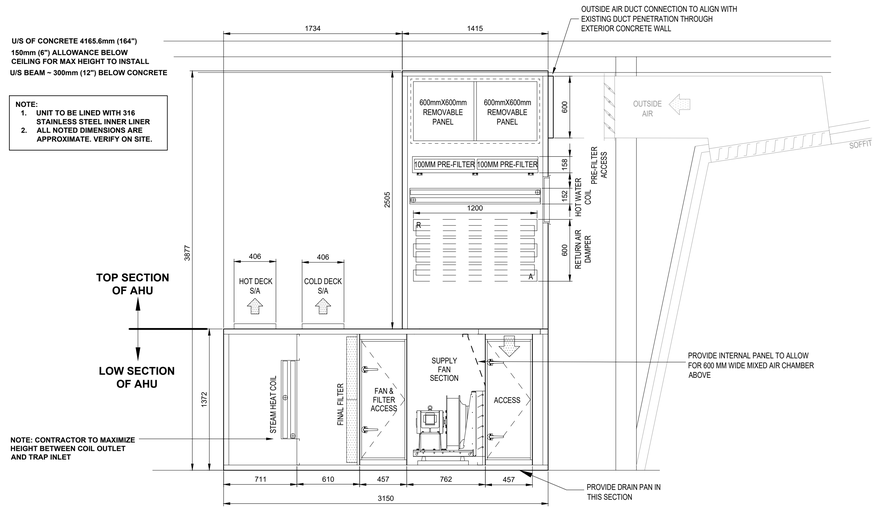
SIDEWALL EXHAUST FAN SECTION DETAIL

SCALE: N.T.S.

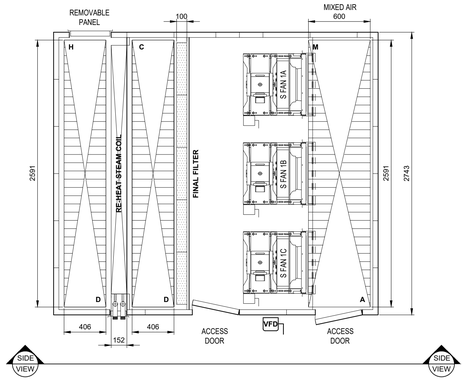
5 / 2.3

U/S OF CONCRETE 4165.6mm (164")
150mm (6") ALLOWANCE BELOW CEILING FOR MAX HEIGHT TO INSTALL
U/S BEAM ~ 300mm (12") BELOW CONCRETE

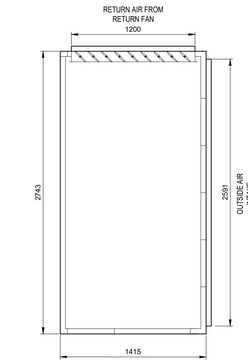
NOTE:
1. UNIT TO BE LINED WITH 316 STAINLESS STEEL INNER LINER
2. ALL NOTED DIMENSIONS ARE APPROXIMATE. VERIFY ON SITE.



SIDE VIEW



PLAN VIEW (BOTTOM SECTION)



PLAN VIEW (TOP SECTION)

AIR HANDLING UNIT DETAIL (OS-AHU-04)

SCALE: N.T.S.

1 / 2.3

A - DETAIL
B - LOCATION/DRAWING No.
C - DRAWING No.

No.	REVISION	DATE (Y/M/D)
R0	ISSUED FOR TENDER	2026/04/02

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REGISTERED PROFESSIONAL ENGINEER
PEG Newfoundland and Labrador
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PROJECT NAME:
OCEAN SCIENCES CENTRE MAIN BUILDING
(FACULTY OF ENGINEERING & APPLIED SCIENCE)
AIR HANDLER REPLACEMENT (OS-AHU-03)
Project #: OS-506-23

DRAWING TITLE:
AHU DETAILS

DESIGNED:	DRAWN:
D.E.	J.S.
REVIEWED: D.E.	APPROVED: D.E.
SCALE: AS NOTED	DATE: APRIL, 2026
PROJECT No. OS-506-23	DRAWING No. **M-2.3**

PARTIAL GROUND FLOOR PLAN - LOWER PIPING DEMOLITION LAYOUT

SCALE: 1:50

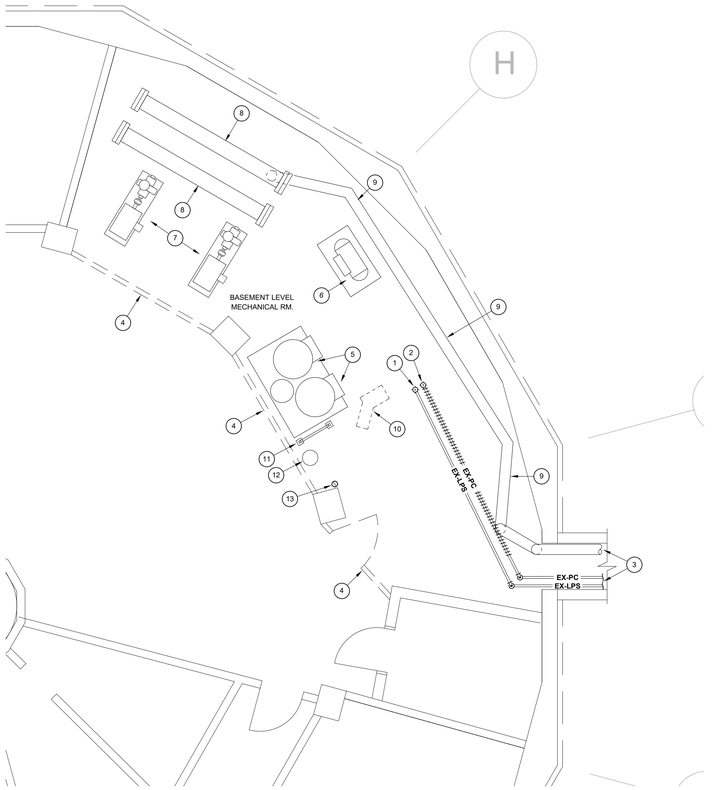
0m 1m 2m 3m 4m 5m

GENERAL NOTES:

1. CONTRACTOR TO CONFIRM EXACT EQUIPMENT AND PIPING LAYOUTS ON SITE BEFORE COMMENCING ANY DEMOLITION. CONTRACTOR SHALL BE RESPONSIBLE FOR IDENTIFYING ALL EXISTING SYSTEMS WHICH MAY BE AFFECTED BY THE WORK, AND REMOVE/MODIFY IN AN APPROVED MANNER TO ALLOW FOR A COMPLETE WORKING SYSTEM.
2. WALLS, CEILINGS AND MECHANICAL INSULATION KNOWN TO CONTAIN ASBESTOS AND/OR LEAD BASED PAINT. ALL ABATEMENT SHALL BE COMPLETED BY CONTRACTOR PRIOR TO STARTING WORK. REFER TO ASBESTOS SURVEY REPORT.
3. OWNER SHALL HAVE FIRST RIGHT OF REFUSAL ON EQUIPMENT TO BE DEMOLISHED. CONTRACTOR SHALL WALK THROUGH WITH OWNER REPRESENTATIVE PRIOR TO DEMO AND DOCUMENT WHAT SHALL BE TURNED OVER TO OWNER. CONTRACTOR WILL BE RESPONSIBLE FOR REMOVING ALL MATERIALS FROM SITE AND DISPOSAL.

DRAWING NOTES:

1. EXISTING CONDENSATE PIPING SERVING EXISTING AHU STEAM COIL TO BE REMOVED BACK TO CONDENSATE RECEIVER TANK. REMOVE ALL PIPE ACCESSORIES, FITTINGS, HANGERS, SUPPORTS, AND INSULATION. MAINTAIN TEMPORARY CONDENSATE RETURN FOR EXISTING HEAT EXCHANGERS UNTIL NEW CONDENSATE PUMP INSTALLED AND OPERATIONAL.
2. EXISTING CONDENSATE RECEIVER TANK C/W WITH PUMPS TO BE REMOVED.
3. EXISTING SECTION OF CONDENSATE RECEIVER VENT PIPE TO BE REMOVED UP TO LOCATION SHOWN.
4. EXISTING SECTION OF PUMPED CONDENSATE PIPING TO BE REMOVED.
5. EXISTING CONDENSATE RECEIVER VENT DRAIN DOWN TO EXISTING FLOOR DRAIN TO BE REMOVED.
6. EXISTING HOT WATER TANK TO REMAIN.
7. EXISTING SHELL AND TUBE HEAT EXCHANGER TO REMAIN.
8. EXISTING BRAZED PLATE HEAT EXCHANGER TO REMAIN.
9. EXISTING LOW PRESSURE STEAM PIPING UP FROM LEVEL BELOW TO REMAIN.
10. EXISTING PUMPED CONDENSATE PIPING DOWN TO LEVEL BELOW TO BE REMOVED.
11. EXISTING CONDENSATE SERVING EXISTING HEAT EXCHANGER UP ALONG WALL. VERTICAL PIPE DROP ALONG WALL TO BE REMOVED. PIPING ALONG FLOOR TO HEAT EXCHANGERS TO REMAIN.



PARTIAL BASEMENT LEVEL FLOOR PLAN - PIPING DEMOLITION LAYOUT

SCALE: 1:50

0m 1m 2m 3m 4m 5m

GENERAL NOTES:

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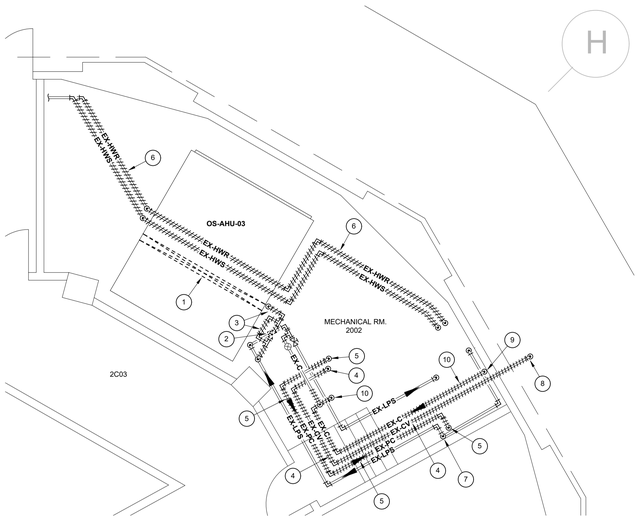
2. WALLS, CEILINGS AND MECHANICAL INSULATION KNOWN TO CONTAIN ASBESTOS AND/OR LEAD BASED PAINT. ALL ABATEMENT SHALL BE COMPLETED BY CONTRACTOR PRIOR TO STARTING WORK. REFER TO ASBESTOS SURVEY REPORT.
3. OWNER SHALL HAVE FIRST RIGHT OF REFUSAL ON EQUIPMENT TO BE DEMOLISHED. CONTRACTOR SHALL WALK THROUGH WITH OWNER REPRESENTATIVE PRIOR TO DEMO AND DOCUMENT WHAT SHALL BE TURNED OVER TO OWNER. CONTRACTOR WILL BE RESPONSIBLE FOR REMOVING ALL MATERIALS FROM SITE AND DISPOSAL.

DRAWING NOTES:

1. EXISTING LOW PRESSURE STEAM PIPING TO LEVEL ABOVE TO REMAIN.
2. EXISTING PUMPED CONDENSATE PIPING DOWN FROM LEVEL ABOVE TO BE REMOVED. REMOVE PIPING TO LOCATION INDICATED FOR RECONNECTION TO NEW PIPING.
3. EXISTING STEAM AND CONDENSATE LINES TO MECHANICAL SERVICES BUILDING THROUGH TUNNEL TO REMAIN.
4. HALF HEIGHT SEPARATION FENCE/WALL TO REMAIN.
5. EXISTING HOT WATER TANKS TO REMAIN.
6. EXISTING AIR COMPRESSOR AND RECEIVER TANK TO REMAIN.
7. EXISTING SEA WATER PUMPS TO REMAIN.
8. EXISTING SEA WATER PIPING HEADERS TO REMAIN.
9. EXISTING SEA WATER PIPING ROUTED ALONG WALL TO REMAIN.
10. EXISTING TRENCH DRAIN CUT IN CONCRETE.
11. EXISTING UNISTRUT FRAME C/W MIXING VALVE TO REMAIN.
12. EXISTING FLOOR MOUNTED EXPANSION TANK TO REMAIN
13. EXISTING SANITARY STACK TO REMAIN.



PARTIAL GROUND FLOOR PLAN - HIGH LEVEL PIPING DEMOLITION LAYOUT

SCALE: 1:50

0m 1m 2m 3m 4m 5m

GENERAL NOTES:

1. CONTRACTOR TO CONFIRM EXACT EQUIPMENT AND PIPING LAYOUTS ON SITE BEFORE COMMENCING ANY DEMOLITION. CONTRACTOR SHALL BE RESPONSIBLE FOR IDENTIFYING ALL EXISTING SYSTEMS WHICH MAY BE AFFECTED BY THE WORK, AND REMOVE/MODIFY IN AN APPROVED MANNER TO ALLOW FOR A COMPLETE WORKING SYSTEM.
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DRAWING NOTES:

1. EXISTING STEAM COIL IN AIR HANDLING UNIT TO BE REMOVED. REMOVE ALL ASSOCIATED PIPING, HANGERS, SUPPORTS, AND INSULATION BACK TO LOCATION INDICATED. REFER TO PIPING SCHEMATICS.
2. EXISTING PNEUMATIC CONTROL STEAM VALVE TO BE REMOVED.
3. ALL EXISTING STEAM PIPING SERVING AHU STEAM HEATING COIL TO BE REMOVED C/W WITH ALL ASSOICATED PIPING FITTINGS, ACCESSORIES, SUPPORTS, HANGERS AND INSULATION, REFER TO PIPING SCHEMATICS.
4. EXISTING SECTION OF CONDENSATE RECEIVER VENT PIPE TO BE REMOVED UP TO LOCATION SHOWN.
5. EXISTING SECTION OF PUMPED CONDENSATE PIPING TO BE REMOVED.
6. EXISTING HOT WATER HEATING SUPPLY AND RETURN PIPING TO BE REMOVED AND REINSTALLED TO ACCOMMODATE REMOVAL AND INSTALLATION OF NEW AHU. RE-ROUTE NEW PIPING AS NECESSARY TO AVOID ALL INTERFERENCES.
7. EXISTING LOW PRESSURE STEAM PIPING UP FROM LEVEL BELOW TO REMAIN.
8. EXISTING CONDENSATE RECEIVER VENT PENETRATING EXTERIOR WALL TO REMOVED AND REPLACED WITH NEW. REFER TO NEW LAYOUTS.
9. EXISTING CONDENSATE PIPING DOWN ALONG WALL TO EXISTING HEAT EXCHANGERS TO BE REMOVED DOWN TO FLOOR. REFER TO NEW LAYOUT. PIPING AT FLOOR LEVEL TO HEAT EXCHANGERS TO REMAIN.
10. EXISTING HEAT EXCHANGER CONDENSATE PIPING TO BE REMOVED.

A - DETAIL
B - LOCATION/DRAWING No.
C - DRAWING No.

No.	REVISION	DATE (Y/M/D)
R0	ISSUED FOR TENDER	2026/04/02

GENERAL NOTES

1. DRAWINGS TO BE READ AS A SET.
2. DO NOT SCALE FROM DRAWINGS.
3. THE CONTRACTOR IS TO VERIFY ALL DIMENSIONS AND SITE CONDITIONS PRIOR TO SUBMISSION OF TENDERS.
4. ALL DEFICIENCIES FOUND IN THIS DRAWING IS TO BE BROUGHT TO THE ATTENTION OF THE FACILITIES ENGINEERING AND DEVELOPMENT OFFICE OF THE DEPARTMENT OF FACILITIES MANAGEMENT, MEMORIAL UNIVERSITY OF NEWFOUNDLAND, PRIOR TO THE SUBMISSION OF THE TENDERS.

