



FACILITIES MANAGEMENT
OPEN CALL FOR BIDS
FOR
L-503-25
Library Cooling Tower Replacement

Request for Open Call Number: **TFM-026-26**

Issued: April 24, 2026

Submission Deadline: **Thursday, May 21, 2026**
@ 3:00PM NST

REQUEST FOR OPEN CALL FOR BIDS INFORMATION SHEET

Request for Open Call			
Title:	L-503-25 Library Cooling Tower Replacement		
Open Call #:	TFM-026-26	Issue Date:	April 24, 2026
Non-Mandatory Site Visit:	Location: QEII Library Main Lobby @3:00PM		May 1, 2026
Questions Deadline:	Eight (8) days prior to closing time, at 3:00pm (NST).	Closing Date & Time:	Thursday May 21, 2026 @ 3:00 pm NST
		Bid Submission Format:	opencalls@mun.ca
		Opening Date, Time & Location:	Thursday, May 21, 2026 @ 3:30 pm NST
			Via Conference line: 1-416-915-6530 (toll free) Access Code: 2774 125 6294 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: <u>BID SUBMISSION: TFM-026-26 L-503-25 LIBRARY COOLING TOWER REPLACEMENT</u> <u>PLEASE NOTE</u> 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-026-26 L-507-25 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*.

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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 risk 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	\$139,000	\$139,000	\$347,400	\$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 its 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 or gases.
- (f) Some University buildings contain asbestos and other hazardous materials. Do not alter or disturb any goods believed to contain asbestos (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)	\$2500	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:

L-503-25 Library Cooling Tower 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
Demolition	
Plumbing	
Cooling Tower Manufacturer	
HVAC	
Controls	
Electrical	
ADD TRADES AS REQUIRED	



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 IN THE 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 foregoing 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 CHANGES IN 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° 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 4.8 have 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

Print Name

I have authority to bind the corporation.

Witness:

Signature

Print Name

Signed of Behalf of Memorial University (the Owner):

Signature

Print Name

I have authority to bind the corporation.

Witness:

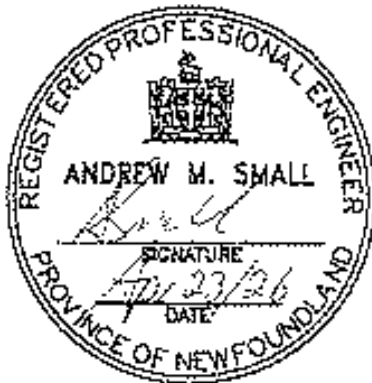
Signature

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



MEMORIAL UNIVERSITY OF NEWFOUNDLAND
MUN LIBRARY COOLING TOWERS
MECHANICAL PROJECT SPECIFICATION
MUN PROJECT #: L-503-25

Issued for Tender
April 23, 2026

PROVINCE OF NEWFOUNDLAND	
 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 <u>D0209</u> which is valid for the year <u>2026</u> .	

Prepared by:



PART 1 **GENERAL**

1.1 **SECTION INCLUDES**

- .1 Title and description of Work.
- .2 Contractor use of premises.
- .3 Owner occupancy.

1.2 **WORK COVERED BY CONTRACT DOCUMENTS**

- .1 Work of this Contract comprises general construction renovation of Cooling Towers for QEII Library, located at Memorial University of Newfoundland and Labrador, St. John's Campus.
- .2 The Work under this Contract will be substantially performed within 11 months notification of award of contract.

1.3 **CONTRACTOR USE OF PREMISES**

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

1.4 **OWNER OCCUPANCY**

- .1 Owner will occupy premises during entire construction period for execution of normal operations.
- .2 Cooperate with Owner in scheduling operations to minimize conflict and to facilitate Owner usage of the building throughout.

**Memorial University of Newfoundland
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Section 01 11 00 – Summary of Works

Page 2 of 2

1.5 RELATED WORK

- .1 The following specification sections are referenced to indicate work responsibilities as specified and carried in other sections.
 - .1 Section 21 05 00 – Common Work Results for Fire Suppression.
 - .2 Section 21 05 01 – Common Work Results for Mechanical.
 - .3 Section 22 05 00 – Common Work Results for Plumbing.
 - .4 Section 23 05 00 – Common Work Results for HVAC.
 - .5 Section 25 05 01 – EMCS – General Requirements.
 - .6 Section 26 05 00 – Common Work Results – Electrical.

1.6 ON-SITE DOCUMENTS

- .1 Maintain at job site documents as indicated in Section 01 31 00 – Project Management and Coordination.

1.7 CONTRACT DOCUMENTS

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

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

PART 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 32 00 – Construct Progress Documentation.
- .2 Section 01 56 00 - Temporary Barriers and Enclosures.

1.2 COOLING OPERATIONS

- .1 At no time shall the cooling for the building be impacted during the removal and/or installation of the new cooling towers. All work to be performed outside the normal cooling season. The existing cooling towers or new towers to be fully operational from April 1st to Oct. 31th.

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 Section includes administrative and procedural requirements for substitutions.

1.3 RELATED SECTIONS

- .1 Section 01 61 00 – Common Product Requirements.

1.4 DEFINITIONS

- .1 Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by General Contractor.
- .2 Substitutions for Cause: Changes proposed by General Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
- .3 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 General Contractor or Owner. No substitutions for convenience are permitted.

1.5 ACTION SUBMITTALS

- .1 Substitution Requests: Submit one (1) copy of each request, in PDF format, for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section Number and Title, and Drawing Numbers and Titles.
 - .1 Substitution Request Form: Use form provided at the end of this section.
 - .2 Documentation: Show compliance with requirements for substitutions and the following, as applicable:

**Memorial University of Newfoundland
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Section 01 25 00 – Substitution Procedures

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- .1 Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
- .2 Coordination information, including a list of changes or revisions 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 architects and owners.
- .8 Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
- .9 Detailed comparison of General 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.
- .10 Cost information, including a proposal of change, if any, in the Contract Sum.
- .11 General 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.

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Section 01 25 00 – Substitution Procedures

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- .12 General 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.
- .3 Owner Action: If necessary, Owner will request additional information or documentation for evaluation within five (5) working days of receipt of a request for substitution. Owner will notify General Contractor of acceptance or rejection of proposed substitution within ten (10) working days of receipt of request, or five (5) working days of receipt of additional information or documentation, whichever is later.
 - .1 Forms of Acceptance: Change Order, Construction Change Order, or Owner Supplemental Instructions for minor changes in the Work.
 - .2 Use product specified if Owner does not issue a decision on use of a proposed substitution within time allocated.

1.6 QUALITY ASSURANCE

- .1 Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.7 PROCEDURES

- .1 Coordination: Revise 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 on discovery of need for change, but not later than fifteen (15) days prior to the time required for preparation and review of related submittals.
 - .1 Conditions: Owner will consider General Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Owner 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.

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Section 01 25 00 – Substitution Procedures

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- .2 Requested substitution provides sustainable design characteristics that specified product provided.
- .3 Substitution request is fully documented and properly submitted.
- .4 Requested substitution will not adversely affect General Contractor's construction schedule.
- .5 Requested substitution has received necessary approvals of authorities having jurisdiction.
- .6 Requested substitution is compatible with other portions of the Work.
- .7 Requested substitution has been coordinated with other portions of the Work.
- .8 Requested substitution provides specified warranty.
- .9 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: Not permitted.

PART 3 **EXECUTION (NOT APPLICABLE)**

END OF SECTION

Equal or Substitute Product Request Form

Request Phase: Pre-Tender ☐ Post Tender ☐
(If Pre-Tender Only) Current Tender Due Date: _____
Request No: _____ Dated: _____
Project Name: _____
Project Location: _____
Project No.: _____ Contract No.: _____

References: Specifications(s): _____ Section(s): _____ Paragraph(s): _____
Drawings(s): Drawing No(s): _____ Detail No(s): _____

Contractually Specified Product _____
Contractor Proposed Product _____

Proposed Product is: Equal ☐ Substitute ☐

See attached data for both specified and proposed products as required by Section 01 61 00.

Data Attached: ☐ Drawings: ☐ Product Data: ☐ Reports: ☐ Samples: ☐
Tests: ☐ Other: ☐

Reason(s) for not providing the Specified Product:

Similar Installation:

Project: _____

Address: _____

Architect: _____ Owner: _____

Date Installed: _____

Post-Tender:

Will proposed substitution impact other parts of the Work? No ☐ Yes ☐

Will proposed substitution increase Contract Time? No ☐ Yes ☐

If Yes attached explanation by number of Days. _____

Actual Dollar Savings if substitution is accepted: \$ _____

The undersigned Certified that the proposed Request for an Equal or Substitute conforms to all the requirements of Division 01 – General requirements, Section 01 25 00 – Substitution Procedures.

Request Submitted by General Contractor _____
(Firm's Name)

By: _____ Title: _____
(Print Name) (Title)

(Signature)

(Date)

**Equal or Substitute
Product Request Form**

Request Received on (Date): _____

Owner's Review – This Substitution is:

- ☐ Approved.
(Submittals in accordance with Section 01 33 00 – Submittal Procedures)
- ☐ Approved as Noted.
(Submittals in accordance with Section 01 33 00 – Submittal Procedures)
- ☐ Rejected.
(Use Specified Materials)
- ☐ Rejected:
(Request Not Received Within Specified Time Period – Use Specified Materials)

Review Issued By: _____

(Print Name)

(Signature)

(Date)

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Section 01 26 00 – Contract Modification Procedures

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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.
- .2 The General Contractor's attention is specifically directed, but not limited, to the following documents for additional requirements:
 - .1 General Conditions of Stipulated Price Contract.
 - .2 Supplementary General Conditions.

1.2 SUMMARY

- .1 Section includes administrative and procedural requirements for handling and processing Contract modifications. Contractor shall develop and implement a system acceptable to Owner for the preparation, review and processing of Proposed Change Orders, contingency and allowance expenditure authorizations, Change Orders, and requests for information.

1.3 RELATED SECTIONS

- .1 Section 01 25 00 - Substitution Procedures.

1.4 DEFINITIONS

- .1 Free Float – the maximum amount of time a scheduled activity can be delayed without delaying the early start date of any succeeding activities or violating a schedule restraint, (or the range an activity can move around without affecting the start of any activity after it.)
- .2 Total Float – the maximum amount of time a scheduled activity can be delayed or extended from its early start date without delaying the project finish date or violating a schedule restraint, (the range an activity can move around without affecting the end date of the project.)

1.5 MINOR CHANGES IN THE WORK

- .1 Owner will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time.

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1.6 OWNER INITIATED PROPOSAL CHANGES

- .1 Owner may 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 Work Proposed Change Orders issued by Owner are not instructions either to stop work in progress or to execute the proposed change.
 - .2 Within time specified in Proposed Change Order or ten (10) working days, when not otherwise specified, after receipt of Proposed Change Order, submit a quotation for cost adjustments to the Contract Sum and the Contract Time necessary to execute the change. 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.
 - .1 Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - .2 Include costs of labor and supervision directly attributable to the change.
 - .3 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.

1.7 GENERAL CONTRACTOR INITIATED PROPOSED CHANGES

- .1 If latent or changed conditions require modifications to the Contract, the General Contractor may initiate a claim by submitting a request for a change to Owner.
 - .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.

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- .4 Include costs of labor and supervision directly attributable to the change.
- .5 Include an updated General 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 Section 01 25 00 - Substitution Procedures if the proposed change requires substitution of one product or system for product or system specified.

1.8 CHANGE ORDER PROCEDURES

- .1 On approval of a Proposed Change Order for the Work, Owner will issue a Contract Change Order signed by the Owner and must be signed by the General Contractor and returned to the Owner.

1.9 CONSTRUCTION CHANGE DIRECTIVE

- .1 Owner may issue a Construction Change Directive.
- .2 A Construction Change Directive
 - .1 Instructs Contractor to proceed with a change in the Work, for potential inclusion in a Change Order.
 - .2 Contains a complete description of change in the Work.
 - .3 Designates method to be followed to determine change in the Contract Sum or the Contract Time.
- .3 Documentation:
 - .1 Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
 - .2 After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

1.10 REQUESTS FOR INFORMATION (RFI)

- .1 In the event that the General Contractor or any Subcontractor involved in the Work, determines that some portion of the drawings, specifications, or other contract documents requires clarification or interpretation by the Owner, the General Contractor shall submit a Request for Information (RFI) in writing to the Owner.

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Section 01 26 00 – Contract Modification Procedures

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- .2 RFI's may only be submitted by the General Contractor and shall only be submitted on the RFI Form as required by the Owner. Any RFI's submitted, not on the official RFI Form will be returned to the Contractor unreviewed.
- .3 In the RFI, the General Contractor shall clearly and concisely set forth the issue for which clarification or interpretation is sought and why a response is needed from the Owner.
- .4 In the RFI, the General Contractor shall set forth an interpretation or understanding of the requirement along with reasons why such an understanding was reached.
- .5 The Owner will review all RFI's to determine whether they are valid RFI's. If it is determined that the document is not a valid RFI, it will be returned to the General Contractor, unreviewed, with an explanation why it was deemed not valid.
- .6 A RFI Response shall be issued within ten (10) working days of receipt of the request from the General Contractor unless the Owner determines that a longer time is necessary to provide an adequate response. If a longer time is determined necessary by the Owner, the Owner will, within five (5) working days of receipt of the request, notify the General Contractor of the anticipated response time.
- .7 If the General Contractor submits a RFI on an activity with ten (10) working days or less of float on the current project schedule, the General Contractor shall not be entitled to any time extension due to the time it takes the Owner to respond to the request provided that the Owner's responds within the ten (10) working days set forth above.
- .8 A RFI Response from Owner will not change any requirement of the Contract Documents. In the event the General Contractor believes that the RFI Response will cause a change to the requirements of the Contract Documents, the General Contractor shall within five (5) working days give written notice to the Owner stating that the General Contractor believes the RFI Response will result in a Change Order and the Contractor intends to submit a "Proposed Change Order" request. Failure to give such written notice of five (5) working days shall waive the General Contractor's right to seek additional time or cost under the requirements of the Contract Documents.

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PART 2 **PRODUCTS (NOT APPLICABLE)**

PART 3 **EXECUTION (NOT APPLICABLE)**

END OF SECTION

Request For Information (RFI)

RFI No.: _____ Page No.: _____ Date Requested: _____
 Project Name: _____
 Project Location: _____
 Project No.: _____ Contract No.: _____
 Contractor: _____

CONTRACTOR'S REQUEST FOR INFORMATION

RFI Subject: _____

References: Specification(s): _____ Section(s): _____ Paragraph(s): _____
Drawings(s): Drawing No(s): _____ Detail No(s): _____

Potential Cost Impact: _____

Potential Schedule Impact: _____

Request By: _____
(Print Name) (Signature)

Information Requested:

General Contractor's Recommendation:

Request For Information (RFI)

OWNER'S RESPONSE

Date Received: _____ Date Answered: _____

Request Reviewed By: _____
 (Print Name) (Signature)

(Date)

Owner's Response to Contractor:

Attachments From Owner:

Note: The RFI system is intended to provide an efficient mechanism for responding to General Contractor's Requests for Information. It does not provide authority to proceed with additional work. If the General Contractor considers the RFI response a changed condition, provide written notice to the Owner in accordance with Contract provisions.

PART 1 **GENERAL**

1.1 **SECTION INCLUDES**

- .1 Coordination work with other contractors and subcontractors under administration of Owner.
- .2 Scheduled project meetings.

1.2 **RELATED SECTIONS**

- .1 Section 01 11 00 - Summary of Work.
- .2 Section 01 91 13.13 – Commissioning (Cx) Requirements.

1.3 **DESCRIPTION**

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

1.4 **PROJECT MEETINGS**

- .1 Project meetings to be held at times and locations as determined by Owner.
- .2 Owner will arrange project meetings and record and distribute minutes.

1.5 **CONSTRUCTION ORGANIZATION AND START-UP**

- .1 Within ten (10) working days after award of Contract, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.
- .2 Establish time and location of meetings and notify parties concerned minimum five (5) days before meeting.
- .3 Agenda to include following:
 - .1 Appointment of official representative of participants in Work.
 - .2 Schedule of Work, progress scheduling in accordance with Section 01 32 00 - Construction Progress Documentation.
 - .3 Schedule of submission of shop drawings, samples, colour chips in accordance with Section 01 33 00 - Submittal Procedures.

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- .4 Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences in accordance with Section 01 51 00 - Temporary Utilities.
- .5 Delivery schedule of specified equipment in accordance with Section 01 32 00 - Construction Progress Documentation.
- .6 Site security in accordance with Section 01 52 00 - Construction Facilities.
- .7 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, and administrative requirements.
- .8 Record drawings in accordance with Section 01 78 00 - Closeout Submittals.
- .9 Maintenance manuals in accordance with Section 01 78 00 - Closeout Submittals.
- .10 Take-over procedures, acceptance, and warranties in accordance with Section 01 77 00 - Closeout Procedures and 01 78 00 - Closeout Submittals.
- .11 Monthly progress claims, administrative procedures, photographs, and holdbacks.
- .12 Appointment of inspection and testing agencies or firms in accordance with Section 01 45 00 - Quality Control.
- .13 Insurances and transcript of policies.
- .4 Comply with Owner's allocation of mobilization areas of site; for field offices and sheds, for access, traffic, and parking facilities.
- .5 During construction coordinate use of site and facilities through Owner's procedures for intra-project communications: Submittals, reports and records, schedules, coordination of drawings, recommendations, and resolution of ambiguities and conflicts.
- .6 Comply with instructions of Owner for use of temporary utilities and construction facilities.

1.6 ON-SITE DOCUMENTS

- .1 Maintain at job site, one copy each of the following:
 - .1 Contract drawings.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Reviewed shop drawings.

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

1.7 SCHEDULES

- .1 Submit preliminary construction progress schedule in accordance with Section 01 32 00 - Construction Progress Documents to Owner coordinated with Owner's project schedule. Schedule to show anticipated progress stages and final completion of work within time period required by contract documents.
- .2 After review, revise and resubmit schedule to comply with project schedule requirements.
- .3 During progress of Work revise and resubmit at project progress meetings or as directed by Owner.

1.8 SUBMITTALS

- .1 Make submittal to Owner's for review.
- .2 Submit preliminary shop drawings, product data and samples in accordance with Section 01 33 00 – Submittal Procedures for review for compliance with Contract Documents; for field dimensions and clearances, for relation to available space, and for relation to Work of other contracts. After review, revise and resubmit for transmittal to Owner.
- .3 Submit requests for payment for review to Owner.
- .4 Submit requests for interpretation of Contract Documents, and obtain instructions through Owner.
- .5 Process change orders through Owner.
- .6 Deliver closeout submittals for review by Owner.

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1.9 COORDINATION

- .1 Coordinate construction operations included in various Sections of the Specifications to ensure efficient and orderly installation of each part of the Work.
- .2 Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection and operation.
- .3 Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
- .4 Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair of all components, mechanical, electrical, and otherwise,
 - .1 Provide adequate clearances for installation and maintenance of equipment.
 - .2 Install work to permit removal of parts requiring periodic replacement or maintenance.
 - .3 Arrange pipes, ducts, raceways and equipment to permit ready access to valves, cocks, traps, starters, motors, and control components.
 - .4 Doors and access panels shall be kept clear.
 - .5 Utilize space efficiently so that adequate accessibility is retained for future maintenance, repairs, modifications and additions.
 - .6 Check the locations selected for all sprinkler heads and check the Architectural reflected ceiling plans to prevent conflicts between the trades.
 - .7 Contractor is cautioned that, where specific dimensions are not indicated or where Drawings are schematic in nature, as with most Electrical and Mechanical Drawings, Contractor shall have sole responsibility to coordinate the work to meet this requirement.
- .5 Make adequate provisions to accommodate items scheduled for later installation.
- .6 Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work and completion within the specified Contract duration. Such administrative activities include, but are not limited to, the following:
 - .1 Preparation of Contractor's Construction Schedule.

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- .2 Installation and removal of temporary facilities and controls.
- .3 Delivery and processing of submittals.
- .4 Progress meetings.
- .5 Start-up, check-out, and final acceptance of systems.
- .6 Project closeout activities.
- .7 Protection of existing and new work.
- .7 Changes required in the Work of the Contract, caused by the Contractor's neglect to coordinate the work with others shall be made at the Contractor's own expense.