REGISTERED PROFESSIONAL ENGINEER
PEG Newfoundland and Labrador
DAVE ENNIS
SIGNATURE
2026 Apr 02
DATE
PROVINCE OF NEWFOUNDLAND

PROVINCE OF NEWFOUNDLAND
pegnl
PERMIT HOLDER
This Permit Allows
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MIRC: 03823
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Permit No. as issued by PEGNL D0209
which is valid for the year 2026.

PRIME, MECHANICAL & ELECTRICAL CONSULTANT:

CORE ENGINEERING INC.
A MEMBER OF BPA

CORE PROJECT #24-3536

PERMIT:

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Department of Facilities Management
This University was raised by the people of Newfoundland as a memorial to the fallen in the great wars, 1914-1918, 1939-1945, that in freedom of learning, their cause and sacrifice might not be forgotten.
- Dedication plaque, Arts & Administration Building, St. John's Campus

PROJECT NAME:

OCEAN SCIENCES CENTRE MAIN BUILDING
(FACULTY OF ENGINEERING
& APPLIED SCIENCE)
AIR HANDLER REPLACEMENT (OS-AHU-03)
Project #: OS-506-23

DRAWING TITLE:

PARTIAL BASEMENT AND GROUND FLOOR PLANS - PIPING DEMOLITION LAYOUT

DESIGNED: D.E.	DRAWN: J.S.
REVIEWED: D.E.	APPROVED: D.E.
SCALE: AS NOTED	DATE: APRIL, 2026
PROJECT No. OS-506-23	DRAWING No. **M-3.1**

PARTIAL GROUND FLOOR PLAN - NEW PIPING LAYOUT

SCALE: 1:50

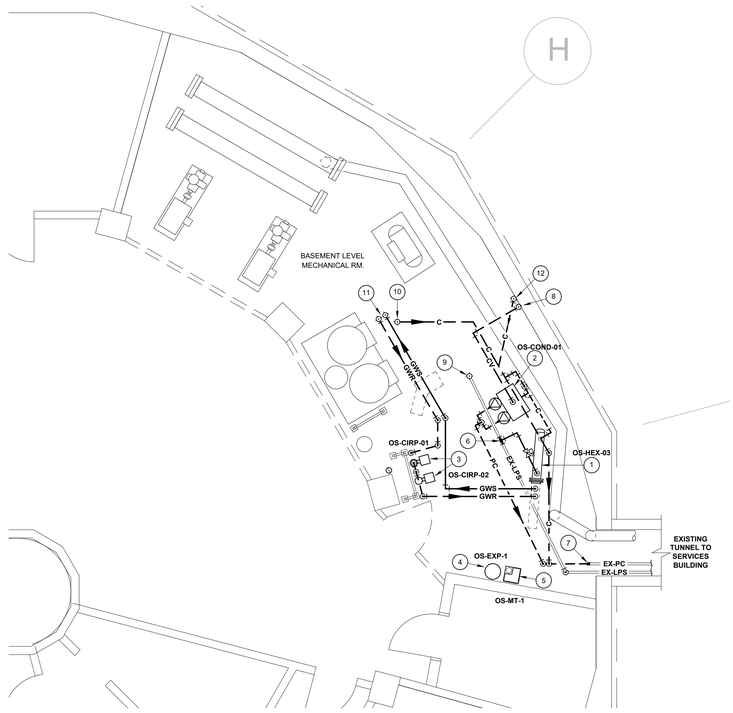
0m 1m 2m 3m 4m 5m

GENERAL NOTES:

1. PROVIDE NECESSARY OFFSETS AS REQUIRED TO RUN ALL PIPING SYSTEMS. CO-ORDINATE ON SITE.
2. FOR PIPE SIZES, PIPING VALVE ARRANGEMENTS, REFER TO PIPING FLOW SCHEMATIC. SCHEMATIC SHALL TAKE PRECEDENCE OVER FLOOR PLANS.
3. PROVIDE AUTOMATIC AIR VENTS ON ALL HIGH POINTS.
4. CONFIRM EXACT LOCATIONS OF UNIT COILS WITH APPROVED SHOP DRAWINGS.
5. CONTRACTOR TO PERFORM SCANS OF THE EXISTING CONCRETE FLOOR FOR ANY NEW FLOOR PENETRATIONS PRIOR TO CUTTING ANY NEW FLOOR PENETRATIONS.
6. MECHANICAL ROOM IS VERY CONGESTED. NOT ALL PIPING AND/OR EQUIPMENT IS SHOWN FOR CLARITY. THE CONTRACTOR IS TO PROTECT ALL SYSTEMS, PIPING, WIRING FROM DAMAGE FOR THE DURATION OF THE CONTRACT. WHERE THE WORK ADJACENT TO OR ABOVE SUCH EQUIPMENT OR PIPING THE CONTRACTOR SHALL INSTALL TEMPORARY WORKS TO PROTECT EQUIPMENT AND PIPING FROM DAMAGE.
7. NEW FLOOR PENETRATIONS SHALL BE XRAY'D PRIOR TO CUTTING TO AVOID REBAR.

DRAWING NOTES:

1. CONNECT NEW LOW PRESSURE STEAM PIPING SERVING NEW OS-AHU-04 HEATING COIL INTO EXISTING STEAM PIPING AT THIS APPROXIMATE LOCATION.
2. NEW LOW PRESSURE STEAM PIPING DOWN TO HEATING COIL IN OS-AHU-04. REFER TO DETAIL 5/6.1
3. NEW STEAM TRAP INSTALLED IN CONDENSATE LINE SERVING NEW HEATING COIL IN OS-AHU-04.
4. AT LOW LEVEL CONNECT NEW CONDENSATE PIPING INTO EXISTING AT THIS LOCATION. REFER TO PIPING SCHEMATIC.
5. NEW CONDENSATE PIPING DOWN TO LEVEL BELOW. X-RAY FLOOR PRIOR TO CUTTING FLOOR.
6. NEW CONDENSATE TANK VENT UP FROM BASEMENT LEVEL BELOW. CORE NEW HOLE IN FLOOR AT THIS LOCATION. X-RAY PRIOR TO CUTTING.
7. NEW CONDENSATE TANK VENT TO TERMINATE BELOW SOFFIT AT THIS APPROXIMATE LOCATION. COORDINATE EXACT LOCATION WITH NEW EXHAUST AIR PLENUM AND EXHAUST FAN. PROVIDE CORROSION RESISANT BIRDSCREEN CAGE AROUND THE TERMINATED PIPE. INSTALL WARNING SIGN WITH BLOCK LETTERS ON YELLOW BACKGROUND. "CAUTION STEAM VENT"
8. NEW GLYCOL HEATING SUPPLY AND RETURN PIPING UP FROM LEVEL BELOW. CORE NEW HOLES IN CONCRETE FLOOR.
9. NEW GLYCOL HEATING SUPPLY AND RETURN PIPING DOWN TO NEW PREHEAT COIL IN OS-AHU-04. OFFSET PIPING AS TO NOT INTERFERE WITH FILTER REMOVAL SPACE ABOVE COIL LOCATION. REFER TO DETAIL 6/6.1
10. APPROXIMATE AREA OF SPACE NEEDED FOR FILTER REMOVAL/REPLACEMENT . COORDINATE WITH ACTUAL PRODUCT.
11. CONNECT NEW CONDENSATE PIPING TO EXISTING PIPING SERVING EXISTING HEAT EXCHANGERS. CORE NEW HOLE IN FLOOR AND DROP DOWN TO BASEMENT LEVEL BELOW
12. PROVIDE 20Ø PIPING FROM AHU DRAIN PAN TO EXISTIGN FLOOR DRAIN, ROUTE ALONG WALL.



PARTIAL BASEMENT LEVEL FLOOR PLAN - NEW PIPING LAYOUT

SCALE: 1:50

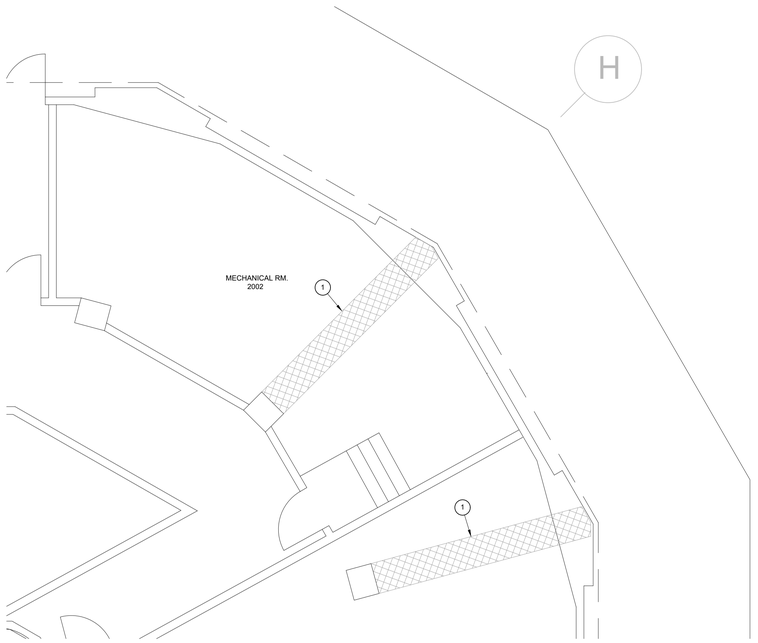
0m 1m 2m 3m 4m 5m

GENERAL NOTES:

1. PROVIDE NECESSARY OFFSETS AS REQUIRED TO RUN ALL PIPING SYSTEMS. CO-ORDINATE ON SITE.
2. FOR PIPE SIZES, PIPING VALVE ARRANGEMENTS, REFER TO PIPING FLOW SCHEMATIC. SCHEMATIC SHALL TAKE PRECEDENCE OVER FLOOR PLANS.
3. PROVIDE AUTOMATIC AIR VENTS ON ALL HIGH POINTS.
4. CONFIRM EXACT LOCATIONS OF UNIT COILS WITH APPROVED SHOP DRAWINGS.
5. PERFORM SCANS OF THE EXISTING CONCRETE FLOOR FOR ANY NEW FLOOR PENETRATIONS PRIOR TO CUTTING ANY NEW FLOOR PENETRATIONS.
6. MECHANICAL ROOM IS VERY CONGESTED. NOT ALL PIPING AND/OR EQUIPMENT IS SHOWN FOR CLARITY. THE CONTRACTOR IS TO PROTECT ALL SYSTEMS, PIPING, WIRING FROM DAMAGE FOR THE DURATION OF THE CONTRACT. WHERE THE WORK ADJACENT TO OR ABOVE SUCH EQUIPMENT OR PIPING THE CONTRACTOR SHALL INSTALL TEMPORARY WORKS TO PROTECT EQUIPMENT AND PIPING FROM DAMAGE.
7. NEW FLOOR PENETRATIONS SHALL BE XRAY'D PRIOR TO CUTTING TO AVOID REBAR.

DRAWING NOTES:

1. NEW SHELL AND TUBE HEAT EXCHANGER MOUNTED ON FLOOR WITH SUPPORT STAND, REFER TO SCHEDULE AND PIPING FLOW SCHEMATIC. REFER TO DETAIL. 7/6.1
2. NEW CONDENSATE RECEIVER TANK AND PUMP COMBINATION. REFER TO SCHEDULE.
3. NEW INLINE CIRCULATOR PUMPS INSTALLED IN VERTICAL ORIENTATION MOUNTED TO UNI-STRUT TYPE STAND SECURED TO FLOOR. CONFIRM EXACT LOCATION ON SITE. REFER TO DETAIL. 4/6.1
4. NEW EXPANSION TANK. REFER TO SCHEDULE AND FLOW SCHEMATIC.
5. NEW GLYCOL MIXING TANK. REFER TO SCHEDULE AND FLOW SCHEMATIC.
6. CONNECT NEW PIPING SERVING NEW HEAT EXCHANGER TO EXISTING STEAM PIPING WITH A NEW WELDED TEE.
7. CONNECTION NEW PUMPED CONDENSATE PIPING INTO EXISTING PUMPED CONDENSATE PIPING.
8. NEW CONDENSATE TANK RELIEF VENT PIPING UP TO FLOOR ABOVE. CORE A NEW HOLE IN FLOOR.
9. EXISTING LOW PRESSURE STEAM PIPING UP TO FLOOR ABOVE.
10. NEW GRAVITY RETURN CONDENSATE PIPING DOWN FROM FLOOR ABOVE THROUGH EXISTING FLOOR PENETRATION WHERE CONDENSATE VENT DRAIN PIPING WAS PREVIOUSLY REMOVED. ENSURE PIPING IS SLOPED TO ALLOW PROPER DRAINAGE BACK TO TUNNEL.
11. NEW GLYCOL WATER SUPPLY AND RETURN PIPING UP TO FLOOR ABOVE SERVING PREHEAT COIL IN NEW OS-AHU-04. CORE NEW HOLE IN FLOOR.
12. NEW GRAVITY RETURN CONDENSATE PIPING DOWN FROM FLOOR ABOVE. CORE NE W HOLE PENETRATION IN FLOOR. ENSURE PIPING IS SLOPED TO ALLOW PROPER DRAINAGE BACK TO TUNNEL.



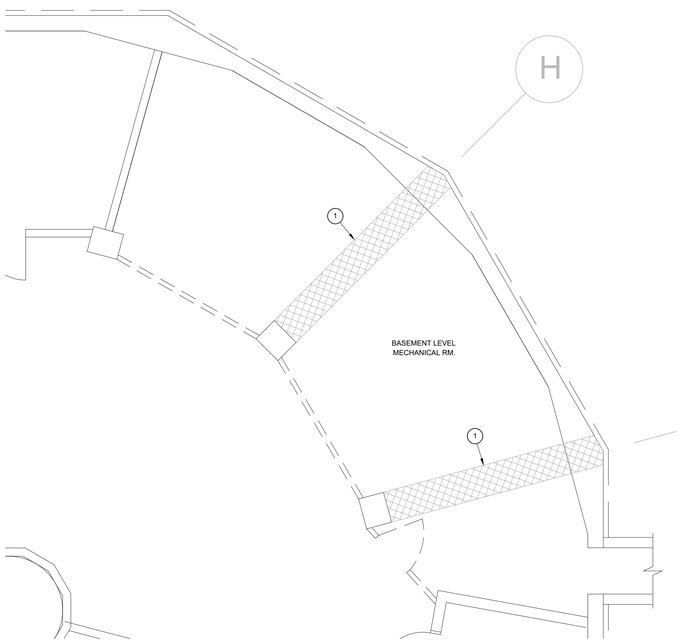
DRAWING NOTES:

1. EXISTING CONCRETE BEAMS LOCATED AT THIS APPROXIMATE LOCATION IN THE FLOOR OF GROUND FLOOR LEVEL. DO NOT CORE THROUGH BEAM.