1.10 COORDINATION DRAWINGS

- .1 Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
- .2 Contractor to submit to the Owner, in AutoCAD format, coordination drawings, drawn accurately to a scale large enough to indicate and resolve conflicts.
- .3 Indicating the functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
- .4 Do not base coordination drawings on standard printed data.
- .5 Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
- .6 Show location and size of access doors required for access to concealed dampers, valves, and other controls.
- .7 Indicate required installation sequences.
- .8 Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements.
- .9 Minor dimension changes and difficult installations will not be considered changes to the Contract.
- .10 Owner will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination. If Owner

determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Owner will so inform Contractor, who shall make changes as directed and resubmit.

1.11 CLOSEOUT PROCEDURES

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

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

PART 1 **GENERAL**

1.1 **RELATED SECTIONS**

- .1 Section 01 77 00 - Closeout Procedures.

1.2 **SCHEDULES REQUIRED**

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

1.3 **FORMAT**

- .1 Prepare schedule in form of a horizontal bar chart.
- .2 Provide a separate bar for each major item of work, trade or operation.
- .3 Split horizontally for projected and actual performance.
- .4 Provide horizontal time scale identifying first work day of each week.
- .5 Format for listings: chronological order of start of each item of work.
- .6 Identification of listings: By Systems description.

1.4 **SUBMISSION**

- .1 Submit initial format of schedules within 15 working days after award of Contract.
- .2 Submit schedules in electronic format, forward on disc as PDF files.
- .3 Submit one opaque reproduction, plus 2 copies to be retained by Owner.
- .4 Owner will review schedule and return review copy within ten (10) working days after receipt.
- .5 Resubmit finalized schedule within seven (7) working days after return of review copy.

- .6 Submit revised progress schedule with each application for payment.
- .7 Distribute copies of revised schedule to:
 - .1 Job site office.
 - .2 Subcontractors.
 - .3 Other concerned parties.
- .8 Instruct recipients to report to Contractor within ten (10) working days, any problems anticipated by timetable shown in schedule.

1.5 CRITICAL PATH SCHEDULING

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

1.6 SUBMITTALS SCHEDULE

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

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

PART 1 **GENERAL**

1.1 **SECTIONS INCLUDE**

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

1.2 **RELATED SECTIONS**

- .1 Section 01 32 00 – Construction Progress Documentation.
- .2 Section 01 43 39 – Mock Up Requirements.
- .3 Section 01 45 00 – Quality Control.
- .4 Section 01 78 00 – Closeout Submittals.

1.3 **ADMINISTRATIVE**

- .1 This section specifies general requirements and procedures for contractor's submissions of shop drawings, product data, samples and mock-ups to Owner for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .2 Do not proceed with work until relevant submissions are reviewed by Owner.
- .3 Present shop drawings, product data, samples and mock-ups in SI Metric units.
- .4 Where items or information is not produced in SI Metric units converted values are acceptable.
- .5 Review submittals prior to submission to Owner. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and shall be considered rejected.

- .6 Notify Owner, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .7 Verify field measurements and affected adjacent Work are coordinated.
- .8 Contractor's responsibility for errors and omissions in submission is not relieved by Owner's review of submittals.
- .9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Owner's review of submission, unless Owner gives written acceptance of specific deviations.
- .10 Make any changes in submissions which Owner may require consistent with Contract Documents and resubmit as directed by Owner. When resubmitting, notify Owner in writing of revisions other than those requested.
- .11 Notify Owner, in writing, when resubmitting, of any revisions other than those requested by Owner.
- .12 Keep one reviewed copy of each submission on site.

1.4 SUBMITTALS

- .1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.
- .2 Coordinate each submission with requirements of work and Contract Documents. Individual submissions will not be reviewed until all related information is available.
- .3 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been coordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.
- .4 Allow ten (10) working days for Owner's review of each submission.
- .5 Adjustments made on shop drawings by Owner are not intended to change contract price. If adjustments affect value of Work, state such in writing to Owner immediately after receipt of approval of shop drawings. If

value of work is to change a change order must be issued prior to proceeding with work.

- .6 Structural Attachments:
 - .1 Make changes in shop drawings as Owner may require, consistent with Contract Documents. When resubmitting, notify Owner in writing of revisions other than those requested.
- .7 Accompany submissions with transmittal letter, containing:
 - .1 Date.
 - .2 Project title and number.
 - .3 Contractor's name and address.
 - .4 Identification and quantity of each shop drawing, product data and sample.
 - .5 Other pertinent data.
- .8 Submissions shall include:
 - .1 Date and revision dates.
 - .2 Project title and number.
 - .3 Name and address of:
 - .1 Subcontractor.
 - .2 Supplier.
 - .3 Manufacturer.
 - .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
 - .5 Details of appropriate portions of Work as applicable:
 - .1 Fabrication.
 - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
 - .3 Setting or erection details.
 - .4 Capacities.
 - .5 Performance characteristics.
 - .6 Standards.
 - .7 Operating weight.
 - .8 Wiring diagrams.
 - .9 Single line and schematic diagrams.
 - .10 Relationship to adjacent work.

- .9 After Owner's review, distribute copies.
- .10 Submit one (1) electronic copy in high quality searchable PDF format of shop drawings(Scans not acceptable) for each requirement requested in specification Sections and as Owner may reasonably request.
- .11 Submit electronic copy in high quality searchable PDF format of product data sheets or brochures for requirements requested in Specification Sections and as requested by Owner where shop drawings will not be prepared due to standardized manufacture of product.
- .12 Delete information not applicable to project.
- .13 Supplement standard information to provide details applicable to project.
- .14 Cross-reference product data information to applicable portions of Contract Documents.
- .15 If upon review by Owner, no errors or omissions are discovered or if only minor corrections are made, copies will be returned and fabrication and installation of work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of work may proceed.
- .16 Samples: examples of materials, equipment, quality, finishes, workmanship. Label samples with origin and intended use.
- .17 Notify Owner in writing, at time of submission of deviations in samples from requirements of contract documents.
- .18 Where colour, pattern or texture is criterion, submit full range of samples.
- .19 Adjustments made on samples by Owner are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Owner prior to proceeding with Work.
- .20 Make changes in samples, which Owner may require, consistent with Contract Documents.
- .21 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.
- .22 Submit drawings stamped and signed by Professional Engineer registered or licensed in the Province of Newfoundland and Labrador.

1.5 MOCK-UPS

- .1 Erect mock-ups in accordance with Section 01 43 39 – Mock Up Requirements.

1.6 PROGRESS PHOTOGRAPHS

- .1 Progress photograph to be electronically formatted and labelled as to location and view.

1.7 SHOP DRAWINGS REVIEW

- .1 The review of shop drawings by Owner is for the sole purpose of ascertaining conformance with the general concept. This review shall not mean that Owner approves the detail design inherent in the shop drawings, responsibility for which shall remain with the Contractor submitting same, 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 construction and contract documents. Without restricting the generality of the foregoing, the Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains to fabrication processes or to techniques of construction and installation and for co-ordination of the work of all sub-trades.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

PART 1 **GENERAL**

1.1 **REFERENCES**

- .1 Canadian Standards Association (CSA)
 - .1 CAN/CSA-Z259.1, Body Belts and Saddles for Work Positioning and Travel Restraint.
 - .2 CAN/CSA-Z259.10, Full Body Harnesses.
 - .3 CAN/CSA-Z259.11, Energy Absorbers and Lanyards.
 - .4 CAN/CSA-Z259.2.1, Fall Arresters, Vertical Lifelines and Rails.
 - .5 FCC No. 301, Standard for Construction Operations.
 - .6 CSA Z275.2, Occupational Safety Code for Diving Operations.
 - .7 CSA Z275.4, Competency Standard for Divers Operations.
 - .8 CSA Z797, Code of Practice for Access Scaffold.
- .2 FCC No. 302, Standard for Welding and Cutting.
- .3 Transportation of Dangerous Goods Act & Regulations.
- .4 Newfoundland and Labrador Occupational Health and Safety Act, Amended
- .5 Consolidated Newfoundland and Labrador Regulations 1149 WHMIS Regulations under the Occupational Health and Safety Act.
- .6 Consolidated Newfoundland and Labrador Occupational Health and Safety Regulations under the Occupational Health and Safety Act.
- .7 Canada Labour Code, Part 2.
- .8 National Building Code of Canada.
- .9 Memorial University of Newfoundland Occupational Health and Safety Manual.
- .10 Memorial University of Newfoundland Contractor Safety Management Program.

1.2 **RELATED SECTIONS**

- .1 Section 01 33 00 - Submittal Procedures.

- .2 Section 01 35 43 - Environmental Procedures.
- .3 Section 01 41 00 - Regulatory Requirements.
- .4 Section 02 82 00.02 - Asbestos Abatement.

1.3 GENERAL

- .1 All work to be performed in accordance with the requirements of the Newfoundland and Labrador Occupational Health and Safety Act and Regulations as amended, and any specified Contract requirements.
- .2 The Contractor shall comply with and enforce compliance by employees, subcontractors, suppliers and visitors with all safety requirements of the Contract Documents, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with the Site Specific Health and Safety Plan (SSSP).
- .3 The Contractor is responsible for all work coordination at the project site, safety oversight, and must maintain full ownership and control of safety within the project area at all times.
 - .1 The Contractor shall ensure co-ordination of work schedules and tasks, and communication thereof for the purpose of ensuring health and safety on the worksite.
- .4 Owner may perform project due diligence, site visits, safety monitoring activities, make suggestions or recommendations for improvement, and/or request changes in how work is performed. Notwithstanding, the Contractor has full responsibility, authority, and accountability for safely performing all work on the project site and/or under the project. Owner solely relies on the Contractor to know how to safely perform all Work including making appropriate decisions on Owner recommendations or requests.
- .5 The Contractor shall ensure that in addition to those requirements set forth in the OHS Act and Regulations, all persons, including those employed by the Contractor or their subcontractors, working on projects for MUN shall wear the following mandatory Personal Protective Equipment at ALL times while working on the project.
 - .1 CSA approved safety boots meeting the CSA Z195 Standard.
 - .2 CSA approved hard hat meeting the CSA Z94.1 Standard.
 - .3 CSA approved safety glasses meeting CSA Z94 Standard.

- .4 High visibility apparel as defined in the OHS Regulations.
- .5 Where noise exceeds standards set out in the OHS Regulations hearing protection shall be worn, and hearing conservation program implemented.
- .6 Other personal protective equipment, as may be required by the work tasks, hazard assessments or the Contractor, depending on duties being performed.