PARTIAL GROUND FLOOR LEVEL FLOOR PLAN - EXISTING CONCRETE FLOOR BEAMS LAYOUT

SCALE: 1:50

0m 1m 2m 3m 4m 5m



DRAWING NOTES:

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PARTIAL BASEMENT LEVEL FLOOR PLAN - EXISTING CONCRETE FLOOR BEAMS LAYOUT

SCALE: 1:50

0m 1m 2m 3m 4m 5m

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REGISTERED PROFESSIONAL ENGINEER
PEGNL Newfoundland and Labrador
DAVE ENNIS
SIGNATURE
2026 Apr 02
DATE
PROVINCE OF NEWFOUNDLAND

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CORE PROJECT #24-3536

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PROJECT NAME:

OCEAN SCIENCES CENTRE MAIN BUILDING
(FACULTY OF ENGINEERING
& APPLIED SCIENCE)
AIR HANDLER REPLACEMENT (OS-AHU-03)
Project #: OS-506-23

DRAWING TITLE:

PARTIAL BASEMENT AND GROUND FLOOR PLANS - NEW PIPING LAYOUT

DESIGNED:	DRAWN:
D.E.	J.S.
REVIEWED: D.E.	APPROVED: D.E.
SCALE: AS NOTED	DATE: APRIL, 2026
PROJECT No. OS-506-23	DRAWING No. **M-3.2**

DRAWING NOTES:

1. EXISTING AIR HANDLING UNIT (OS-AHU-03) TO BE REMOVED ALONG WITH ANY ASSOCIATED PNEUMATIC CONTROLS AND/OR WIRING. REMOVE WIRING AND ANY HANGERS, SUPPORTS BACK TO SOURCE AND CAP.
2. EXISTING AIR HANDLING UNIT SUPPLY AIR FAN VFD TO BE REMOVED ALONG WITH ALL CONTROLS WIRING. REMOVED WIRING AND ANY HANGERS AND SUPPORTS BACK TO SOURCE.
3. EXISTING OUTSIDE AIR INTAKE DAMPER TO BE REMOVED. REMOVE ALL PNEUMATIC TUBING AND/OR WIRING BACK TO SOURCE.
4. EXISTING RETURN AIR DAMPER TO BE REMOVED. REMOVE ALL PNEUMATIC TUBING AND/OR WIRING BACK TO SOURCE.
5. EXISTING EXHAUST AIR RELIEF DAMPER TO BE REMOVED. REMOVE ALL PNEUMATIC TUBING AND/OR WIRING BACK TO SOURCE.
6. EXISTING RETURN AIR FAN (OS-RF-01) TO BE REMOVED ALONG WITH ANY ASSOCIATED PNEUMATIC CONTROLS AND/OR WIRING. REMOVE WIRING AND ANY HANGERS, SUPPORTS BACK TO SOURCE AND CAP.
7. EXISTING AIR HANDLING UNIT RETURN AIR FAN VFD TO BE REMOVED ALONG WITH ALL CONTROLS WIRING. REMOVED WIRING AND ANY HANGERS AND SUPPORTS BACK TO SOURCE.
8. EXISTING CONTROL PANEL. REMOVE ALL ABANDONED AND DEMOLISHED CONTROL EQUIPMENT.
9. EXISTING CONDENSATE TANK AND PUMPS TO BE REMOVED ALONG WITH ANY ASSOCIATED CONTROL WIRING OR TUBING. REMOVE BACK TO SOURCE.
10. CONTROLS ASSOCIATED WITH EXISTING HEAT EXCHANGERS ARE TO REMAIN.

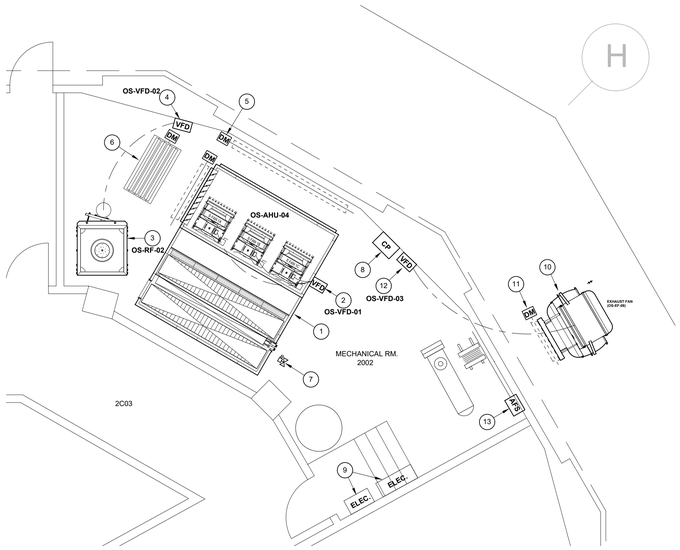
GENERAL NOTES:

1. CONTRACTOR TO CONFIRM EXACT EQUIPMENT LAYOUTS AND CONTROL LOCATIONS ON SITE BEFORE COMMENCING ANY DEMOLITION. CONTRACTOR SHALL BE RESPONSIBLE FOR IDENTIFYING ALL EXISTING SYSTEMS WHICH MAY BE AFFECTED BY THE WORK, AND REMOVE/MODIFY IN AN APPROVED MANNER TO ALLOW FOR A COMPLETE WORKING SYSTEM.
2. OWNER SHALL HAVE FIRST RIGHT OF REFUSAL ON EQUIPMENT TO BE DEMOLISHED. CONTRACTOR SHALL WALK THROUGH WITH OWNER REPRESENTATIVE PRIOR TO DEMO AND DOCUMENT WHAT SHALL BE TURNED OVER TO OWNER. CONTRACTOR WILL BE RESPONSIBLE FOR REMOVING ALL MATERIALS FROM SITE AND DISPOSAL.

PARTIAL GROUND FLOOR PLAN - CONTROLS DEMOLITION LAYOUT

SCALE: 1:50

0m 1m 2m 3m 4m 5m



PARTIAL GROUND FLOOR PLAN - NEW CONTROLS LAYOUT

SCALE: 1:50

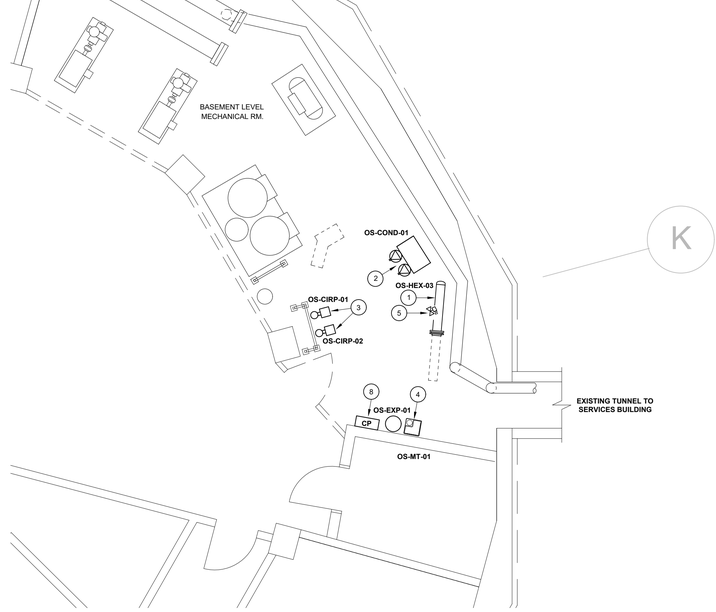
0m 1m 2m 3m 4m 5m

GENERAL NOTES:

1. ALL CONNECTIONS TO DEVICES IS SYMBOLIC ONLY, REFER TO CONTROLS SCHEMATICS.
2. COORDINATED LOCATION OF ALL VFD'S, STARTERS, AND OTHER DEVICES WITH OWNER PRIOR TO ROUGH IN TO AVOID CONFLICT WITH ANY EQUIPMENT, SHELVING, STORAGE, ETC.
3. CONTRACTOR TO PROVIDE UNI-STRUT TYPE SUPPORT SECURED TO WALL/FLOOR FOR DEVICES/PANELS WHERE REQUIRED.
4. REFER TO CONTROL SCHEMATICS FOR LOCATION OF ALL CONTROL COMPONENTS, DEVICES, FLOW METERS, TEMPERATURE SENSORS, DIFFERENTIAL PRESSURE SENSORS, CONTROL VALVES, ETC.

DRAWING NOTES:

1. NEW AIR HANDLING UNIT (OS-AHU-04), REFER TO CONTROL SCHEMATICS
2. NEW VARIABLE FREQUENCY DRIVE (VFD), SERVING AHU SUPPLY AIR FANS, REFER TO CONTROL SCHEMATICS.
3. NEW RETURN AIR FAN (OS-RF-02), REFER TO CONTROL SCHEMATICS.
4. NEW VARIABLE FREQUENCY DRIVE (VFD), SERVING RETURN AIR FAN (OS-RF-02), REFER TO CONTROL SCHEMATICS.
5. NEW OUTSIDE AIR CONTROL DAMPER. REFER TO CONTROL SCHEMATIC.
6. NEW EXHAUST AIR CONTROL DAMPER. REFER TO CONTROL SCHEMATIC.
7. NEW LOW PRESSURE STEAM CONTROL VALVE SERVING AHU HEATING COIL. REFER TO CONTROL SCHEMATIC.
8. NEW CONTROL PANEL.
9. EXISTING ELECTRICAL PANEL.
10. NEW EXHAUST AIR FAN (OS-EF-09), REFER TO CONTROL SCHEMATICS.
11. NEW EXHAUST AIR CONTROL DAMPER, REFER TO CONTROL SCHEMATICS.
12. NEW VARIABLE FREQUENCY DRIVE (VFD), SERVING RETURN AIR FAN (OS-EF-09), REFER TO CONTROL SCHEMATICS.
13. EXHAUST AIR FLOW MEASURING STATION INSTALLED IN EXHAUST AIR OPENING IN EXTERIOR WALL. REFER TO CONTROL SCHEMATICS.



PARTIAL BASEMENT LEVEL FLOOR PLAN - NEW CONTROLS LAYOUT

SCALE: 1:50

0m 1m 2m 3m 4m 5m

GENERAL NOTES:

1. ALL CONNECTIONS TO DEVICES IS SYMBOLIC ONLY, REFER TO CONTROLS SCHEMATICS.
2. CONFIRM LOCATION OF ALL VFD'S, STARTERS, AND OTHER DEVICES WITH OWNER PRIOR TO ROUGH IN TO AVOID CONFLICT WITH ANY EQUIPMENT, SHELVING, STORAGE, ETC.
3. CONTRACTOR TO PROVIDE UNI-STRUT TYPE SUPPORT SECURED TO WALL/FLOOR FOR DEVICES/PANELS WHERE REQUIRED.
4. REFER TO CONTROL SCHEMATICS FOR LOCATION OF ALL CONTROL COMPONENTS, DEVICES, FLOW METERS, TEMPERATURE SENSORS, DIFFERENTIAL PRESSURE SENSORS, CONTROL VALVES, ETC.

DRAWING NOTES:

1. NEW SHELL AND TUBE HEAT EXCHANGER.
2. NEW CONDENSATE RECEIVER TANK AND PUMP PACKAGE, REFER TO CONTROL SCHEMATIC.
3. NEW CIRCULATOR, REFER TO CONTROL SCHEMATIC.
4. NEW GLYCOL MIXING TANK.
5. NEW LOW PRESSURE STEAM CONTROL VALVE SERVING HEAT EXCHANGER, REFER TO CONTROL SCHEMATIC.
6. NEW DDC CONTROL PANEL.

A - DETAIL
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REGISTERED PROFESSIONAL ENGINEER
PEGNL Newfoundland and Labrador
DAVE ENNIS
SIGNATURE
2026 Apr 02
DATE
PROVINCE OF NEWFOUNDLAND

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PROJECT NAME:
OCEAN SCIENCES CENTRE MAIN BUILDING
(FACULTY OF ENGINEERING
& APPLIED SCIENCE)
AIR HANDLER REPLACEMENT (OS-AHU-03)
Project #: OS-506-23

DRAWING TITLE:
PARTIAL GROUND FLOOR PLAN - CONTROLS LAYOUT

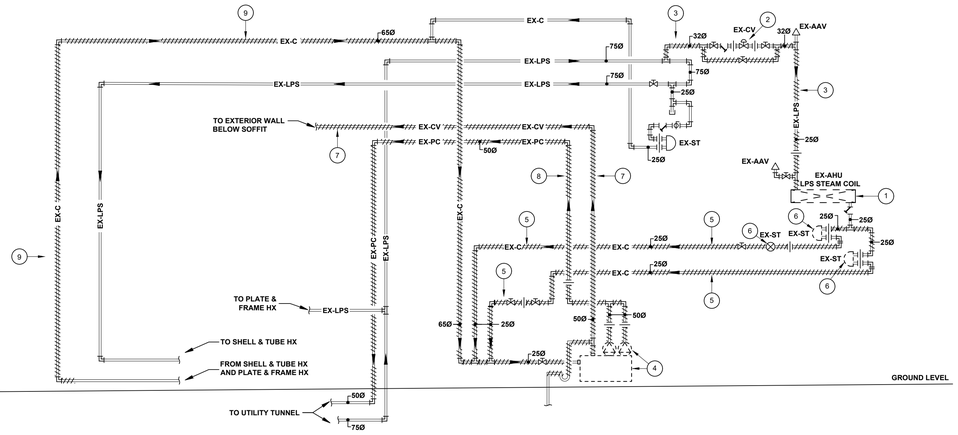
DESIGNED:	DRAWN:
D.E.	J.S.
REVIEWED: D.E.	APPROVED: D.E.
SCALE: AS NOTED	DATE: APRIL, 2026
PROJECT No. OS-506-23	DRAWING No. **M-4.1**

GENERAL NOTES:

1. CONTRACTOR TO CONFIRM EXACT EQUIPMENT AND PIPING LAYOUTS ON SITE BEFORE COMMENCING ANY DEMOLITION. CONTRACTOR SHALL BE RESPONSIBLE FOR IDENTIFYING ALL EXISTING SYSTEMS WHICH MAY BE AFFECTED BY THE WORK, AND REMOVE/MODIFY IN AN APPROVED MANNER TO ALLOW FOR A COMPLETE WORKING SYSTEM.
2. WALLS, CEILINGS AND MECHANICAL INSULATION KNOWN TO CONTAIN ASBESTOS AND/OR LEAD BASED PAINT. ALL ABATEMENT SHALL BE COMPLETED BY CONTRACTOR PRIOR TO STARTING WORK. REFER TO ASBESTOS SURVEY REPORT.

DRAWING NOTES:

1. EXISTING STEAM COIL IN AIR HANDLING UNIT TO BE REMOVED. REMOVE ALL ASSOCIATED PIPING, HANGERS, SUPPORTS, AND INSULATION BACK TO LOCATION INDICATED.
2. EXISTING STEAM PNEUMATIC CONTROL STEAM VALVE TO BE REMOVED.
3. ALL EXISTING STEAM PIPING SERVING AHU STEAM HEATING COIL TO BE REMOVED C/W WITH ALL ASSOICATED PIPING FITTINGS, ACCESSORIES, SUPPORTS, HANGERS AND INSULATION.
4. EXISTING CONDENSATE RECEIVER TANK C/W WITH PUMPS TO BE REMOVED.
5. EXISTING CONDENSATE PIPING SERVING EXISTING AHU STEAM COIL TO BE REMOVED BACK TO CONDENSATE RECEIVER TANK. REMOVE ALL PIPE ACCESSORIES, FITTINGS, HANGERS, SUPPORTS, AND INSULATION.
6. EXISTING STEAM TRAP TO BE REMOVED.
7. EXISTING CONDENSATE RECEIVER VENT PIPE TO BE REMOVED.
8. EXISTING SECTION OF CONDENSATE PUMP PIPING TO BE REMOVED.
9. EXISTING CONDENSATE PIPING FROM EXISTING HEAT EXCHANGERS TO BE REMOVED.



EXISTING HEATING SYSTEM FLOW DEMOLITION SCHEMATIC

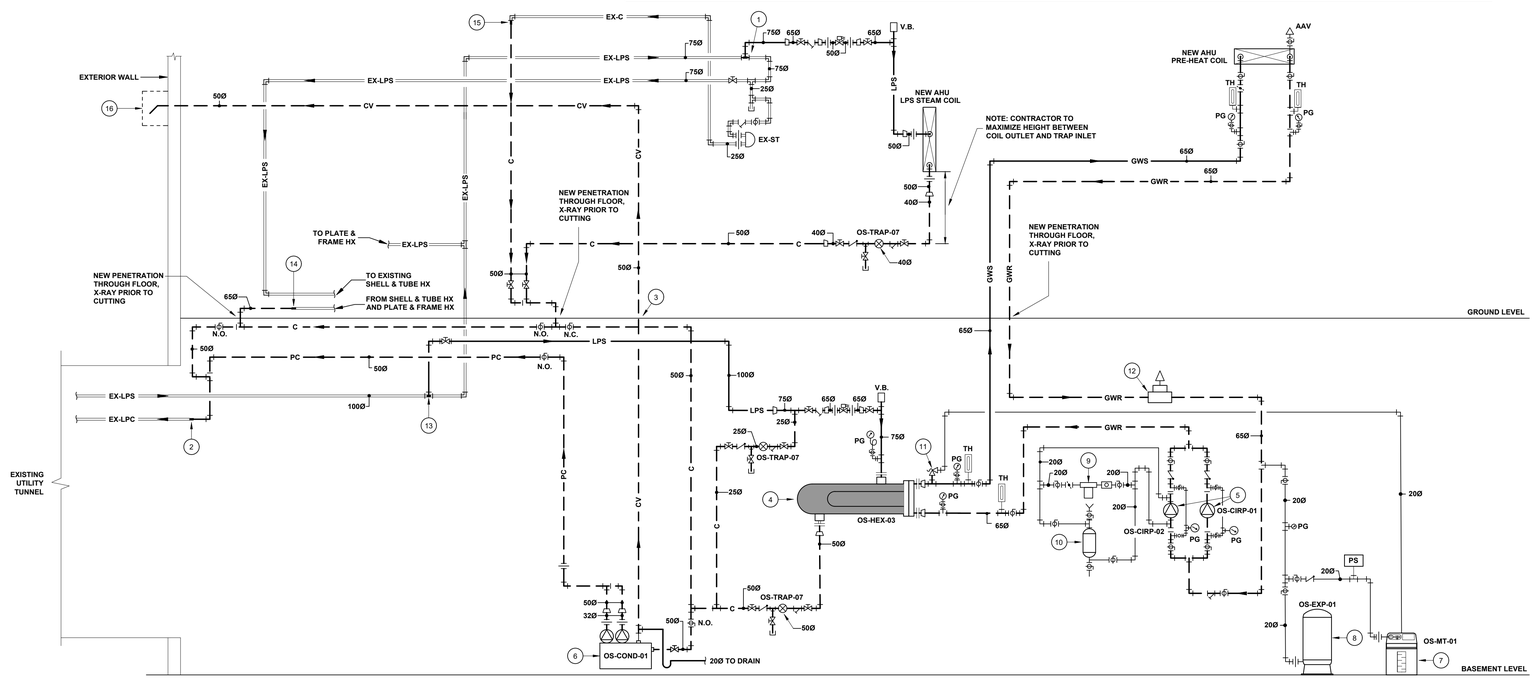
SCALE: N.T.S.

GENERAL NOTES:

1. PROVIDE SYSTEM DRAINS IN MECH ROOM AT ALL LOW POINTS C/W BALL VALVE, AND CAP.
2. PROVIDE AUTOMATIC AIR VENTS AT ALL SYSTEM HIGH POINTS.
3. TRANSITION ALL LINE SIZES TO EQUIPMENT SIZE AND EQUIPMENT.
4. PROVIDE REMOVABLE INSULATION COVERS ON BOTH HEAT EXCHANGER SHELL AND HEAD. COVERS SHALL BE PER SPECIFICATION AND PERMIT EASY REMOVAL AND REINSTATEMENT.
5. HEAT EXCHANGER NAMEPLATE TO BE LEFT EXPOSED SUCH THAT ITS EASILY READABLE BY GOVERNMENT SERVICES.
5. PROVIDE MANUAL RESET SWITCHES ON HEAT EXCHANGERS AS REQUIRED BY SERVICE NL. SWITCHES TO BE OPERATED FROM GROUND LEVEL.
6. CONTRACTOR SHALL COORDINATE ALL PIPING ON SITE AND SHALL COORDINATE ALL INSTRUMENTATION CONNECTIONS ON PIPING PRIOR TO RELEASING FABRICATION.
7. CONTRACTOR TO REFER TO SPECIFICATION, DETAILS AND FLOOR PLANS FOR ALL REQUIREMENTS.
8. ALL HYDRONIC AND STEAM COILS & HEAT EXCHANGER SHALL BE PROVIDE WITH NL CRN'S.

DRAWING NOTES:

1. CONNECT NEW WELDED 75 x 75 x 75 TEE INTO EXISTING LOW PRESSURE (41 KPA) STEAM PIPING. VERIFY PRESSURE WITH POWER ENGINEER PRIOR TO SUBMITTING PERMITTING. TEE BRANCH CONNECTION SHALL BE TAKEN OFF WITH TOP OF THE PIPE.
2. CONNECT NEW CONDENSATE INTO EXISTING AT EXISTING TUNNEL ENTRANCE.
3. CORE NEW HOLE IN FLOOR AND ROUTE NEW CONDENSATE TANK VENT PIPING TO EXTERIOR OF BUILDING.
4. NEW SHELL AND TUBE HEAT EXCHANGER, REFER TO SCHEDULE.
5. NEW CIRCULATOR PUMP. REFER TO SCHEDULE
6. NEW CONDENSATE RECEIVER TANK AND PUMP PACKAGE. REFER TO SCHEDULE
7. AUTOMATIC GLYCOL MAKE-UP SYSTEM (OS-MT-1) EQUAL TO AXIOM MF200 WITH 25L TANK AND 170kPa OUTLET PRESSURE CAPABILITY. C/W LOW LEVEL ALARM AND REMOTE CONTACTS
8. EXPANSION TANK. REFER TO SCHEDULE.
9. SIDE STREAM CARTRIDGE FILTER, 250mm LONGx100mmØ, C/W 10 MICRON DISPOSABLE FILTER AND 20mm INLET/ OUTLET BALL VALVES. FILTER TO BE RATED FOR A MIN. OF 413kPa. PROVIDE FOUR SPARE FILTERS. SHALL BE C/W SIGHT FLOW INDICATOR AND PORTED BALANCING VALVE.
10. BYPASS POT FEED ASSEMBLY RATED FOR 10346kPa, 7.6L CAPACITY WITH 20 MESH STRAINER. EQUAL TO AXIOM CBF-2. PROVIDE UNI-STRUT FLOOR SUPPORT STAND.
11. PRESSURE RELIEF VALVE RATED FOR 517 KPA (75PSI) ORIFICE AREA D (0.126"). FLOW CAPACITY 34 GPM, 20MM INLET, 20MM OUTLET, ASME SECTION VIII RATED WITH NL CRN. AQUATROL 740 OR APPROVED EQUAL. PIPE AS INDICATED.
12. INLINE AIR SEPARATOR, EQUAL TO WATTS SERIES "AS"
13. CONNECT NEW WELDED 100 x 100 x 100 TEE INTO EXISTING LOW PRESSURE (41 KPA) STEAM PIPING. VERIFY PRESSURE WITH POWER ENGINEER PRIOR TO SUBMITTING PERMITTING. TEE BRANCH CONNECTION SHALL BE TAKEN OFF WITH TOP OF THE PIPE.
14. CONNECT EXISTING CONDENSATE PIPING SERVING EXISTING HEAT EXCHANGERS TO NEW PIPING.
15. CONNECT EXISTING CONDENSATE PIPING SERVING STEAM MAIN DRIP LEG INTO NEW CONDENSATE PIPING.
16. NEW STEAM VENT WITH BIRDSCREEN CAGE AROUND IT. INSTALL WARNING SIGN WITH BLOCK LETTERS ON YELLOW BACKGROUND. "CAUTION STEAM VENT"



NEW HEATING SYSTEM FLOW SCHEMATIC

SCALE: N.T.S.

A - DETAIL
B - LOCATION/DRAWING No.
C - DRAWING No.

No.	REVISION	DATE (Y/M/D)
R0	ISSUED FOR TENDER	2026/04/02

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REGISTERED PROFESSIONAL ENGINEER
PEGNL Newfoundland and Labrador
DAVE ENNIS
SIGNATURE
2026 Apr 02
DATE
PROVINCE OF NEWFOUNDLAND

PROVINCE OF NEWFOUNDLAND
PEGNL PERMIT HOLDER
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CORE PROJECT #24-3536

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- Dedication plaque, Arts & Administration Building, St. John's Campus

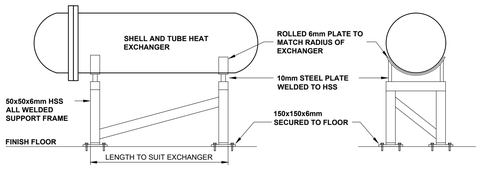
PROJECT NAME:

OCEAN SCIENCES CENTRE MAIN BUILDING
(FACULTY OF ENGINEERING & APPLIED SCIENCE)
AIR HANDLER REPLACEMENT (OS-AHU-03)
Project #: OS-506-23

DRAWING TITLE:

DEMOLITION AND NEW PIPING FLOW SCHEMATIC

DESIGNED:	DRAWN:
D.E.	J.S.
REVIEWED:	APPROVED:
D.E.	D.E.
SCALE:	DATE:
AS NOTED	APRIL, 2026
PROJECT No.	DRAWING No.
OS-506-23	**M-5.1**

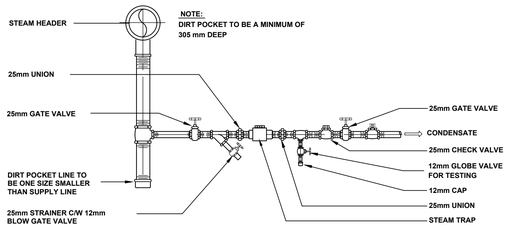


NOTES:
1. DO NOT WELD HEAT EXCHANGER SHELL TO SADDLES.
2. PROVIDE SUPPORTS IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS.

SHELL & TUBE EXCHANGER SUPPORT DETAIL

SCALE: N.T.S.

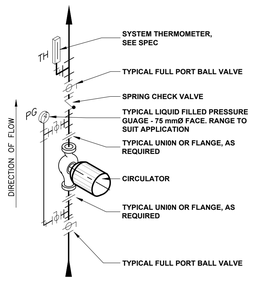
7 / 6.1



STEAM DRIP LEG & STEAM TRAP DETAIL

SCALE: N.T.S.

8 / 6.1

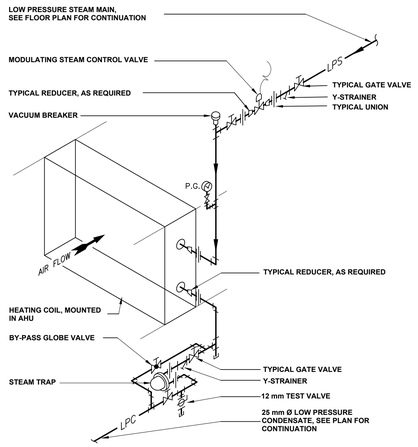


NOTES:
1. UNLESS NOTED OTHERWISE ON THE DRAWINGS, ALL INLINE CIRCULATORS TO HAVE SAME COMPONENTS/ ARRANGEMENT.

TYPICAL INLINE CIRCULATOR PIPE/FITTING ARRANGEMENT

SCALE: N.T.S.

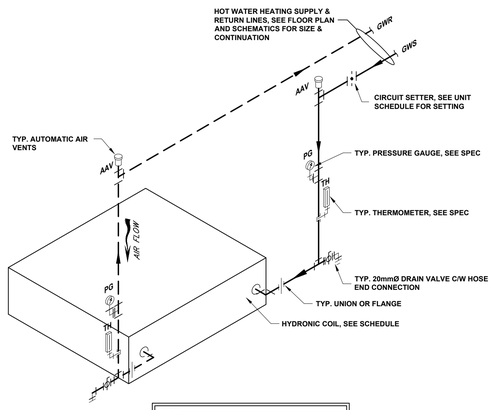
4 / 6.1



STEAM HEATING COIL PIPING DETAIL
AIR HANDLING UNIT MOUNTED

SCALE: N.T.S.

5 / 6.1

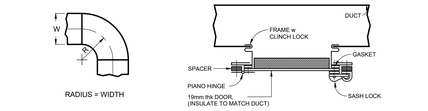


NOTE:
1. REFER TO FLOOR PLANS FOR PIPE SIZING.

UNIT MOUNTED HYDRONIC HEATING COIL PIPING DETAIL

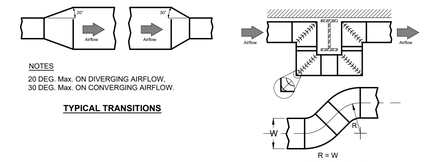
N.T.S.

6 / 6.1



STANDARD RADIUS ELBOW

TYP. DUCT MTD. ACCESS DOOR

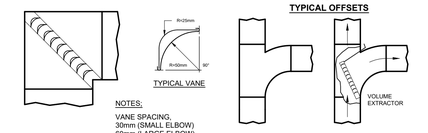


NOTES
20 DEG. Max. ON DIVERGING AIRFLOW,
30 DEG. Max. ON CONVERGING AIRFLOW.

TYPICAL TRANSITIONS

R = W

TYPICAL OFFSETS



NOTES;
VANE SPACING,
30mm (SMALL ELBOW)
60mm (LARGE ELBOW)

TYPICAL VANED ELBOWS

TYPICAL "TEE" CONNECTIONS

NOTES:
1. ALL DUCTWORK CONSTRUCTION SHALL CONFORM TO SMACNA LOW AND/OR HIGH VELOCITY DUCT STANDARDS AS REQUIRED.
2. NOT ALL CONDITIONS SHOWN ABOVE MAY APPLY TO THIS JOB. COORDINATE ON-SITE

TYP. DUCT CONSTRUCTION STANDARDS

SCALE: N.T.S.

1 / 6.1

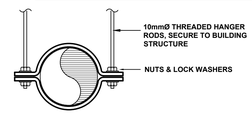
DUCT HANGER SCHEDULE

RECTANGULAR DUCT

LONGEST DIMENSION OF DUCT (mm)	HANGER ROD (mmØ)	STRAP HANGERS (mm)	TRAPEZE SHELF HANGERS (mm)	MAX. SPACING (mm)
UP TO 457	3.26 WIRE	25 x 1.29 tk.	25 x 25 x 3.2	3050
483 - 750	3.26 WIRE	25 x 1.29 tk.	25 x 25 x 3.2	3050
787 - 1067	6.35	25 x 1.29 tk.	40 x 40 x 3.2	3050
1092 - 1524	10.5	25 x 1.29 tk.	40 x 40 x 3.2	3050
1550 - 2134	10.5	40 x 1.29 tk.	50 x 50 x 3.2	2438

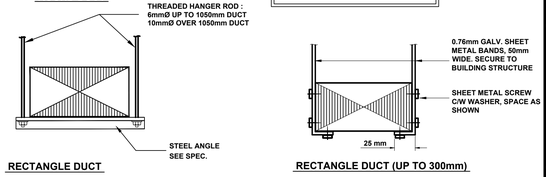
ROUND DUCT

DUCT DIAMETER (mmØ)	HANGER ROD (mmØ)	STRAP HANGERS (mm)	No. OF HANGERS	MAX. SPACING (mm)
UP TO 457	3.26 WIRE	25 x 1.29 tk.	1	3050
483 - 750	---	25 x 2.05 tk.	1	3050
787 - 1067	---	50 x 1.29 tk.	1	3050



ROUND DUCT

NOTE:
ALL HANGER RODS TO BE SECURELY FASTENED TO BUILDING STRUCTURE.