1.4 SUBMITTALS

- .1 At least 10 (ten) working days prior to commencing any site work: submit to Owner copies of:
 - .1 A complete Site Specific Health and Safety Plan (SSSP).
 - .2 If work entails blasting, submit the following:
 - .1 Valid Blaster's Certificate and Certificates of Qualification acceptable to the OHS Regulations 5/12 under section 419 identifying the Level of Qualification for the project requirements (Journey Persons Blaster Certificate will still be accepted). An acceptable letter of extension of blasters certificate from the Apprenticeship and Trades Certification Division of the Provincial Department of Immigration, Skills and Labour is required when certificate expires (5 years max.). Certificate numbers and names are required for all blasters proposed for the project.
 - .2 Temporary Magazine License, when required issued, by Natural Resources Canada.
 - .3 Explosives Vehicle Certificate, when required, issued by Transport Canada for transport of explosives regulated under the Transportation of Dangerous Good Act.
 - .4 Blaster resume which clearly states and demonstrates:
 - .1 Minimum five (5) years of experience in handling, storage and detonation of explosives.
 - .2 Training at a blaster's school which is acceptable to the provincial government.
 - .3 If work entails confined space, submit the following:
 - .1 Copies of current confined space entry training certificates acceptable to Workplace NL, as well as copies of confined space entry programs, confined space assessment, safe work practices and rescue plans.

- .2 Review and acceptance of the SSSP and other submitted documents by the Owner shall only be viewed as acknowledgement that the contractor has submitted the required documentation under this specification section.
- .3 Owner makes no representation and provides no warranty for the accuracy, completeness and legislative compliance of the Site Specific Health and Safety Plan and other submitted documents by this acceptance.
- .4 Responsibility for errors and omissions in the SSSP and other submitted documents is not relieved by acceptance by Owner.
- .5 Contractor to complete and submit to the Construction Manager, on a monthly basis, the Monthly Safety Performance Form, indicating monthly OHS performance indicators, OHS activities, training information and equipment maintenance.
- .1 Monthly Safety Performance Form: use form provided at the end of this section.

1.5 OCCUPATIONAL HEALTH AND SAFETY (SITE SPECIFIC HEALTH AND SAFETY PLANS)

- .1 Conduct operations in accordance with latest edition of the Newfoundland Occupational Health and Safety (OHS) Act and Regulations, with specific reference to codes and standards referenced therein, the Memorial University of Newfoundland Occupational Health and Safety Manual (<https://www.gov.nl.ca/ti/files/publications-ohs-full.pdf>), and the Memorial University of Newfoundland Contractor Safety Management Plan (<https://www.gov.nl.ca/ti/files/Contractor-Safety-Management-program-November-20212.pdf>).
- .2 Prepare a detailed Site Specific Health and Safety Plan (SSSP) that shall identify, evaluate and control job specific hazards through a detailed hazard assessment of the tendered project outlining phases of the project and hazards/controls associated with specific work, equipment, locations and tasks associated with the work conducted during each phase of the project and the necessary control measures to be implemented for managing hazards.
- .3 The plan shall also ensure adequate policies, procedures and safe work practices are in place to manage hazards identified in the hazard assessment that cannot be addressed through engineering controls.

- .4 It is the responsibility of the Contractor to submit only one SSSP that incorporates all relevant portions of their subcontractors' safety documentation.
- .5 For projects exceeding thirty (30) days, provide a copy of the SSSP upon request to Occupational Health and Safety Division, Digital Government and Service NL, Province of Newfoundland and Labrador and the Owner.
- .6 The written SSSP shall incorporate the following:
 - .1 Hazard assessment results.
 - .2 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.
 - .3 An organizational structure, in the form of an organizational chart with contact information of the key positions, which shall establish the specific chain of command and specify the overall responsibilities of contractor's employees at the work site.
 - .1 The chart shall also include relevant information for all subcontractors.
 - .4 Identification of the designated qualified work coordinator(s) (i.e. Supervisor, Contractor Safety Representative) as per Section 21 of the OHS Regulations.
 - .5 A comprehensive work plan which shall:
 - .1 Outline the phases of the Project and the required tasks, equipment, positions, resources and objectives for each phase, including all subcontracted work.
 - .2 Conduct a detailed hazard assessment of each project phase, including all subcontracted work, taking into consideration the objectives, tasks, equipment, positions, resources, training, etc.
 - .3 Identify the controls required for all identified hazards and project phases that may include engineering controls, policies, procedures, equipment, safe work practices, training and communication with staff, etc.
 - .6 Establish personnel requirements for implementing the plan and controls, and establish site-specific training and notification requirements and schedules.

- .7 A personal protection equipment (PPE) Program which shall detail PPE:
 - .1 Selection criteria based on site hazards as determined by the hazard assessment.
 - .2 Use, maintenance, inspection and storage requirements and procedures.
 - .3 Decontamination and disposal procedures.
 - .4 Inspection procedures prior to, during and after use, and other appropriate medical considerations.
 - .5 Limitations during temperature extremes, heat stress and other appropriate medical consideration.
- .8 An emergency response procedure, refer to clause [1.6 Supervision and Emergency Response Procedure](#) of this section for requirements.
- .9 A hazard communication program for informing workers, visitors and individuals outside of the work area as required. This will include but not be limited to a visitor safety and orientation policy and program that will include education on hazards, required PPE and accompaniment while on site.
 - .1 This program shall also take into consideration the safety of the general public that may come in contact with the work site and appropriate measures for notification and safety
- .10 A hearing conservation program in accordance with Part VI, Section 68 of the OHS Regulations.
- .11 A vehicle inspection matrix (tabular or spreadsheet format) showing required inspection type and date of most recent inspection for all powered mobile equipment (including light vehicles) that will be used in fulfilling the terms of the contract, including rented and the subcontractor's equipment. Upon request, the Contractor shall provide to the Owner, individual inspection forms that at a minimum state that the equipment is in a safe operating condition and is signed by a qualified journeyman mechanic..
- .12 A complete listing of employee names, their driver's license classification, expiry date, endorsements and the type of equipment that they are qualified to operate for the complete scope of work for this project. The Driver's License Number should not be provided as this is confidential information. Provision of the License Number may breach *PIPEDA* - the Personal Information Protection and Electronic Documents Act. (Federal Act) or *ATIPPA* - Access to Information and Protection of Privacy Act - Part IV. (Provincial Act)

- of Newfoundland and Labrador). This shall also include documentation where required of certification in power line hazards.
- .13 An acceptable parking policy for all powered mobile equipment to be used on this project. The policy shall, at a minimum, be based on a hazard assessment that considers factors such as equipment type, potential for roll over, load capacity of the parking area, pedestrian and vehicular traffic, and potential for equipment tampering, equipment energy, and equipment contact with power lines.
 - .14 A diving program which shall contain standard operating procedures to be followed in the diving operation.
 - .15 A traffic control plan. Refer to clause [1.24 Traffic Control](#).
 - .16 A fall protection plan, if necessary. Refer to clause [1.22 Working at Heights](#).
 - .17 A dust suppression management program, if necessary.
 - .18 An assessment of all possible risks of violence for the project and corresponding control measures. Considerations should include location and circumstances of the site, previous history of incidents and or possible triggers.
 - .19 General safety rules.
- .7 Periodically review and modify as required each component of the SSSP when a new hazard is identified during completion of work and when an error or omission is identified in any part of the SSSP.
- .8 Review the completeness of the hazard assessment 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, evaluating and managing any report of actual or potential hazards.
 - .2 Clearly define accident incident investigation procedures.
 - .3 Clearly define policy and processes for early and safe return to work.
 - .4 Retain copies of all completed hazard assessments at the project site and make available to the Owner immediately upon request.
- .9 Implement all requirements of the SSSP.
- .1 Ensure that every person entering the project site is informed of requirements under the SSSP.

- .2 Take all necessary measures to immediately implement any engineering controls, administrative controls, personal protective equipment required or termination of work procedures to ensure compliance with the SSSP.
- .10 Conduct site orientations to advise workers of the hazards on their worksites. Site orientations to be performed by the party most familiar with the hazards of the worksite.
- .11 Hold regular toolbox talks, with additional talks if there are changes to the job.
- .12 Conduct weekly site inspections of the worksite.

1.6 SUPERVISION AND EMERGENCY RESCUE PROCEDURE

- .1 Develop an organizational structure which establishes a specific chain of command and overall responsibilities of all employees at the work site.
- .2 Carry out work under the direct supervision of competent persons responsible for safety by ensuring the work complies with the appropriate section of OHS Act and Regulations
- .3 Assign a sufficient number of supervisory personnel to the work site.
 - .1 Any person assigned to supervisory duties shall not conduct significant work in relation to the contract that inhibits them from the ability to properly supervise the work site.
- .4 Ensure the site supervisor has complete understanding, working knowledge and familiarity with the SSSP, applicable codes and standards as well as the OHS Act and Regulations.
- .5 Ensure the site supervisor fully implements, enforces, and monitors the SSSP.
- .6 Prior to the start of work, ensure that the site supervisor(s) have the training, knowledge, and understanding in:
 - .1 Project tasks and construction activities.
 - .2 Hazard recognition evaluation and control.
 - .3 Development and implementation of safe work practices and procedures.
 - .4 Accident incident investigations and reporting.
 - .5 Workplace violence and harassment prevention.