RECTANGLE DUCT

RECTANGLE DUCT (UP TO 300mm)

TYP. DUCT SUPPORT DETAILS

SCALE: N.T.S.

2 / 6.1

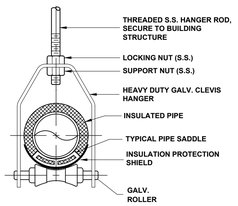
HANGER ROD SCHEDULE

PIPE SIZE (mm)	ROD SIZE (mm)	PIPE SIZE (mm)	ROD SIZE (mm)
UP TO 50	9.5 DIA.	100 THRU 125	16 DIA
65 THRU 75	12.7 DIA.	150 THRU 300	22 DIA.

HANGER ROD SPACING

PIPE SIZE (mm)	25	32	40	50	65	75	100	125	150	200	250	300
MAXIMUM ALLOWABLE SPACING (METERS)	2.1	2.4	2.7	3.0	3.3	3.6	4.2	4.8	5.1	5.7	6.7	7.0

NOTE: FOR TRAPEZE HANGER , TAKE SPACING FOR SMALLEST DIAMETER PIPE



PIPE HANGER DETAIL

SCALE: N.T.S.

3 / 6.1

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REGISTERED PROFESSIONAL ENGINEER
PEGNL Newfoundland and Labrador
DAVE ENNIS
SIGNATURE
2026 Apr 02
DATE
PROVINCE OF NEWFOUNDLAND

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PEGNL
PERMIT HOLDER
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(FACULTY OF ENGINEERING & APPLIED SCIENCE)
AIR HANDLER REPLACEMENT (OS-AHU-03)
Project #: OS-506-23

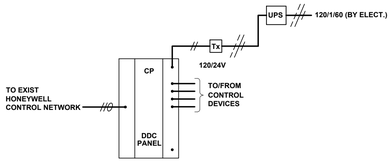
DRAWING TITLE:
MECHANICAL DETAILS

DESIGNED:	DRAWN:
D.E.	J.S.
REVIEWED:	APPROVED:
D.E.	D.E.
SCALE:	DATE:
AS NOTED	APRIL, 2026
PROJECT No.	DRAWING No.
OS-506-23	**M-6.1**

CONTROLS LEGEND

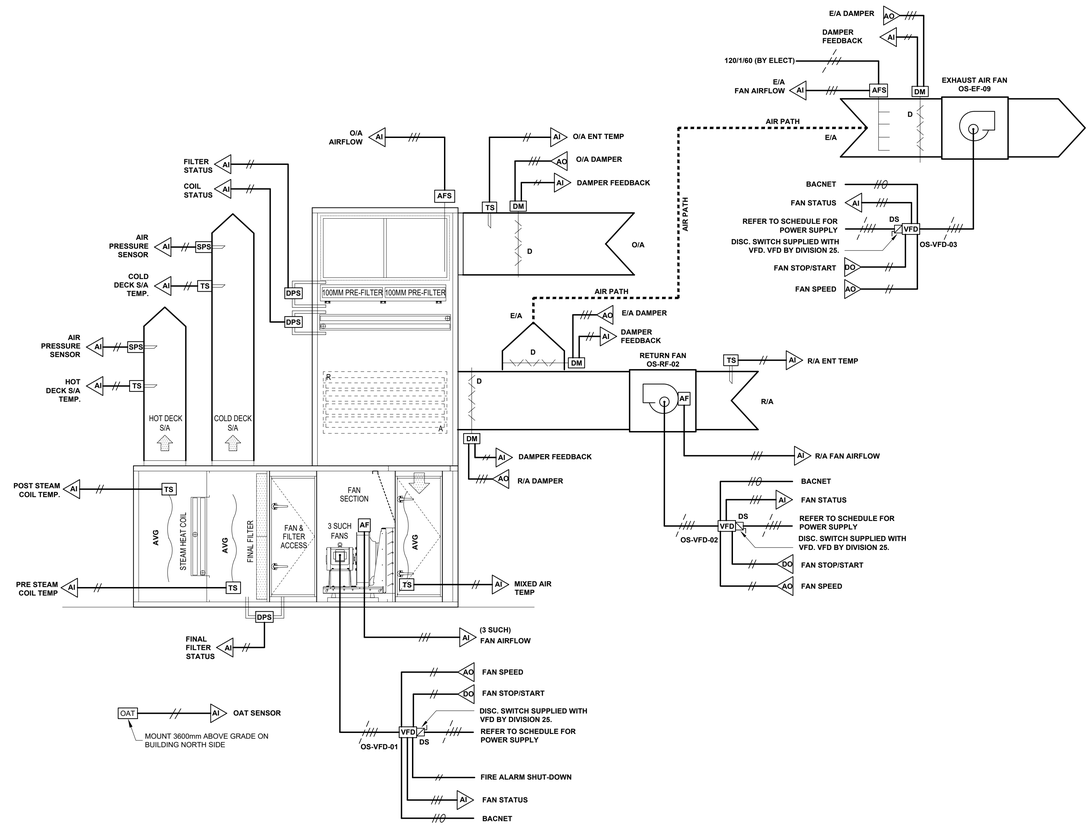
TS	TEMPERATURE SENSOR DUCT MOUNTED/PIPE MOUNTED. PROVIDE IMMERSION WELL FOR PIPE MOUNTED APPLICATION. PROVIDE CORRECT LENGTH ELEMENT FOR AVERAGING APPLICATION.
DPS1	ANALOG DIFFERENTIAL LIQUID PRESSURE SENSOR WITH REMOTE SENSORS, +/- 1% ACCURACY, 4-20mA OUTPUT, LOCAL LCD DISPLAY, 0-100 PSI RANGE, 24VAC POWER. EQUAL TO GREYSTONE DP SERIES.
DPS	DIFFERENTIAL STATIC AIR PRESSURE SENSOR. SIZE TO SUIT APPLICATION. RANGE: 0-500 Pa ACCURACY +/- 2%. 4-20mA OUTPUT, AND FIELD CALIBRATION C/W LCD DISPLAY FOR FIELD MONITORING.
SPS	STATIC AIR PRESSURE SENSOR. SIZE TO SUIT APPLICATION. RANGE: 0-500 Pa ACCURACY +/- 2%, 4-20mA OUTPUT, AND FIELD CALIBRATION C/W LCD DISPLAY FOR FIELD MONITORING.
PS-H	HIGH PRESSURE & TEMPERATURE SENSOR COMPLETE WITH SIPHON AND COOLING ELEMENT, PRESSURE RATED WELL AND CRN. REFER TO SPECIFICATION.
TS-H	HIGH TEMPERATURE SENSOR COMPLETED WITH WELDED THERMOWELL CRN, REFER TO SPECIFICATION.
SP	PRESSURE SENSOR FOR LIQUID APPLICATION WITH 4-20mA OUTPUT, ACCURACY: +/- 2% RANGE: 0-150kPa.
DM	DAMPER MOTOR (MODULATING: AO), (2-POSITION: DO) MINIMUM TORQUE 133 in-lb. VOLTAGE: 24 VAC C/W INSULATED DAMPER OF SIZE TO SUIT DUCT.
D	INSULATED DAMPER, "TAMCO" 9000-SW SERIES c/w SALT WATER RESISTANCE OPTION . SIZE TO SUIT DUCT WITH CLEAR INSIDE DIMENSIONS OF DAMPER TO MATCH DUCT
V1	MODULATING 2 WAY GLOBE CONTROL VALVE C/W ANALOG POSITION FEEDBACK, 24 VAC FAIL IN POSITION ACTUATOR WITH MANUAL OVERRIDE AND CV AS INDICATED. "BELIMO" OR APPROVED EQUAL.
HL	NEW HONEYWELL AQUASTAT SINGLE POLE DOUBLE THROW SWITCH. ADJUSTABLE HIGH LIMIT SET AT 97.8°C (208°F).
PL	HONEYWELL PRESSURETROL HIGH PRESSURE LIMIT SWITCH ADJUSTABLE BETWEEN 70 kPA TO 1035 kPA. SET AT 689 kPa (100 PSI). CONFIRM PRESSURE SETTING LIMIT WITH ANNEX PRIOR TO START-UP.
AF	FAN INLET AIRFLOW PIEZOMETRIC RING TYPE MEASUREMENT STATION. 4-20mA OUTPUT. CALIBRATE OUTPUT DURING BALANCING. ACCURACY: ± 2%.
AFS	AIRFLOW MEASURING STATION EBTRON OR APPROVED EQUAL SIZED TO SUIT DUCT AND AIRFLOW. ACCURACY: +/- 1% 4-20mA OUTPUT. CALIBRATE DURING COMMISSIONING.
VFD	VARIABLE FREQUENCY MOTOR DRIVE BY CONTROLS CONTRACTOR, U/L/C LABELED WITH FULL GRAPHIC INTERFACE, PROGRAMMABLE GENERAL ALARM OUTPUT, RATED FOR +/- 10% OF MOTOR VOLTAGE, SIZED TO SUIT MOTOR LOAD, BACNET INTERFACE NEMA1 ENCLOSURE, C/W DISC. SWITCH, HAND-OFF-AUTO CONTROL WITH MANUAL SPEED ADJUSTMENT. MOUNT 1200mm A.F.F.
OAT	OUTSIDE AIR TEMPERATURE SENSOR, GREYSTONE OR EQUAL.
ECM	ELECTRONIC CONTROL MODULE SUPPLIED WITH PUMP. 0-10VDC CONTROL SIGNAL
	DISCONNECT SWITCH (BY ELECTRICAL TRADE UNLESS OTHERWSE NOTED)
Tx	CONTROL TRANSFORMER PROVIDE 120/24 VAC CONTROL TRANSFORMERS AS REQUIRED, SIZE TO SUIT LOADS
UPS	UNINTERRUPTED POWER SUPPLY, SIZED FOR MIN. 30 MINUTES RUN TIME.
////	SHIELDED WIRE PROVIDE SHIELDED WIRE WHERE SHOWN AND WHERE NECESSARY
////	INDICATES # OF WIRES CONTRACTOR TO VERIFY AND INCLUDE ADEQUATE WIRING IN TENDER PRICE TO SUIT DDC CONTRACTOR
DO	DIGITAL OUTPUT SIGNAL FROM THE DDC PANEL
DI	DIGITAL INPUT SIGNAL TO THE DDC PANEL
AO	ANALOG OUTPUT SIGNAL FROM THE DDC PANEL
AI	ANALOG INPUT SIGNAL TO THE DDC PANEL

NOTES:
1. PROVIDE LAMECOID LABELS FOR ALL EQUIPMENT.
2. ALL CONTROL WIRING 50 VOLTS & LESS AND CONDUIT TO BE SUPPLIED AND INSTALLED BY CONTROLS CONTRACTOR.
3. ALL CONTROL DEVICES SHOWN ABOVE TO BE SUPPLIED BY CONTROLS CONTRACTOR UNLESS NOTED OTHERWISE.
4. LINE VOLTAGE WIRING AND CONDUIT BY ELECTRICAL.
5. FIRE ALARM WIRING AND CONDUIT BY ELECTRICAL.



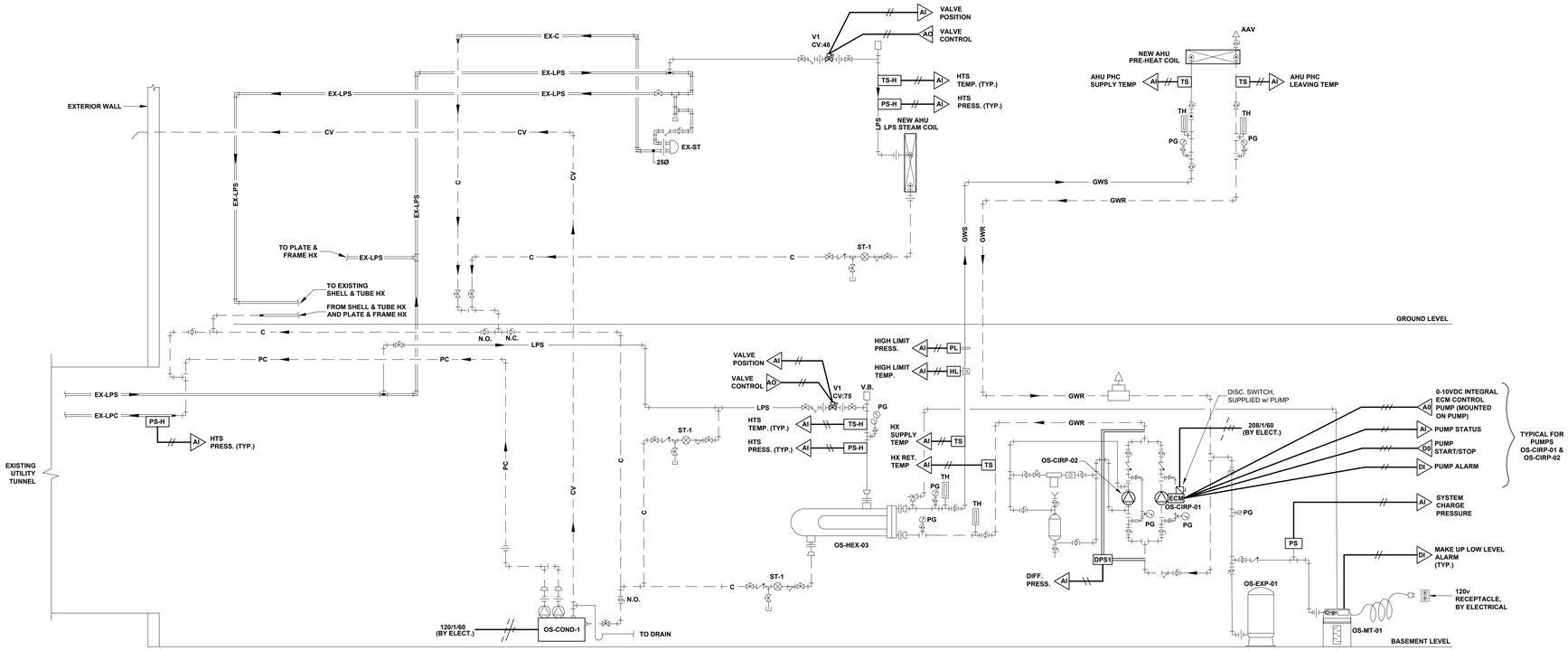
DDC SYSTEM ARCHITECTURE

SCALE: N.T.S.



AIR HANDLING UNIT CONTROL SCHEMATIC (OS-AHU-04)

SCALE: N.T.S.



NEW HEATING SYSTEM FLOW CONTROL SCHEMATIC

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(FACULTY OF ENGINEERING & APPLIED SCIENCE)
AIR HANDLER REPLACEMENT (OS-AHU-03)
Project #: OS-506-23

DRAWING TITLE:

CONTROL SCHEMATICS

DESIGNED: D.E.	DRAWN: J.S.
REVIEWED: D.E.	APPROVED: D.E.
SCALE: AS NOTED	DATE: APRIL, 2026
PROJECT No. OS-506-23	DRAWING No. **M-7.1**

MECHANICAL LEGEND

PIPING

- EXISTING PIPING TO BE REMOVED
- EXISTING PIPING TO REMAIN
- EX-LPS — EXISTING LOW PRESSURE STEAM PIPING
- EX-C — EXISTING CONDENSATE PIPING
- EX-PC — EXISTING PUMPED CONDENSATE PIPING
- EX-CV — EXISTING CONDENSATE TANK VENT RELIEF PIPING
- EX-HWS — EXISTING HYDRONIC HEATING SUPPLY PIPING
- EX-HWR — EXISTING HYDRONIC HEATING RETURN PIPING
- LPS — NEW LOW PRESSURE STEAM PIPING
- LPC — NEW LOW PRESSURE CONDENSATE PIPING
- C — NEW CONDENSATE PIPING
- CV — NEW CONDENSATE TANK VENT PIPING
- PC — NEW PUMPED CONDENSATE PIPING
- GWS — NEW GLYCOL HEATING RETURN PIPING
- GWR — NEW GLYCOL HEATING SUPPLY PIPING
- GATE VALVE
- GLOBE VALVE
- CHECK VALVE
- BALL VALVE
- BUTTERFLY VALVE
- CIRCUIT SETTER BALANCING VALVE
- ELBOW UP AND DOWN
- EXISTING PNEUMATIC CONTROL VALVE
- CONTROL VALVE
- PRESSURE REDUCING VALVE
- "Y" STRAINER
- UNION SCREWED OR FLANGED
- STEAM TRAP
- ST-X — FLEXIBLE CONNECTOR
- RELIEF VALVE
- AAV — AUTOMATIC AIR VENT
- PG — PRESSURE GAUGE
- PG — PRESSURE GAUGE WITH PIGTAIL SIPHON
- TH — THERMOMETER
- REDUCER, CONCENTRIC AND ECCENTRIC
- CIRCULATOR, FOR DESCRIPTION SEE SCHEDULE
- NEW HEATING COIL
- INDICATES DETAIL NUMBER / INDICATES DRAWING SHOWN ON

H.V.A.C

- EXISTING DUCTWORK TO REMAIN
- EXISTING DUCTWORK TO BE REMOVED
- UN-INSULATED DUCTWORK
- THERMALLY INSULATED DUCTWORK
- ROUND DUCTWORK
- DUCTS UP
- DUCTS DOWN
- DUCT ELBOWS, or 0.5 AS REQ'D, VANED 90° ELBOW.
- DUCT TRANSITIONS; RECT./ROUND, RECT./RECT.
- B.D. — BACKDRAFT DAMPER
- DM — MOTORIZED DAMPER c/w ACTUATOR

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EXPANSION TANK SCHEDULE

NO.	SERVING	MANU	MODEL	TYPE	MIN. TANK ACC. VOLUME (L)	FLUID	NOTES
OS-EXP-03	AHU PRE-HEAT LOOP	CALEFACTIO	OT SERIES	FIXED BLADDER	24	40% ETH GLY	

NOTES: 1. RATED FOR MIN 962kPa

HEAT TRANSFER FLUID MIXTURE SCHEDULE

SYSTEM	TYPE	DESIGN TEMP(°C)	FREEZE PROTECTION TEMP(°C)	% GLYCOL MIX BY VOL.	VISCOSITY AT -1.1°C(cps)	REMARKS
AHU PREHEAT LOOP	INHIBITED PROPYLENE GLYCOL	-16 TO 93	-20	40	8.8	DOWFROST OR APPROVED EQUAL.

NOTES: 1. C/W CORROSION INHIBITORS.
2. RESERVE ALKALINITY SHALL BE IDENTIFIED ON THE PRODUCT SUBMITTAL.

STEAM TRAP SCHEDULE

TAG	MANUFACTURER	MODEL	TYPE	CAPACITY (kg/hr)	CONNECTION SIZE (mm)	REMARKS
OS-TRAP-07	SPIRAX-SARCO	FT-15	FLOAT & THERMOSTATIC	-	LINE SIZE	RATED FOR 103 kPa OPERATING

NOTE:
1. CRN FOR NL

CONDENSATE TRANSFER UNIT SCHEDULE

TAG	AREA LOCATED	MANUFACTURER/MODEL	DISCHARGE PRESSURE(kPa)	PUMP CAPACITY (L/S)	RECEIVER CAPACITY (L)	MOTOR (KW)	ELECTRICAL DATA				
							VOLT	PH	CYC	MOCP	MCA
OS-COND-01	BASEMENT	SPIRAX SARCO V SERIES	137	0.75	79.0	0.37 EACH	120	1	60	--	--

1. WELDED STEEL CONSTRUCTION
2. INCLUDE ONE SPARE FITTING WITH PLUG ON TANK.
3. COMPLETE WITH CONTROL PANEL MOUNTED TO RECEIVER, DUPLEX WITH TWO FLOAT SWITCHES, GAUGE GLASS.
4. CORROSION RESISTANT LINER, DISCHARGE PRESSURE GAUGE, DISCHARGE GATE VALVE.

PUMP SCHEDULE

TAG	SERVICE	MANUFACTURER	MODEL	FLUID	TYPE	FLANGE SIZE	DIFF. HEAD (kPa)	FLOW RATE (L/s)	% EFF	RPM	MOTOR BHP(kW)	MOTOR (kW)	ELECTRICAL DATA			REMARKS
													VOLT	PH	CYC	
OS-CIRP-01 OS-CIRP-02	AHU PRE-HEAT LOOP	TACO	VR25H	40% PROP. GLY.	INLINE CIRCULATOR	50Ø	89	4.73	57	4000	-	1.55	208	1	60	ECM MOTOR

NOTE:
1. ALL PUMPS TO BE SUPPLIED WITH ECM DUTY MOTORS(TEFC)

FAN SCHEDULE

SYMBOL	SERVING	MANUFACTURER	MODEL	TYPE	CAPACITY (L/S)	PRESSURE LOSS (Pa)	DRIVE	CURB	RPM	ELECTRICAL DATA					WEIGHT (KG)	BACK-DRAFT DAMPER	REMARKS
										B.H.P. (kW)	MOTOR (kW)	VOLT	PH	CYC			
OS-RF-02	BUILDING RETURN VENTILATION	COOK	SQN-B 245	CENTRIFUGAL SQUARE INLINE	4,719	125	BELT DRIVE	-	1088	2.72	3.73	575	3	60	145	-	C/W DISC. SWITCH, VIBRATION ISOLATION SUSPENSION KIT, EPOXY COATING, INLET PIEZOMETRIC RING FOR AIRFLOW MEASURING.
OS-EF-09	BUILDING EXHAUST VENTILATION	COOK	VCR 300	BELT DRIVE SIDEWALL MOUNTED	4,719	112	BELT DRIVE	-	626	1.5	2.23	575	3	60	100	-	C/W DISC. SWITCH, EPOXY COATING.

NOTES:
1. ALL FANS TO BE SUPPLIED WITH INVERTOR DUTY MOTORS SUITABLE FOR VFD'S
2. PRESSURE LOSS ABOVE IS FAN EXTERNAL PRESSURE AT SUCTION CONNECTION ALL INTERNAL LOSSES, DISCHARGE CONE LOSSES, ETC. SHALL BE ADDED TO FAN SELECTION.

SHELL AND TUBE HEAT EXCHANGER SCHEDULE

NO.	LOCATION	MANUFACTURER	MODEL	SERVICE	CAPACITY (KW)	SHELL SIDE				TUBE SIDE					MINIMUM SURFACE AREA (M^2)	NUMBER OF PASSES (SHELL/TUBE)	MAX LENGTH (M)	MATERIAL			REMARKS
						FLUID	FLOW (KG/HR)	INLET PRESS. (kPa)	PRESS DROP (kPa)	DESIGN PRESS(kPa)	FLUID	FLOW (L/S)	EWT °C	LWT °C	PRESS DROP (kPa)	DESIGN PRESS (kPa)				SHELL	TUBE	HEAD	
OS-HEX-03	BASEMENT LEVEL MECHANICAL ROOM	XYLEM STANDARD XCHANGE	-	AHU PREHEAT COIL	296	LOW PRESSURE STEAM (41KPA)	478	41	28.5	1,043	40% PROP. GLYCOL	4.73	87.7	71.1	12	1,043	3.6	(1/2)	1.06	STEEL	COPPER	CAST IRON	0.0000881 M2°K/W TUBESIDE FOULING FACTOR

NOTES:
1. EXCHANGERS TO BE SUPPLIED WITH SHELL DRAIN CONNECTION AND --MM DIA. NPT TOP RELIEF VALVE CONNECTION.
2. EXCHANGERS TO BE ASME ASME Sect VIII Div 1 CONSTRUCTION WITH NL CRN.
3. NON-ASBESTOS GASKETS

AIR HANDLING UNIT SCHEDULE

SYMBOL	SERVING	MANUFACTURER/ MODEL	FAN DATA (SUPPLY SIDE)							GLYCOL PRE-HEAT COIL										HOT DECK LOW PRESSURE STEAM HEATING COIL										MOTOR DATA (SUPPLY SIDE)		SUPPLY FAN ELECTRICAL		FILTERS		UNIT WEIGHT (KG)	REMARKS
			NO. FANS	FAN TYPE	TOT. CAP. (L/s)	CAP. EACH (L/s)	EXT. SP. (Pa)	B.H.P. (kW)	MOTOR (kW)	FLUID	AIRFLOW (L/S)	TOTAL CAPACITY (kW)	EWT (°C)	LWT (°C)	FLOW (L/s)	EAT (°C)	LAT (°C)	MAX FINS PER INCH	FLUID MAX DP (kPa)	AIR MAX DP (Pa)	FLUID	AIRFLOW (L/S)	TOTAL CAPACITY (kW)	ENT. TEMP (°C)	FLOW (KG/HR)	EAT (°C)	LAT (°C)	MAX FINS PER INCH	FLUID MAX DP (kPa)	AIR MAX DP (Pa)	kW	VOLTAGE	MCA	MOCP	PRE-FILTERS	FINAL		
OS-AHU-04	BUILDING VENTILATION	CUSTOM DUAL DECK	3	MODULAR PLENUM AIRFOIL	8260	2753	995	9.9 (EACH)	11.2 (EACH)	40% PROP. GLYCOL	8260	260	87.7	71.1	4.73	-16	10	8	7.5	44	STEAM	4719	190	110	306.7	10	43.3	8	-	74	11.2 (EACH)	600/3/60	63.75	80	100mm DEEP PLEATED MERV 9	300mm DEEP PLEATED MERV 14	-	SEE SPECIFICATIONS FOR ADDITIONAL REMARKS.

NOTES:
1. UNIT TO BE SUPPLIED WITH SINGLE VFD TO DRIVE SUPPLY FANS.
2. UNIT TO HAVE 316 STAINLESS STEEL INNER LINER.
3. FAN CELLS TO HAVE BACKDRAFT DAMPERS AND AIR FLOW STATION
4. ALL COILS TO HAVE CRN FOR NL.
5. ALL DAMPERS SHALL BE MARINE GRADE.
6. ANTI-CORROSION PHENOLIC COATINGS FOR PREHEAT COIL AND STEAM HEATING COIL. 316 CASING, HEADERS.
7. UNIT SHALL BE ASSEMBLED ON SITE IN PIECES SMALL ENOUGH TO BE BROUGHT IN THROUGH EXISTING DOOR WAYS.
8. HOT DECK / COLD DECK DAMPERS.
9. VICTAULITC CONNECTIONS FOR GLYCOL PREHEAT COIL
10. PIZO RINGS FOR FAN INLETS

REGISTERED PROFESSIONAL ENGINEER
PEGNL Newfoundland and Labrador
DAVE ENNIS
SIGNATURE
2026 Apr 02
DATE
PROVINCE OF NEWFOUNDLAND

PROVINCE OF NEWFOUNDLAND
pegnl
PERMIT HOLDER
This Permit Allows
CORE ENGINEERING INC.
MIRC: 03823
To practice Professional Engineering in Newfoundland and Labrador.
Permit No. as issued by PEGNL D0209
which is valid for the year 2026.

PRIME, MECHANICAL & ELECTRICAL CONSULTANT:

CORE ENGINEERING INC.
A MEMBER OF BPA

CORE PROJECT #24-3536

PERMIT:

MEMORIAL UNIVERSITY
Department of Facilities Management
This University was raised by the people of Newfoundland as a memorial to the fallen in the great wars, 1914-1918, 1939-1945, that in freedom of learning, their cause and sacrifice might not be forgotten.
- Dedication plaque, Arts & Administration Building, St. John's Campus

PROJECT NAME:

OCEAN SCIENCES CENTRE MAIN BUILDING
(FACULTY OF ENGINEERING & APPLIED SCIENCE)
AIR HANDLER REPLACEMENT (OS-AHU-03)
Project #: OS-506-23

DRAWING TITLE:

MECHANICAL LEGEND AND SCHEDULES

DESIGNED:	DRAWN:
D.E.	J.S.
REVIEWED:	APPROVED:
D.E.	D.E.
SCALE:	DATE:
AS NOTED	APRIL, 2026
PROJECT No.	DRAWING No.
OS-506-23	**M-8.1**

Memorial University of Newfoundland

AIR HANDLER REPLACEMENT (AHU-2)

OCEAN SCIENCES CENTRE

APRIL 2, 2026

ISSUED FOR TENDER

LIST OF ELECTRICAL DRAWINGS

0S-506-23 ISSUED FOR TENDER

DEPARTMENT OF
FACILITIES MANAGEMENT

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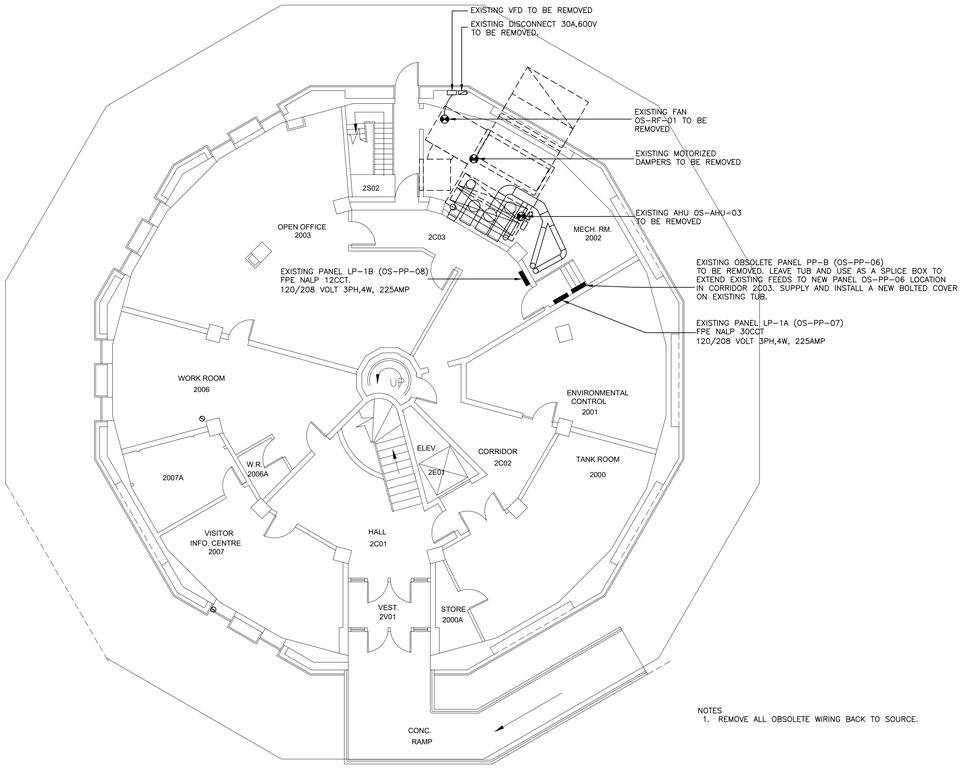
MEMORIAL
UNIVERSITY

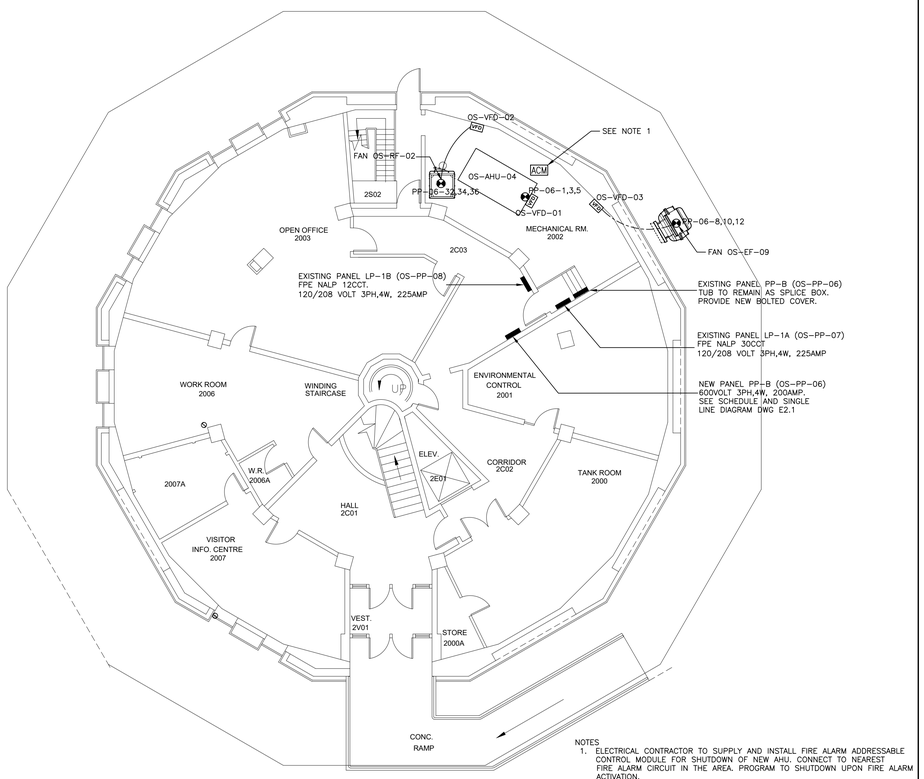


NOTES
1. REMOVE ALL OBSOLETE WIRING BACK TO SOURCE.