- .6 Equipment maintenance and inspections required for preventive safety.
- .7 Care and maintenance of PPE to be used on site.
- .8 Standard First Aid training certified by WorkplaceNL.
- .9 WHMIS 2015.
- .7 The Site Supervisor shall:
 - .1 Be responsible for project safety by ensuring the work complies with all requirements of the SSSP and with the appropriate section(s) of OHS Act and Regulations, latest edition.
 - .2 Prior to mobilization on site, hold a pre-start Health and Safety meeting with the Contractors, subcontractors, and Owner to review of the SSSP including all its contents.
 - .3 Be responsible for the delivery and documentation of the site safety orientations and ensure that personnel who have not been oriented are not permitted to enter the site. This applies to all workers (Contractor, Subcontractor, and Department), and visitors.
 - .4 Advise of the health and safety hazards for the work site, provide written or verbal instructions of any precautions to be taken to protect everyone at the work site and ensure that the applicable personal protective equipment is used and worn on site at all times.
 - .5 Review hazard assessment for completeness immediately prior to commencing work, when a new hazard is identified during completion of work, or when an error or omission is identified.
 - .6 Address all safety concerns brought to their attention in a timely manner depending on the severity of the hazard.
 - .7 Be responsible for the maintenance of a daily log of inspections, meetings, infractions and mitigating measures. The log is to be filed daily and copies provided to the Owner as requested.
 - .8 Be responsible to log, investigate, track and follow-up on mitigations for all near misses, incidents and/or accidents.
 - .9 Promote employees' right to work in a respectful, harassment-free, and psychologically healthy and safe work environment. Assist the Owner to investigate incidents of workplace violence or harassment carried out against a MUN employee by contractor or sub-contractor employees.
 - .10 Ensure the correct traffic control signage plan is utilized on site and staff have been notified of the requirements. Ensure that road signage is inspected for accuracy and condition by a competent and trained person upon set-up, each morning prior to work, and at any

- point in which the signage requires change during the workday or life of the contract. A Traffic Control and Signage Log must be submitted with the Contractor's Monthly OHS Performance Report.
- .11 If required for the project, coordinate with and support the efforts of the on-site safety representative.
 - .8 Assign a dedicated on-site safety representative to assist the Site Supervisor during the completion of high-risk activities. This person shall have training, knowledge, and understanding regarding the activity(s) being completed. High-risk activities may include, but are not limited to:
 - .1 Heavy lift operations which includes items greater than 1000 kg or which may need an engineered lift plan due to other identified risk factors.
 - .2 Lift operations that occur closer than 10 m of energized power lines or close proximity to moving traffic, public and residential areas, or other sensitive locations.
 - .3 When greater than three (3) employers are working in close proximity at the same time. Close proximity execution means any time the operations of each employer are close enough to directly influence or add risk to another employer.
 - .4 Working within or near highly populated residential areas when there is an appreciable ongoing risk to the public that needs continual safety oversight.
 - .5 When a complex traffic control plan is needed in high volume areas.
 - .6 Work involving confined space entry.
 - .7 Working with or near toxic and hazardous substances.
 - .8 Any other high-risk activity identified through hazard/risk assessment by the Contractor or by the Owner.
 - .9 In such instances, the Contractor may request and the Department may agree that such dedicated safety representation is not needed if the Contractor demonstrates there are adequate safety controls in place to mitigate the risk.
 - .9 Provide a suitable means of communications and check-in for workers required to work alone.
 - .10 Develop an emergency rescue plan for the job site and ensure that supervisors and workers are trained in the emergency rescue plan.
 - .11 The emergency response plan shall address, as a minimum:

- .1 Pre-emergency planning (included the assessment of controls to reduce the likelihood of such an emergency if possible).
- .2 Personnel roles, lines of authority and communication (include a communication list of all emergency services in the immediate and surrounding areas).
- .3 Emergency recognition and prevention (identification of each potential type of emergency and evaluation of requirements for response).
- .4 Required communication equipment including landlines, mobile phones, radios, satellite phones, and/or other equipment needed to ensure appropriate emergency communications in the area of the Project.
- .5 Safe distances and places of refuge.
- .6 Site security and control.
- .7 Evacuation routes and procedures.
- .8 Decontamination procedures which are not covered by the site specific safety and health plan.
- .9 Emergency medical treatment and first aid.
- .10 Emergency alarm, notification and response procedures including procedures for reporting incidents to local, provincial and federal government departments.
- .11 PPE and emergency equipment.
- .12 Procedures for handling emergency incidents.
- .13 Procedures and protocol for working alone and/or remote working.
- .14 Site specific emergency response training requirements and schedules.
- .15 For diving operation, include procedures for:
 - .1 Managing deteriorating environmental conditions.
 - .2 Managing unexpected weather or sea-state condition.
 - .3 Evacuation of diver(s) under pressures greater than atmospheric pressure.
 - .4 In-water emergency transfers.
 - .5 Managing failing of equipment below the surface that impairs the ability of a diver to complete a dive.
 - .6 Managing failure of any major component of diving plant or equipment.

- .7 Emergency signalling between divers involved in the diving program and between the diver(s) and the attendants using umbilical, tethers or other suitable methods.
- .8 Mobilizing stand-by divers.
- .9 Mobilizing crafts, stand-by boats and any other devices to be used for rescue.
- .10 Contacting evacuation, rescue, treatment facilities and medical services that will be used in the diving program.
- .11 Operation of emergency power and lighting facilities.
- .12 The emergency response procedures shall be rehearsed regularly as part of the overall training program and the results documented. The frequency at which all aspects of the emergency response plan will be rehearsed must be stated.
- .13 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 Occupational Health and Safety First Aid Regulations.

1.7 CONTRACTORS SAFETY REPRESENTATIVE

- .1 The contractor shall employ a Contractor's Safety Representative (CSR) who shall have as a minimum successfully completed the following training, and must have current credentials for those that have expiration dates:
 - .1 Training in hazardous materials management and response/protocols.
 - .2 Training in the use, maintenance of fall protection systems certified by Workplace NL at a minimum.
 - .3 Training in the inspection of scaffolding in accordance with CSA Z797.
 - .4 Training in confined space entry protocols, techniques and rescue plans, certified by Workplace NL at a minimum.
 - .5 Supervisory training.
 - .6 Training in records and statistics.
 - .7 Training in hazard identification, inspections, analysis and control.
 - .8 Training in WHMIS 2015.
 - .9 Training in health and safety program content.
 - .10 Training in investigations and reporting.
 - .11 Training in occupational health/hygiene.

- .12 Training in employee training and communication.
- .13 Training in Emergency Preparedness and First Aid.
- .14 A working knowledge of, and experience satisfactory to the Department, using the occupational safety and health legislation and regulations specific to Newfoundland and Labrador.
- .15 Experience, satisfactory to the Department, with the safe work practices required for execution of the work and operation of equipment specific to the project.
- .16 Experience, satisfactory to the Department, in developing and monitoring site safety and housekeeping policies.
- .17 Experience, satisfactory to the Department, in developing and monitoring a preventative maintenance and inspection program for Construction Site Equipment.
- .2 The CSR shall:
 - .1 Be responsible for developing, implementing, daily enforcement, monitoring and updating of the SSSP.
 - .2 Be responsible for the delivery of the site safety orientation and ensure that the personnel who have not been orientated are not permitted to enter the site. This applies to workers, inspectors and visitors.
 - .3 Report directly to and be under direction of the Site Superintendent or Contractor's Project Manager.
 - .4 Prior to mobilization on-site, hold an orientation meeting with the contractors, subcontractors and Owner to review project occupational health and safety. Include but not limit meeting to a review of:
 - .1 The SSSP.
 - .2 Construction Safety Measures.
 - .3 Supervision and Emergency Rescue Procedures.
 - .4 Hazard Assessments
 - .5 Maintain a daily log of inspections, meetings, infractions and mitigating measures. Log is to be filed daily and copies to be provided to the Site Superintendent and Owner.
 - .6 The CSR shall have:
 - .1 Formal training in OHS Management (degree, diploma, or certificate) combined with at least two (2) years of relevant experience, or

- .2 A designation of National Construction Safety Officer (NCSO), Construction Safety Officer (CSO), Canadian Registered Safety Professional (CRSP), Canadian Registered Safety Technician (CRST), or Certified Health and Safety Consultant (CHSC), or other similar designation.

1.8 HEALTH AND SAFETY COMMITTEE

- .1 Establish an Occupational Health and Safety Committee where ten or more workers are employed on the job site for greater than 30 days as per the OHS Act and Regulations.
- .2 Committee members shall receive training from a WorkplaceNL recognized training provider.
- .3 Provide a copy of all committee minutes with the Contractor's Monthly OHS Performance Report.

1.9 CONTRACTOR ROLES AND RESPONSIBILITIES

- .1 Ensure that their organization is staffed appropriately to ensure completion of project tasks and all necessary safety related duties and responsibilities.
- .2 Ensure co-ordination of work schedules and tasks, and communication thereof for the purpose of ensuring health and safety on the worksite.
- .3 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.
- .4 Develop a SSSP that thoroughly assesses the health and safety hazards of each project phase, including all subcontracted work.
- .5 Implement all requirements of the SSSP. The Contractor shall take all necessary measures to immediately implement any engineering controls, administrative controls, personal protective equipment required or termination of work procedures to ensure compliance with the SSSP and the OHS Act and Regulations. All measures should be immediately communicated to staff.
- .6 Comply with and enforce compliance by employees, subcontractors, suppliers and visitors with safety requirements of Contract Documents, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with SSSP.

- .7 Where safety risks exist, the contractor must stop the work until such time as the risk can be mitigated to a safe level.
- .8 Take appropriate steps to ensure that the hazards are mitigated to a safe level, workers are notified of the hazards and how to protect themselves. As well, workers must be provided with any new safe work practices or information regarding mitigation of the risk.
- .9 Periodically review and modify the SSSP as required including but not limited to when a new hazard is identified during completion of work or when an error or omission is identified in any part of the SSSP.
- .10 Support/permit periodic inspections of the Contractor's work by the Owner to maintain compliance with the SSSP. Inspections may include visual inspections of the site and documentation, as well as testing and sampling as required.
- .11 Be responsible for any and all costs associated with delays as a result of the Contractor's failure to comply with the requirements outlined in this Section or the OHS Act and Regulations.
- .12 Ensure that all workers receive necessary training as per the training matrix contained in the SSSP prior to the start of work. Maintain training records in a tabular format or spreadsheet for all employees on the project site and complete periodic reviews to ensure that necessary re-certifications are completed prior to expiration dates.
- .13 Ensure all equipment, vehicles, tools, or other devices necessary throughout the Project are suitable for the task and are inspected and maintained in accordance with the manufacturers' specifications and/or CSA standards adopted by the OHS Regulations.
- .14 Be responsible to ensure that site inspections have been completed at no less than one (1) week intervals. These site inspections shall include risk assessments where the nature of the ongoing work or tasks associated with the work increase in risk or significantly change due to phases in the project or project progression.
- .15 Ensure that toolbox meetings are held with staff no less than once per week and shall include review of safety related information that is pertinent to the safety of employees.

- .16 Ensure that all toolbox meetings, site inspections, risk assessments, OHS Committee meetings and any OHS Directives or reports are documented and submitted with the Contractor's Monthly OHS Performance Report.
- .17 Review for completeness the hazard assessment results immediately prior to commencing work, when a new hazard is identified during completion of work or when an error or omission is identified.
- .18 Be solely responsible for investigating, evaluating and managing any report of actual or potential hazards.
- .19 Retain copies of all completed hazard assessments at the project site and provide a copy to the Owner. Copies of any hazard assessments not included in the original SSSP must be submitted immediately to the Owner and noted on the Contractor's Monthly OHS Performance Report.
- .20 Promote the employees' right to work in a respectful, harassment-free, and psychologically healthy and safe work environment. Assist the Owner to investigate incidents of workplace violence or harassment carried out against a MUN employee by contractor or sub-contractor employees.

1.10 UNFORSEEN HAZARDS

- .1 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 verbally and in writing.

1.11 REPORTING AND INVESTIGATION

- .1 The Contractor shall adhere to a documented incident, hazard, safety reporting, and investigation process. The system shall:
 - .1 Ensure all hazards, near misses, incidents, accidents, injuries, equipment damage are recorded and properly investigated.
 - .2 Rank actual and potential severity of observations and report all high potential near misses, accidents, and incidents immediately to the Owner and to the OHS Division of Digital Government and Service NL.
 - .3 Advise the Owner and the OHS Division of Digital Government and Service NL verbally and in writing immediately of any incident that results in serious injury to a person or results in the death of a person; or had the reasonable potential to cause serious injury.

- .4 Provide a copy of all notifications made to the OHS Division of Digital Government and Service NL to Memorial University of Newfoundland.
- .5 Where life safety risks or other high potential risks exists, the Contractor must stop work until such time as the risk can be mitigated to a safe level.
- .6 Make appropriate steps to ensure that the hazards are mitigated to a safe level, workers are notified of the hazards and how to protect themselves. Additionally, workers must be provided with any new safe work practices or information regarding mitigation of the risk.

1.12 INSTRUCTION AND TRAINING

- .1 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.
- .2 Contractors shall develop an OHS training program that reflects OHS Legislative requirements and specific safety hazards based on Project work
- .3 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.
 - .7 Workers must receive training from a WorkplaceNL recognized training provider as outlined in the OHS legislation (i.e. fall protection, confined space entry, power line hazards, traffic control persons training).

- .8 Training in the use, care and maintenance of PPE to be used on site.
- .9 Training in the Contractor's emergency response plan for the Project. Workers engaged in fall arrest or confined space rescue operations will require specific training for the tasks involved.
- .10 All workers at site must receive training in Workplace Violence and Harassment Prevention.
- .11 Training in WHMIS 2015.
- .12 Safety and health hazards associated with working in extreme weather conditions (i.e. heat/cold hazards).
- .4 Provide and maintain training of workers, as required, by Federal and Provincial legislation.
- .5 Provide copies of all training records to Owner for review, before a worker is to enter the work site. Site training records must be in tabular or spreadsheet format, stating employee name, occupation, required training, date that training was obtained and expiry date. This must be signed and dated by a member of the Contractor's management team.
- .6 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 SSSP.
 - .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.
 - .6 Accompanied while on site, and provided with the appropriate PPE.
- .7 All workers will be instructed and trained on the hazards associated with work they will perform and how to protect themselves. This will include a review of all safe work practices, the reporting and documentation of hazards, reporting accidents and injuries as well as, formal training in areas of high risk (i.e. fall protection, power line hazards, traffic control persons training).
- .8 The work site shall have the appropriate number of persons trained in emergency and Standard First Aid according to the First Aid Regulations.

1.13 CONSTRUCTION SAFETY MEASURES

- .1 Observe construction safety measures of National Building Code, latest edition, Federal and Provincial Government, OHS Act and Regulations, Workplace NL and Municipal Authority provided that in any case of conflict or discrepancy more stringent requirements shall apply.
- .2 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 SSSP.
- .3 Provide Owner with copies of all orders, directions and any other documentation, issued by the Occupational Health and Safety Division, Digital Government and Service NL, immediately after receipt.
- .4 Forward copies of all orders, directions or any other documentation immediately after receipt.

1.14 POSTING OF DOCUMENTS

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

1.15 HEALTH AND SAFETY MONITORING

- .1 Periodic inspections of the contractor's work may be carried out by the Owner to maintain compliance with the Health and Safety Program. Inspections will include visual inspections as well as testing and sampling as required.
- .2 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 NOTIFICATION

- .1 For projects exceeding thirty (30) days or more, the contractor shall, prior to the commencement of work, notify in writing the Occupational Health and Safety Division, Digital Government and Service NL with the following information and provide a copy to the Owner:
 - .1 Name and location of construction site.
 - .2 Company name and mailing address of contractor doing the work.

- .3 The number of workers to be employed.
- .4 A copy of the SSSP, if requested.

1.17 CORRECTION OF NON-COMPLIANCE

- .1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Owner.
- .2 Provide Owner with written report of action taken to correct non-compliance of health and safety issues identified within ten (10) working days.
- .3 Owner may stop work if non-compliance of health and safety regulations is not corrected.

1.18 WHMIS 2015

- .1 Ensure that all controlled products are in accordance with the Workplace Hazardous Materials Information System (WHMIS 2015) Regulations and Chemical Substances of the OHS Act and Regulations regarding use, handling, labelling, storage, and disposal of hazardous materials.
- .2 Deliver copies of relevant Safety Data Sheets (SDS) to job site and the Owner. 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. All SDS should be located in accessible locations for all workers and visitors throughout the site, bound and organized in binders.
- .3 Train workers required to use or work in close proximity to controlled products as per OHS Act and Regulations. This must be documented as part of the on-site orientation and a copy provided to the Owner.
- .4 Label controlled products at jobsite as per OHS and Regulations and WHMIS.
- .5 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.
- .6 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.
- .7 No controlled products are to be brought on-site without prior approved SDS.
- .8 The SDS are to remain on site at all times and are accessible to everyone on site.

1.19 OVERLOADING

- .1 The Contractor's Full Time CSR and/or Site Superintendent shall ensure no part of work or associated equipment is subjected to loading that will endanger its safety or will cause permanent deformation.
- .2 Ensure equipment operations follow manufacturer's operating manual.

1.20 FALSEWORK

- .1 Design and construct falsework in accordance with CSA S269.1.

1.21 SCAFFOLDING

- .1 Design, erect, inspect, operate, modify, and dismantle scaffolding in accordance with CSA Z797, Part XI: sections 147-249 of the OH&S Act and Regulations, and the scaffold manufacturer's written instructions.
- .2 Provide trained and certified Competent Scaffold Erectors for all scaffold erection, modification and dismantling. Training certification must be valid at time of erection, modification and dismantling of scaffold.
- .3 Conduct and document daily inspections of scaffolding by trained and certified Competent Scaffold Inspectors or Erectors. Training certification must be valid at the time of inspection.
 - .1 Records and copies of these inspections shall be kept on site and provided upon request to the Memorial University of Newfoundland officials, Owner, etc.
- .4 Scaffolding inspection reports may be required to be provided with the Contractor's Monthly OHS Performance Reports, at the discretion of the Owner.
- .5 Provide a scaffold tagging system as described in CSA Z797.

- .6 Ensure that all industry best practices for safe scaffold usage, including fall protection, proper loading, safe access, electrical hazards, exit door management and other concerns are strictly adhered to.

1.22 WORKING AT HEIGHTS

- .1 Develop a site specific fall protection plan, including a rescue plan, and provide it to the Owner as a part of the SSSP when fall protection systems are required during the course of the Project
- .2 Ensure that fall restraint or fall arrest devices are used by all workers working at elevations greater than 3.05 meters above grade or floor level in accordance with CSA Z259, where alternate fall protection systems are not provided in accordance with Occupational Health and Safety Act and Regulations.
- .3 All workers performing work at height and who will be required to utilize a fall arrest system must be trained in a fall protection program certified by the Workplace NL. Training must be current and valid at the time of use.
- .4 Prior to working at height workers shall be instructed in a Contractor Safe Work Practice for working at height and associated Rescue Plan for working at heights, developed specific to the work to be performed, locations and risks.
- .5 Maintain a list of all persons trained in WorkplaceNL certified fall protection training on site. To be combined with other training records as required in a tabular or spreadsheet format listed throughout this Section.
- .6 Ensure regular inspections of all fall protection and fall arrest equipment are completed and that records are maintained and kept on site. Daily inspections of fall restraint and horizontal fall protection/arrest systems shall be conducted.
- .7 Ensure that manufacturer's specifications for engineered fall protection/arrest/restraint systems are kept on site at all times.
- .8 Develop Working from Height Safe Work Practices specific to the Work, location and risks, and ensure the workers receive specific instruction regarding the work tasks and associated rescue plans.
- .9 Ensure that rescue equipment for fall rescues is kept in close proximity to workers working at height.

- .10 Where necessary the Contractor shall ensure that adequate protection from falling debris is addressed in site specific safety plans, this may include debris nets, barriers, etc.

1.23 PERSONAL PROTECTIVE EQUIPMENT

- .1 Ensure workers on the jobsite use personal protective equipment appropriate to the hazards identified in the SSSP and those workers are trained in the proper care, use, and maintenance of such equipment.
- .2 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. PPE must also be fitted for the worker.
- .3 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 recommendations of the ACGIH, do not meet the appropriate standards for the specific contaminants or are not in accordance with the OHS regulations.
 - .2 Respiratory protection shall be provided in accordance with the requirements of the Occupational Health and Safety Division, Digital Government and Service NL and these specifications.
 - .3 Establish, implement and maintain a respirator inspection and maintenance program in accordance with the CSA standard identified in the OHS Regulations.
 - .4 Copies of all respirator owners' maintenance manuals shall be kept at all times at the contractor's site office.
- .4 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.
- .5 Provide all workers and up to five (5) 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, in accordance with the Hearing Conservation Program.
- .6 Provide all workers and up to five (5) 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.
- .7 Provide workers and up to five (5) visitors to the site with CSA approved hard hats meeting the CSA Z94.1.
- .8 Provide high visibility apparel as defined in Occupational Health and Safety Regulations.
- .9 Provide CSA approved safety boots meeting CSA Z195.
- .10 Provide other personal protective equipment, as may be required by the owner, depending on duties being performed.