GROUND FLOOR PLAN – DEMOLITION LAYOUT

SCALE : 1:100

0m 1m 2m 3m 4m 5m 6m 7m 8m 9m 10m

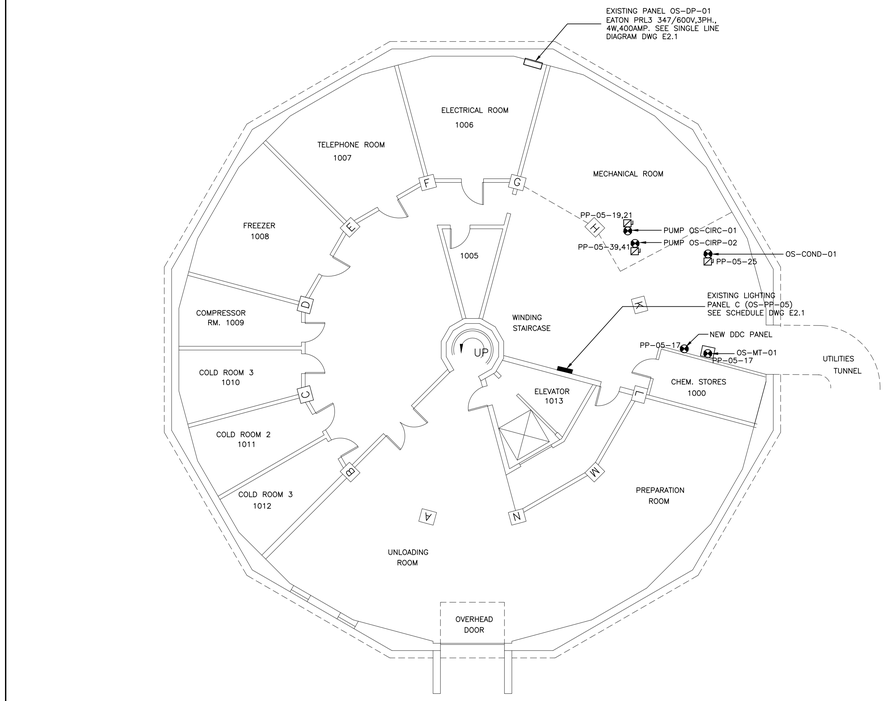


NOTES
1. ELECTRICAL CONTRACTOR TO SUPPLY AND INSTALL FIRE ALARM ADDRESSABLE CONTROL MODULE FOR SHUTDOWN OF NEW AHU. CONNECT TO NEAREST FIRE ALARM CIRCUIT IN THE AREA. PROGRAM TO SHUTDOWN UPON FIRE ALARM ACTIVATION.

GROUND FLOOR PLAN – NEW LAYOUT

SCALE : 1:100

0m 1m 2m 3m 4m 5m 6m 7m 8m 9m 10m



BASEMENT FLOOR PLAN – NEW LAYOUT

SCALE : 1:100

0m 1m 2m 3m 4m 5m 6m 7m 8m 9m 10m

A - DETAIL
B - LOCATION/DRAWING No.
C - DRAWING No.

No.	REVISION	DATE (Y/M/D)
R0	ISSUED FOR TENDER	2026/04/02

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REGISTERED PROFESSIONAL ENGINEERS NEWFOUNDLAND & LABRADOR
PEGNL
TREVOR M. BLACKLER
REGISTERED
2026.04.02
DATE

PROVINCE OF NEWFOUNDLAND
pegnl
PERMIT HOLDER
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CORE PROJECT #24-3536

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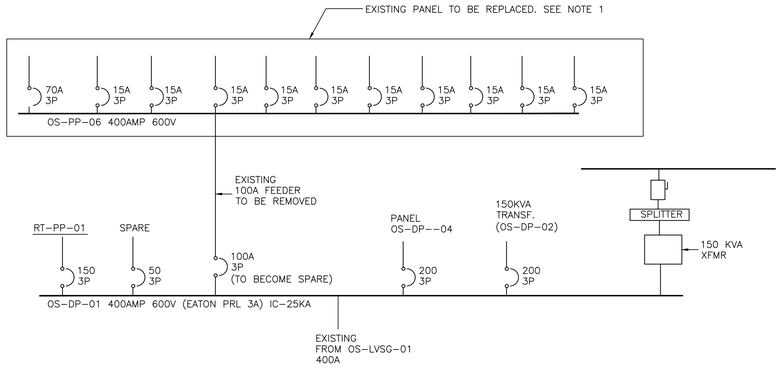
(FACULTY OF ENGINEERING
& APPLIED SCIENCE)
AIR HANDLER REPLACEMENT (OS-AHU-03)
Project #: OS-506-23

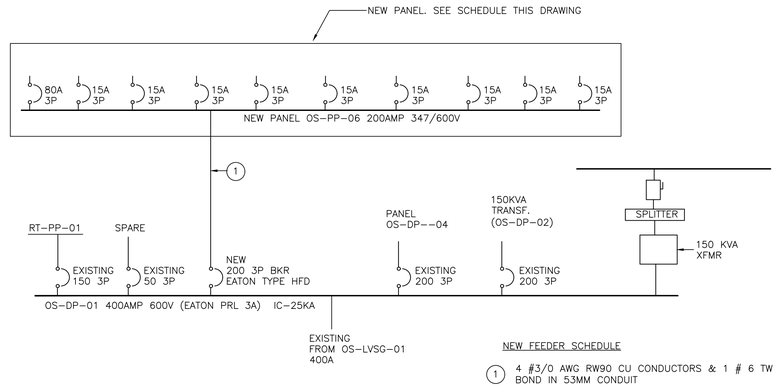
DRAWING TITLE:

LEVEL 1 & 2 – ELECTRICAL LAYOUT DEMOLITION AND NEW

DESIGNED:	DRAWN:
TB	RC
REVIEWED:	APPROVED:
TB	TB
SCALE:	DATE:
AS NOTED	MAY, 2025
PROJECT No.	DRAWING No.
OS-506-23	E1.1



PARTIAL RISER - EXISTING CONDITIONS



PARTIAL RISER - NEW CONDITIONS

EXISTING PANEL TO BE REMOVED. SEE NOTE 1 BELOW

PANEL PP–B (OS–PP–06) — PANEL SCHEDULE — REV. NO. 0

TYPE CIRCUIT BREAKER TYPE

RATING 600V, 3PH, 3W, 400A

STANDARD OF ACCEPTANCE FPE CDP

MINIMUM INTERUPTING CAPACITY ––R.M.S. SYMM AMPERES

NOTES SURFACE MOUNT

	CIRCUIT DESCRIPTION	LOAD	WIRE SIZE	BRKR. SIZE	CIRCUIT NO.		BRKR. SIZE	WIRE SIZE	LOAD	CIRCUIT DESCRIPTION	
"O"	FAULTY BREAKER			15 3	1	2	15 3			SUMP PUMP TUNNEL	"O"
					3	4					
					5	6					
"RR"	COMPRESSOR			15 3	7	8	15 3			EXHAUST FAN EF–1	"O"
					9	10					
					11	12					
"RR"	ELEVATOR			15 3	13	14	15 3			(UNKNOWN)	"RR"
					15	16					
					17	18					
"RR"	GRAD STUDENT			15 3	19	20	15 3			CIRCULATER MOTOR	"RR"
					21	22					
					23	24					
"RR"	HEAT AND LTS TUNNEL			15 3	25	26	15 3			STREET LIGHTS	"O"
					27	28					
					29	30					
"O"	AIR HANDLING UNIT			70 3	31	32	15 3			UNKNOWN	"O"
					33	34					
					35	36					

"RR"–INDICATES EXISTING CIRCUIT TO BE REROUTED TO NEW PANEL OS–PP–06 IN CORR 2C03

"O"–INDICATES OBSOLETE CIRCUIT (NO WIRING)

NOTES

1. EXISTING PANEL OS–PP–06 INTERIOR C/W BREAKERS TO BE REMOVED. UTILIZE EXISTING TUB AS SPLICE BOX. EXTEND EXISTING ACTIVE CIRCUITS TO NEW PANEL OS–PP–06 LOCATED IN CORRIDOR 2C03. SUPPLY AND INSTALL NEW BOLTED COVER ON TUB.

NEW PANEL LOCATED IN CORR 2C03

PANEL PP–B (OS–PP–06) — PANEL SCHEDULE — REV. NO. 0

TYPE CIRCUIT BREAKER TYPE

RATING 347/600V, 3PH, 4W, 200A

STANDARD OF ACCEPTANCE CUTLER HAMMER

MINIMUM INTERUPTING CAPACITY 25ka R.M.S. SYMM AMPERES

NOTES SURFACE MOUNT

	CIRCUIT DESCRIPTION	LOAD	WIRE SIZE	BRKR. SIZE	CIRCUIT NO.		BRKR. SIZE	WIRE SIZE	LOAD	CIRCUIT DESCRIPTION	
	OS–AHU–04		* 4	* 80 3	1	2	15 3			SPARE BREAKER	
					3	4					
					5	6					
"E"	COMPRESSOR		12	15 3	7	8	15 3	12	3 HP	EXHAUST FAN OS–EF–09	
					9	10					
					11	12					
"E"	ELEVATOR		12	15 3	13	14	15 3	12		EXISTING (UNKNOWN)	"E"
					15	16					
					17	18					
"E"	GRAD STUDENT		12	15 3	19	20	15 3	12		CIRCULATER MOTOR	"E"
					21	22					
					23	24					
"E"	HEAT AND LTS TUNNEL		12	15 3	25	26	15 3			SPARE BREAKER	
					27	28					
					29	30					
					31	32	15 3	12	5 HP	RETURN FAN OS–RF–02	
					33	34					
					35	36					

"E"–INDICATES EXISTING CIRCUIT REROUTED FROM OBSOLETE PANEL OS–PP–06 IN MECH RM 2002 SEE NOTE 1.

* –CONTRACTOR TO CONFIRM EXACT BREAKER & MCA OF AHU BEING SUPPLIED AND PROVIDE BREAKER/WIRE TO SUIT.

EXISTING

PANEL C (OS–PP–05) — PANEL SCHEDULE — REV. NO. 0

TYPE CIRCUIT BREAKER TYPE

RATING 120/208V, 3PH, 4W, 225A

STANDARD OF ACCEPTANCE SQ D NQOD

MINIMUM INTERUPTING CAPACITY 18ka R.M.S. SYMM AMPERES

NOTES SURFACE MOUNT

	CIRCUIT DESCRIPTION	LOAD	WIRE SIZE	BRKR. SIZE	CIRCUIT NO.		BRKR. SIZE	WIRE SIZE	LOAD	CIRCUIT DESCRIPTION	
"EX"	RECEPTACLES		12	15	1	2	15			RECEPTACLES	"EX"
"EX"	RECEPTACLES				3	4	15			HONEYWELL PANEL	"EX"
"EX"	RECEPTACLES			20 2	5	6	20 2			RECEPTACLES	"EX"
					7	8					
"EX"	RECEPTACLES			15	9	10	20 2			RECEPTACLES	"EX"
"EX"	RECEPTACLES			15	11	12					
"EX"	RECEPTACLES			20 2	13	14	15			RECEPTACLES	"EX"
					15	16	20 2			RECEPTACLES	
"N"	DDC PANEL & OS–MT–1	100	12	15	17	18					"EX"
"N"	NEW PUMP OS–CIRP–01	2.1 HP	10	30 2	19	20	15			RECEPTACLES	"EX"
					21	22	20 2			RECEPTACLES	
"EX"	RECEPTACLES			15	23	24					"EX"
# "N"	OS–COND–01	.37 KW	12	25 #	25	26	15			DROP CORD	"EX"
"EX"	CONDENSING UNIT			50 2	27	28	15			DROP CORD	"EX"
					29	30	15			UNKNOWN	"EX"
"EX"	RECEPTACLES			15	31	32	15			UNKNOWN	"EX"
"EX"	RECEPTACLES			?? 2	33	34	15			RECEPTACLES	"EX"
					35	36	15			RECEPTACLES	"EX"
					37	38	15			RECEPTACLES	"EX"
"N"	PUMP OS–CIRP–02	2.1 HP	10	30 2	39	40	15			RECEPTACLES	"EX"
					41	42	15			RECEPTACLES	"EX"

"N"–INDICATES NEW CIRCUIT AND BREAKER #–COORDINATE BREAKER SIZE WITH EQUIP. SUPPLIER

"EX"–INDICATES EXISTING CIRCUIT

REMOVE EXISTING OBSOLETE BREAKERS AND INSTALL NEW BREAKERS AT AND INSTALL NEW BREAKERS AT CIRCUIT NUMBERS 17, 25 AND 19,21, AND 39,41.

A - DETAIL
B - LOCATION/DRAWING No.
C - DRAWING No.