1.24 TRAFFIC CONTROL

- .1 Provide traffic control measures when working on, or adjacent to, roadways in accordance with the Traffic Control Manual, latest edition, Memorial University of Newfoundland.
 - .1 This will include but is not limited to appropriate signage, traffic control persons and control vehicles.
- .2 Ensure daily completion of the Memorial University of Newfoundland, Traffic Control and Signage Log. The log will be submitted monthly with the Contractor Monthly Safety Performance Form and may be inspected randomly by MUN staff for completion and accuracy.
- .3 Complete hazard assessments for traffic control plans to identify hazards unique to the work (i.e., volume of heavy equipment, size of lanes and

barriers to protect workers from traffic, additional decreases in posted speeds, etc.).

- .4 The Contractor shall ensure that traffic control persons have completed Traffic Control Person Level I training as certified by WorkplaceNL.
- .5 The Contractor shall ensure that a competent individual is responsible for monitoring, maintaining and adjusting traffic control plans throughout the life of the project. This individual shall:
 - .1 Have completed Traffic Control Person Level II training as certified by WorkplaceNL.
 - .2 Be provided with authority and resources to ensure continuous monitoring of the worksite and revision of the traffic control plan when necessary.
 - .3 Be responsible to complete the Traffic Control and Signage Log to accompany the Contractor's Monthly Safety Performance Form requirements.
 - .4 Ensure compliance with Part XVI of the OHS Regulations 5/12.

1.25 CONFINED SPACE WORK

- .1 Comply with the Newfoundland and Labrador Occupational Health and Safety Regulations.
- .2 Ensure a hazard assessment has been conducted related to the confined space and the work to be performed within the space.
- .3 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.
- .4 Ensure all required PPE is provided to the workers and workers are trained in its use, care and selection.
- .5 Develop a confined space entry (CSE) program specific to the nature of work performed and in accordance with OHS Act and Regulations and ensure supervisors and workers are trained in the confined space entry program. This shall include training on the CSE permit system, rescue plan, testing, communication equipment and all equipment and safe work procedures conducted in and around the confined space.

- .1 Ensure that personal protective equipment and emergency rescue equipment appropriate to the nature of the work being performed is provided and used.
- .6 Provide and maintain training of workers through a provider certified by the Workplace NL.
- .7 Provide Owner with a copy of an “Entry Permit” for each entry into the confined space to ensure compliance Provincial Legislation.

1.26 HAZARDOUS MATERIALS

- .1 Should material resembling hazardous materials (e.g. asbestos/mould) not previously identified/documented be encountered during the execution of work, stop work and notify Owner. Do not proceed until written instructions have been received from Owner.
- .2 Unless otherwise noted the services of a recognized Environmental Consultant to provide all air monitoring and testing services required by regulatory requirements for hazardous materials abatement and repair.

1.27 HEAVY EQUIPMENT

- .1 Ensure mobile equipment used on jobsite is of the type specified in OHS Act and Regulations fitted with a Roll Over Protective (ROP) Structure and Falling Object Protective (FOP) Structure.
- .2 Ensure that operators of mobile equipment have adequate instruction and are competent in the operation of mobile equipment.
- .3 Provide certificate of training in Power Line Hazards for operators of heavy equipment.
- .4 Obtain written clearance from the power utility where equipment is used in close proximity to (within 5.5 metres) overhead or underground power lines.
- .5 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.

1.28 WORKPLACE VIOLENCE AND HARASSMENT

- .1 Develop a Workplace Violence and Harassment Prevention Plan for the project that complies with the latest edition of the OHS Regulations.

1.29 ACCESS, EGRESS AND WALKWAYS

- .1 Ensure that all accesses, egresses and walkways are continuously monitored for hazards which may include slips, trips, slippery conditions and other hazards.
- .2 Develop provisions for snow clearing of walkways, accesses and egresses.
- .3 Ensure that all access, egress hatches, holes or other potential hazards of this nature are clearly identified to workers and adequately covered.

1.30 RIGGING AND SLINGING

- .1 Ensure that workers required to perform work related to rigging and slinging are trained and deemed competent in such operations and practices.
- .2 Maintain and inspect all rigging and slinging equipment in accordance with manufacturers' specifications, CSA Standards and OHS Regulations.
- .3 Ensure that the working load limit of rigging and slinging equipment on site is marked and visible on the product.
- .4 At a minimum, ensure that rigging and slinging operations meet the requirements of the OHS Act and Regulations.
- .5 Ensure that rigging and slinging equipment identified in daily inspections or otherwise identified as damaged, worn or unacceptable to manufacturers' specifications, appropriate standards or OHS Regulations is immediately taken out of service and destroyed.

1.31 WORK STOPPAGE

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

1.32 OWNER'S STATEMENT

- .1 The Owner shall not be responsible for injury or damage occasioned by a failure of the Contractor to adhere to the provisions of this Section.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

Monthly Safety
Performance Form

Contractor Information				
Contractor/Company Name				
Report Prepared By				
Report for Period		Beginning:	Ending:	
Project and Location				
Contact	Name		Contact Number	
Project Manager				
Contractor CSR				
Site Superintendent				
Monthly OHS Performance Indicators				
Lagging Indicators		Leading Indicators		
Indicate the total within reporting period above	Monthly Total	Indicate the total within reporting period above	Monthly Total	Records available
Lost Time Injuries		Tool Box Talks (safety specific)*		
Working Days Lost		OHS Committee/Rep Meetings*		
Return to Work Plans		Bi-Weekly Project Meeting		
First Aid Incidents		Site Safety Orientations		
Medical Aid Incidents		Weekly Site Inspections*		
Total Hours Worked (site)		Hazard Reports Submitted		
Accident /Incident reports*		Hazard Assessments Conducted*		
Accident Incident Investigations Conducted*		Traffic Control Signage Log Completed*		
		NLCSA Certificate of Recognition (COR)*		
OHS Division Activities				
OHS Division Inspections		OHS Division Directives Issued*		
Sub-Contractor Information				
Name sub-contractors working on site	Description of work conducted by sub-contractors		Days on site	COR Certified (Y/N)
Training Information				
Training conducted with staff	Brief description of training conducted with safety or work practice focus		Total staff trained	Records available (Y/N)
Equipment Maintenance				
Annual equipment inspections conducted (Y/N)	All equipment passed inspection (Y/N)	Records Available (Y/N)	Non-Routine maintenance required? Identify equipment	List maintenance conducted
Report completed on:		Signature:		

Please attach information pertaining to items highlighted with an asterisk (*)

Definitions

1. **Accident** – An undesired event resulting in death, ill health, damage or other loss.
2. **Accident/Incident Investigation** – An investigation by the employer into the root cause of an accident or incident to identify hazards and prevent workplace accidents/incidents from recurring.
3. **Accident/Incident Report** – all accidents and incidents must be reported, whether through an internal reporting structure or through the Workplace NL employers Form 7. All accidents of a serious nature must also be reported to the PHS Division within 24 hours (serious accidents as outlined in Section 54(3) of the OHS Act).
4. **First Aid Incident** – An occupational injury/illness that requires first aid treatment only and does not result in loss of time from work or restricted work.
5. **Incident** – An unplanned, undesired event that had the potential to cause injury or other damage.
6. **Lost-Time Injury** – An injury/illness resulting in Lost Days beyond the date of injury as a direct result of the occupational injury/illness incident on the project.
7. **Medical Aid incident** – A classification of occupational injury/illness for medical treatment beyond first aid injury where there has been no lost days, i.e., visit to a health care provider or hospital specific to the injury.
8. **Total Hours Worked** – Total number of hours of employment (i.e., the actual worked hours) of all employees for each contractor and sub-contractor companies for the reporting period specific to the project.
9. **Working Days Lost** – The number of calendar days that the employee is unable to work beyond the day of the injury specific to the project in which the injury occurred. Calculate total days for all employees working on the project.

Traffic Control and Signage Log

Contractor Information			
Contractor/Company Name			
Report Prepared By			
Project and Location			
Contact	Name	Contact Number	
Project Manager			
Contractor CSR			
Site Superintendent			
Log No. _____			
Date/Time:		Number/Name of Signage Layout from TCM:	
Condition/Placement of Signage:			
Current/Expected Weather Conditions:		Signage/Equipment Adequate for work and Conditions (Y/N):	
Deficiencies Completed Prior to Start of Work (Signage Repairs, Replacements, Upgrading, etc.)			
Report Completed By:		Date/Time:	
TI Representative:		Date/Time:	
Log No. _____			
Date/Time:		Number/Name of Signage Layout from TCM:	
Condition/Placement of Signage:			
Current/Expected Weather Conditions:		Signage/Equipment Adequate for work and Conditions (Y/N):	
Deficiencies Completed Prior to Start of Work (Signage Repairs, Replacements, Upgrading, etc.)			
Report Completed By:		Date/Time:	
TI Representative:		Date/Time:	
Log No. _____			
Date/Time:		Number/Name of Signage Layout from TCM:	
Condition/Placement of Signage:			
Current/Expected Weather Conditions:		Signage/Equipment Adequate for work and Conditions (Y/N):	
Deficiencies Completed Prior to Start of Work (Signage Repairs, Replacements, Upgrading, etc.)			
Report Completed By:		Date/Time:	
TI Representative:		Date/Time:	
Log No. _____			
Date/Time:		Number/Name of Signage Layout from TCM:	
Condition/Placement of Signage:			
Current/Expected Weather Conditions:		Signage/Equipment Adequate for work and Conditions (Y/N):	
Deficiencies Completed Prior to Start of Work (Signage Repairs, Replacements, Upgrading, etc.)			
Report Completed By:		Date/Time:	
TI Representative:		Date/Time:	

PART 1 **GENERAL**

1.1 **FIRES**

- .1 Fires and burning of rubbish on site not permitted.

1.2 **DISPOSAL OF WASTES**

- .1 Do not bury rubbish and waste materials on site.
- .2 Do not dispose of waste or volatile materials, such as mineral spirits, oil or paint thinner into waterways, storm or sanitary sewers.

1.3 **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 local authority requirements.

1.4 **SITE CLEARING AND PLANT PROTECTION**

- .1 Protect trees and plants on site and adjacent properties where indicated.
- .2 Wrap in burlap, trees and shrubs adjacent to construction work, storage areas and trucking lanes, and encase with protective wood framework from grade level to height of 2.0 m.
- .3 Protect roots of designated trees to dripline during excavation and site grading to prevent disturbance or damage. Avoid unnecessary traffic, dumping and storage of materials over root zones.
- .4 Minimize stripping of topsoil and vegetation.
- .5 Restrict tree removal to areas indicated or designated by Owner.