No.	REVISION	DATE (Y/M/D)
R0	ISSUED FOR TENDER	2026/04/02

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REGISTERED PROFESSIONAL ENGINEERS — PEGNL — Certificate of Authorization — TREVOR M. BLACKLER — REGISTERED — 2026.04.02 — DATE — NEWFOUNDLAND & LABRADOR

PROVINCE OF NEWFOUNDLAND

pegnl — PERMIT HOLDER This Permit Allows

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MIRC: 04896

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CORE PROJECT #24-3536

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OCEAN SCIENCES CENTRE MAIN BUILDING
(FACULTY OF ENGINEERING
& APPLIED SCIENCE)
AIR HANDLER REPLACEMENT (OS-AHU-03)
Project #: OS-506-23

DRAWING TITLE:

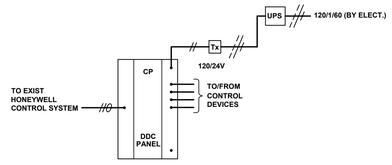
ELECTRICAL DETAILS

DESIGNED:	DRAWN:
TB	RC
REVIEWED:	APPROVED:
TB	TB
SCALE:	DATE:
AS NOTED	MAY, 2025
PROJECT No.	DRAWING No.
OS-506-23	E2.1

CONTROLS LEGEND

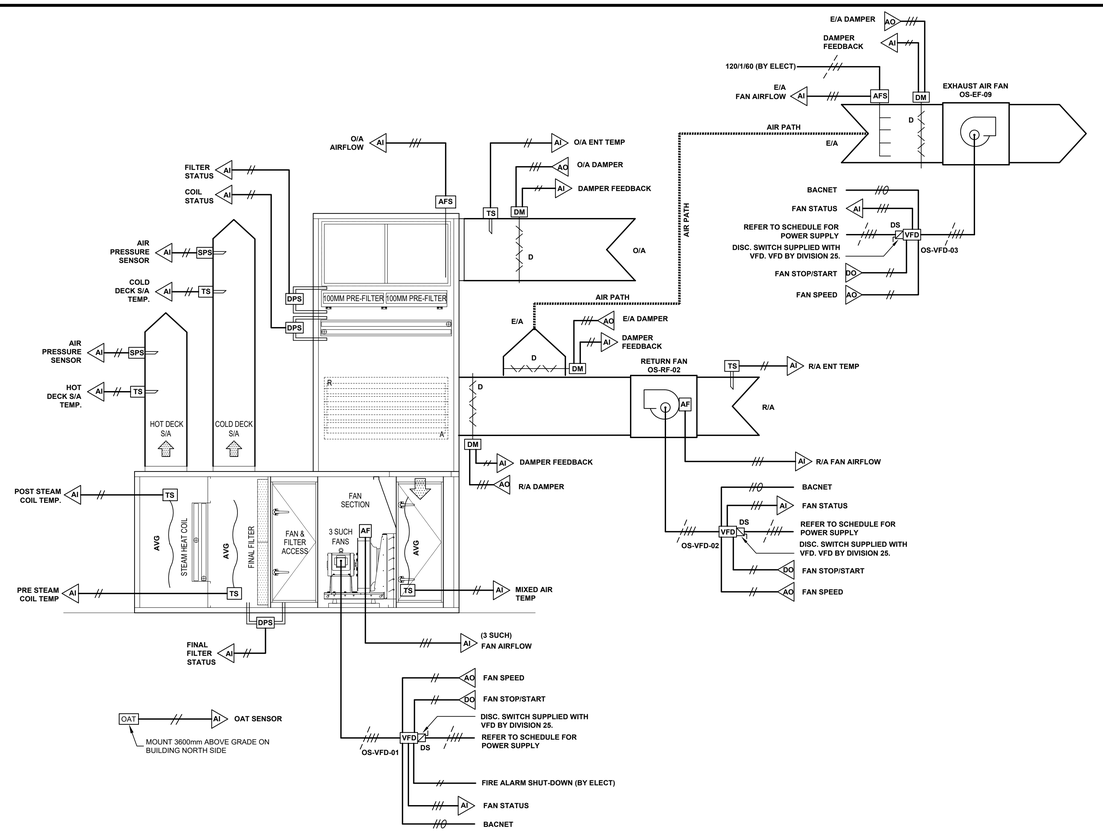
TS	TEMPERATURE SENSOR DUCT MOUNTED/PIPE MOUNTED. PROVIDE IMMERSION WELL FOR PIPE MOUNTED APPLICATION. PROVIDE CORRECT LENGTH ELEMENT FOR AVERAGING APPLICATION.
DPS-I	ANALOG DIFFERENTIAL LIQUID PRESSURE SENSOR WITH REMOTE SENSORS, +/- 1% ACCURACY, 4-20mA OUTPUT, LOCAL LCD DISPLAY, 0-100 PSI RANGE, 24VAC POWER. EQUAL TO GREYSTONE DP SERIES.
DPS	DIFFERENTIAL STATIC AIR PRESSURE SENSOR. SIZE TO SUIT APPLICATION. RANGE: 0-500 Pa ACCURACY +/- 2%, 4-20mA OUTPUT, AND FIELD CALIBRATION C/W LCD DISPLAY FOR FIELD MONITORING.
SPS	STATIC AIR PRESSURE SENSOR. SIZE TO SUIT APPLICATION. RANGE: 0-500 Pa ACCURACY +/- 2%, 4-20mA OUTPUT, AND FIELD CALIBRATION C/W LCD DISPLAY FOR FIELD MONITORING.
PS-H	HIGH PRESSURE & TEMPERATURE SENSOR COMPLETE WITH SIPHON AND COOLING ELEMENT, PRESSURE RATED WELL AND CRN. REFER TO SPECIFICATION.
TS-H	HIGH TEMPERATURE SENSOR COMPLETED WITH WELDED THERMOWELL CRN, REFER TO SPECIFICATION.
SP	PRESSURE SENSOR FOR LIQUID APPLICATION WITH 4-20mA OUTPUT, ACCURACY: +/- 2% RANGE: 0-150kPa.
DM	DAMPER MOTOR (MODULATING: AO), (2-POSITION: DO) MINIMUM TORQUE 133 in-lb. VOLTAGE: 24 VAC C/W INSULATED DAMPER OF SIZE TO SUIT DUCT.
D	INSULATED DAMPER, "TAMCO" 9000-SW SERIES c/w SALT WATER RESISTANCE OPTION . SIZE TO SUIT DUCT WITH CLEAR INSIDE DIMENSIONS OF DAMPER TO MATCH DUCT
V1	MODULATING 2 WAY GLOBE CONTROL VALVE C/W ANALOG POSITION FEEDBACK, 24 VAC FAIL IN POSITION ACTUATOR WITH MANUAL OVERRIDE AND CV AS INDICATED. "BELIMO" OR APPROVED EQUAL.
HL	NEW HONEYWELL AQUASTAT SINGLE POLE DOUBLE THROW SWITCH. ADJUSTABLE HIGH LIMIT SET AT 97.8°C (208°F).
PL	HONEYWELL PRESSURETROL HIGH PRESSURE LIMIT SWITCH ADJUSTABLE BETWEEN 70 kPA TO 1035 kPA. SET AT 689 kPa (100 PSI). CONFIRM PRESSURE SETTING LIMIT WITH ANNEX PRIOR TO START-UP.
AF	FAN INLET AIRFLOW PIEZOMETRIC RING TYPE MEASUREMENT STATION. 4-20mA OUTPUT. CALIBRATE OUTPUT DURING BALANCING. ACCURACY: ± 2%.
AFS	AIRFLOW MEASURING STATION EBTRON OR APPROVED EQUAL SIZED TO SUIT DUCT AND AIRFLOW. ACCURACY: +/- 1% 4-20mA OUTPUT. CALIBRATE DURING COMMISSIONING.
VFD	VARIABLE FREQUENCY MOTOR DRIVE BY CONTROLS CONTRACTOR, ULC LABELED WITH FULL GRAPHIC INTERFACE, PROGRAMMABLE GENERAL ALARM OUTPUT, RATED FOR +/- 10% OF MOTOR VOLTAGE, SIZED TO SUIT MOTOR LOAD, BACNET INTERFACE NEMA1 ENCLOSURE, C/W DISC. SWITCH, HAND-OFF-AUTO CONTROL WITH MANUAL SPEED ADJUSTMENT. MOUNT 1200mm A.F.F.
OAT	OUTSIDE AIR TEMPERATURE SENSOR, GREYSTONE OR EQUAL.
ECM	ELECTRONIC CONTROL MODULE SUPPLIED WITH PUMP. 0-10VDC CONTROL SIGNAL
	DISCONNECT SWITCH (BY ELECTRICAL TRADE UNLESS OTHERWSE NOTED)
Tx	CONTROL TRANSFORMER PROVIDE 120/24 VAC CONTROL TRANSFORMERS AS REQUIRED, SIZE TO SUIT LOADS
UPS	UNINTERRUPTED POWER SUPPLY, SIZED FOR MIN. 30 MINUTES RUN TIME.
////	SHIELDED WIRE PROVIDE SHIELDED WIRE WHERE SHOWN AND WHERE NECESSARY
//	INDICATES # OF WIRES CONTRACTOR TO VERIFY AND INCLUDE ADEQUATE WIRING IN TENDER PRICE TO SUIT DDC CONTRACTOR
DO	DIGITAL OUTPUT SIGNAL FROM THE DDC PANEL
DI	DIGITAL INPUT SIGNAL TO THE DDC PANEL
AO	ANALOG OUTPUT SIGNAL FROM THE DDC PANEL
AI	ANALOG INPUT SIGNAL TO THE DDC PANEL

NOTES:
1. PROVIDE LAMECOID LABELS FOR ALL EQUIPMENT.
2. ALL CONTROL WIRING 50 VOLTS & LESS AND CONDUIT TO BE SUPPLIED AND INSTALLED BY CONTROLS CONTRACTOR.
3. ALL CONTROL DEVICES SHOWN ABOVE TO BE SUPPLIED BY CONTROLS CONTRACTOR UNLESS NOTED OTHERWISE.
4. LINE VOLTAGE WIRING AND CONDUIT BY ELECTRICAL.
5. FIRE ALARM WIRING AND CONDUIT BY ELECTRICAL.



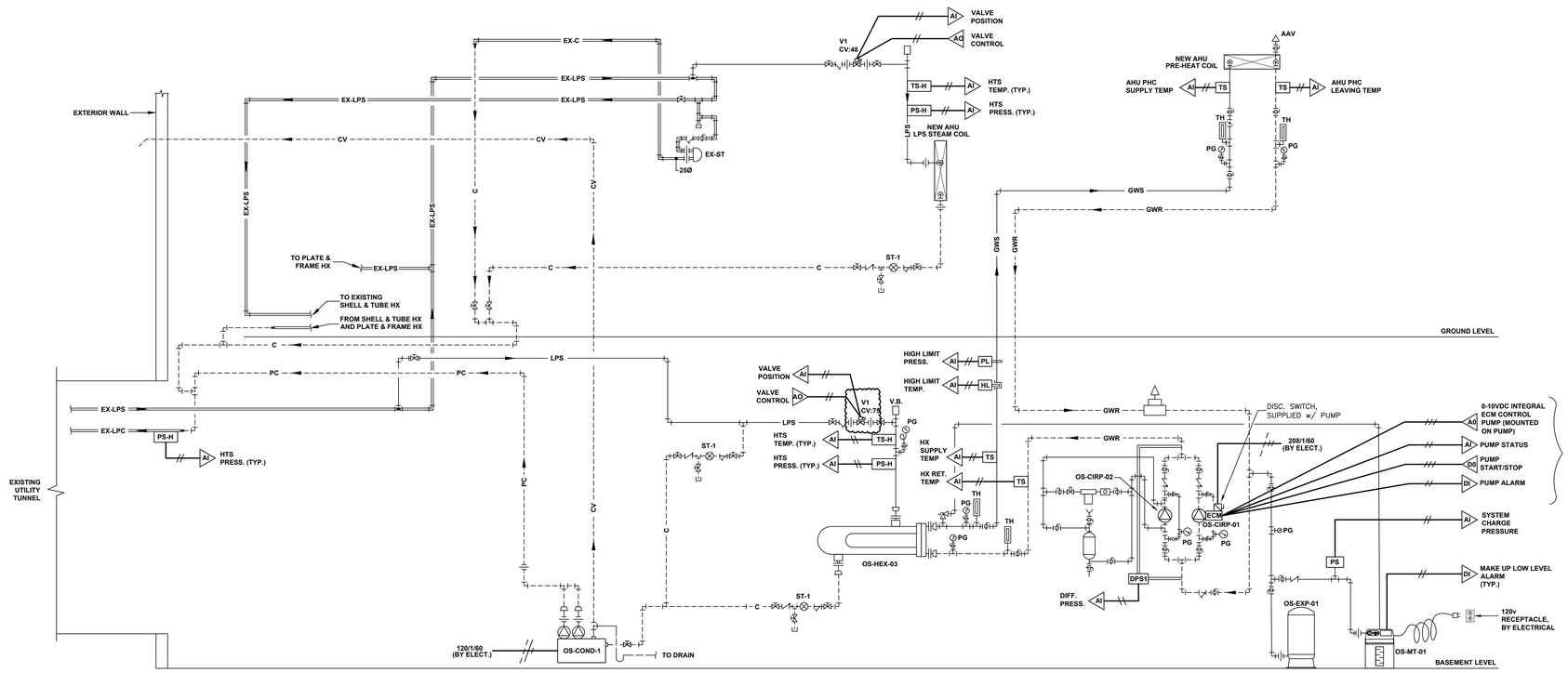
DDC SYSTEM ARCHITECTURE

SCALE: N.T.S.



AIR HANDLING UNIT CONTROL SCHEMATIC (OS-AHU-04)

SCALE: N.T.S.



NEW HEATING SYSTEM FLOW CONTROL SCHEMATIC

SCALE: N.T.S.

A - DETAIL
B - LOCATION/DRAWING No.
C - DRAWING No.

No.	REVISION	DATE (Y/M/D)
R0	ISSUED FOR TENDER	2026/04/02

GENERAL NOTES

1. DRAWINGS TO BE READ AS A SET.
2. DO NOT SCALE FROM DRAWINGS.
3. THE CONTRACTOR IS TO VERIFY ALL DIMENSIONS AND SITE CONDITIONS PRIOR TO SUBMISSION OF TENDERS.
4. ALL DEFICIENCIES FOUND IN THIS DRAWING IS TO BE BROUGHT TO THE ATTENTION OF THE FACILITIES ENGINEERING AND DEVELOPMENT OFFICE OF THE DEPARTMENT OF FACILITIES MANAGEMENT, MEMORIAL UNIVERSITY OF NEWFOUNDLAND, PRIOR TO THE SUBMISSION OF THE TENDERS.

REGISTERED PROFESSIONAL ENGINEERS PEGNL NEWFOUNDLAND & LABRADOR
TREVOR M. BLACKLER
REGISTERED
2026.04.02
DATE

PROVINCE OF NEWFOUNDLAND
pegnl PERMIT HOLDER
This Permit Allows
CORE ENGINEERING INC.
MIRC: 04896
To practice Professional Engineering in Newfoundland and Labrador.
Permit No. as issued by PEGNL D0209
which is valid for the year 2026.

PRIME, MECHANICAL & ELECTRICAL CONSULTANT:

CORE ENGINEERING INC. | A MEMBER OF BPA

CORE PROJECT #24-3536

MEMORIAL UNIVERSITY
Department of Facilities Management
This University was raised by the people of Newfoundland as a memorial to the fallen in the great wars, 1914-1918, 1939-1945, that in freedom of learning, their cause and sacrifice might not be forgotten.
- Dedication plaque, Arts & Administration Building, St. John's Campus

PROJECT NAME:
OCEAN SCIENCES CENTRE MAIN BUILDING
(FACULTY OF ENGINEERING & APPLIED SCIENCE)
AIR HANDLER REPLACEMENT (OS-AHU-03)
Project #: OS-506-23

DRAWING TITLE:
ELECTRICAL CONTROLS

DESIGNED:	DRAWN:
TB	RC
REVIEWED:	APPROVED:
TB	TB
SCALE:	DATE:
AS NOTED	MAY, 2025
PROJECT No.	DRAWING No.
OS-506-23	E3.1