1.5 **WORK ADJACENT TO WATERWAYS**

- .1 Do not operate construction equipment in waterways.
- .2 Do not use waterway beds for borrow material.

- .3 Do not dump excavated fill, waste material or debris in waterways.
- .4 Design and construct temporary crossings to minimize erosion to waterways.
- .5 Do not skid logs or construction materials across waterways.
- .6 Avoid indicated spawning beds when constructing temporary crossings of waterways.
- .7 Do not blast under water or within 100 m of indicated spawning beds.

1.6 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.

1.7 NOTIFICATION

- .1 Owner will notify Contractor in writing of observed non-compliance with Federal, Provincial or Municipal environmental laws or regulations, permits, and other elements of environmental protection. Contractor: after receipt of such notice, inform Owner of proposed corrective action and take such action as approved by Owner.
- .2 Owner may issue stop order of work until satisfactory corrective action has been taken.
- .3 No time extensions will be granted or equitable adjustments allowed to Contractor for such suspensions.

PART 2 **PRODUCTS (NOT APPLICABLE)**

PART 3 **EXECUTION (NOT APPLICABLE)**

END OF SECTION

PART 1 **GENERAL**

1.1 **RELATED SECTIONS**

- .1 Section 02 82 00.02 – Asbestos Abatement

1.2 **REFERENCES AND CODES**

- .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 Specific design and performance requirements listed in specifications or indicated on Drawings may exceed minimum requirements established by referenced Building Code; these requirements will govern over the minimum requirements listed in Building Code:
 - .1 Meet or exceed requirements of:
 - .1 Contract documents.
 - .2 Specified standards, codes and referenced documents.

1.3 **HAZARDOUS MATERIAL DISCOVERY**

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

1.4 **BUILDING SMOKING ENVIRONMENT**

- .1 Comply with smoking restrictions.

1.5 **RELICS AND ANTIQUITIES**

- .1 Protect relics, antiquities, items of historical or scientific interest such as cornerstones and contents, commemorative plaques, inscribed tablets, and similar objects found during course of work.

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- .2 Give immediate notice to Owner and await Owner's written instructions before proceeding with work in this area.
- .3 Relics, antiquities and items of historical or scientific interest remain Her Majesty's property.

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 this contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this section.

1.2 **INDUSTRY STANDARDS**

- .1 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 part of the Contract Documents by reference.
- .2 All construction industry standards referenced in this specification to meet the edition of the standard referenced by the National Building Code of Canada (NBC). If the construction industry standard is not referenced in the National Building Code of Canada (NBC), the latest edition of the standard shall apply.
- .3 Each entity engaged in construction on this Project must be familiar with construction industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Construction Documents.
 - .1 Where copies of construction industry standards are needed to perform a required construction activity, obtain copies directly from publication source and make them available upon request.

1.3 **ABBREVIATIONS AND ACRONYMS FOR INDUSTRY ORGANIZATIONS**

- .1 Where abbreviations and acronyms are used, they shall mean the recognized name of the entities in the following list. Names are believed to be accurate and up-to-date as of the date of the Contract Documents.
- .2 Industry Organizations:
 - .1 Air Conditioning and Mechanical Contractors Association (AMCA).
 - .2 Air Conditioning and Refrigeration Institute (ARI).
 - .3 Americans with Disability Act (ADA).
 - .4 Air Movement and Control Association (AMCA).

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- .5 The Aluminum Association, Inc. (AA).
- .6 American Architectural Manufacturers Association (AAMA).
- .7 American Association of State Highway and Transportation Officials (AASHTO).
- .8 American Association of Textile Chemists and Colourists (AATCC).
- .9 American Bearing Manufacturers Association (ABMA).
- .10 American Boiler Manufacturer's Association (ABMA).
- .11 American Concrete Institute (ACI).
- .12 American Industrial Hygiene Association (AIHA).
- .13 American Institute of Steel Construction (AISC).
- .14 American Iron & Steel Institute (AISI).
- .15 American National Standards Institute (ANSI).
- .16 American Petroleum Institute (API).
- .17 American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE).
- .18 American Society of Mechanical Engineers (ASME).
- .19 American Society of Sanitary Engineer's (ASSE).
- .20 American Society for Testing and Materials (ASTM).
- .21 American Water Works Association (AWWA).
- .22 American Welding Society (AWS).
- .23 American Wood-Preservers' Association (AWPA).
- .24 Architectural Woodwork Institute (AWI).
- .25 Architectural Woodwork Manufacturers Association of Canada (AWMAC).
- .26 Asphalt Institute (AI).
- .27 Associated Air Balance Council (AABC).
- .28 Association of the Wall and Ceilings Industries International (AWEI).
- .29 Atomic Energy Control Board Regulations.
- .30 Brick Industry Association (BIA).
- .31 Building Industry Consulting Services International (BICSI).
- .32 Canada Green Building Council (CaGCB).
- .33 Canada Labour Code.
- .34 Canadian Council of Ministers of the Environment (CCME).
- .35 Canadian Code for Preferred Packaging.
- .36 Canadian Construction Materials Centre (CCMC).
- .37 Canadian Environmental Protection Act (CEPA).

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- .38 Canadian Gas Association (CGA).
- .39 Canadian General Standards Board (CGSB).
- .40 Canadian Institute of Steel Construction (CISC).
- .41 Canadian Nursery Landscape Association (CNLA).
- .42 Canadian Paint Manufacturer's Association (CPMA).
- .43 Canadian Roofing Contractors' Association (CRCA).
- .44 Canadian Sheet Steel Building Institute (CSSBI).
- .45 Canadian Standards Association (CSA).
- .46 Canadian Steel Door and Frame Manufacturers' Association (CSDFMA).
- .47 Canadian Urethane Foam Contractors' Association Inc. (CUFCA).
- .48 Carpet and Rug Institute (CRI).
- .49 Ceramic Tile Institute (CTI).
- .50 Consumer Electronics Association (CEA).
- .51 Cooling Technology Institute (CTI).
- .52 Department of Justice Canada (Jus).
- .53 Electrical and Electronic Manufacturers' Association of Canada (EEMAC).
- .54 Electronic Industries Alliance (EIA).
- .55 Environment Canada (EC).
- .56 The Environmental Choice Program.
- .57 Environmental Protection Agency (EPA).
- .58 Environmental Protection Services (EPS).
- .59 ETL Listing Laboratories (ETL).
- .60 Factory Mutual (FM).
- .61 Federal Communications Commission (FCC).
- .62 Flat Glass Manufacturers Association (FGMA).
- .63 Green Seal Environmental Standards.
- .64 Health Canada - Workplace Hazardous Materials Information System (WHMIS).
- .65 Hydraulics Institute (HI).
- .66 Hydronic Institute of Boiler and Radiator Manufacturers (IBR).
- .67 Industry Canada - Terminal Attachment Program.
- .68 Institute of Electrical and Electronics Engineers (IEEE).
- .69 Institute for Research in Construction (IRC).
- .70 Insulated Cable Engineers Association (ICEA).
- .71 International ElectroTechnical Commission (IEC).

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- .72 International Masonry Industry All-Weather Council (IMIAC).
- .73 International Standards Organization (ISO).
- .74 Laminators Safety Glass Association (LSGA).
- .75 Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS).
- .76 Master Painters Institute (MPI).
- .77 National Energy Code of Canada for Buildings (NECB).
- .78 National Association of Architectural Metal Manufactures (NAAMM).
- .79 National Association of Corrosion Engineers (NACE).
- .80 National Building Code of Canada (NBC).
- .81 National Bureau of Standards/Products Standard (NBS/PS).
- .82 National Electrical Manufacturers Association (NEMA).
- .83 National Environmental Balancing Bureau (NEBB).
- .84 National Fire Code of Canada (NFC).
- .85 National Fire Protection Association (NFPA).
- .86 National Floor Covering Association (NFCA).
- .87 National Hardwood Lumber Association (NHLA).
- .88 National Lumber Grades Authority (NLGA).
- .89 National Plumbing Code of Canada (NPC).
- .90 National Research Council Canada (NRC).
- .91 National Roofing Contractors Association (NRCA).
- .92 National Sanitation Foundation (NSF).
- .93 Newfoundland Occupational Health and Safety Act.
- .94 Plumbing and Drainage Institute (PDI).
- .95 Province of Newfoundland and Labrador Building Accessibility Regulations.
- .96 Provincial Boiler, Pressure Vessel and Compressed Gas Regulations.
- .97 Scientific Equipment and Furniture Association (SEFA).
- .98 Sealant and Waterproofer's Institute.
- .99 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).
- .100 Society of Automotive Engineers (SAE).
- .101 The Society for Protective Coatings (SSPC).
- .102 South Coast Air Quality Management District (SCAQMD).
- .103 Telecommunications Distribution Methods Manual (TDMM).

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- .104 Telecommunications Industries Association (TIA).
- .105 Terrazzo Tile and Marble Association of Canada (TTMAC).
- .106 Thermal Insulation Association of Canada (TIAC).
- .107 Transport Canada (TC).
- .108 Transport Canada - Marine Safety (TCMS).
- .109 Treasury Board of Canada (TB).
- .110 Treasury Board Information Technology Standard (TBITS).
- .111 Truss Plate Institute of Canada (TPIC).
- .112 Underwriters' Laboratories Inc. (UL).
- .113 Underwriter's Laboratories of Canada (ULC).
- .114 United States Federal Trade Commission (US Federal Trade Commission).
- .115 U.S. Coast Guard Equipment List (USCG).
- .116 U.S. Department of Transportation (DOT).
- .117 National Fireproofing Contractors Association (NFCA).

PART 2 **PRODUCTS (NOT APPLICABLE)**

PART 3 **EXECUTION (NOT APPLICABLE)**

END OF SECTION

PART 1 **GENERAL**

1.1 **SUMMARY**

- .1 This sections covers administrative and procedural Quality Control and Quality Assurance requirements for this Contract.
- .2 Quality control requirements include inspections, tests and related actions including reports performed by independent agencies, governing authorities, and the Contractor.
- .3 The Contractor is responsible for controlling the quality of work, including work of its subcontractors and suppliers, and for ensuring the quality specified in the Contract Documents is achieved.
- .4 Provisions for quality assurance apply to workmanship and craftsmanship applied to work executed in the performance of the Contract.
 - .1 Perform work with suitable qualified personnel to produce work of specified quality.
 - .2 Refer to applicable Codes and Standards.
 - .3 Refer to printed manufacturer's instructions.
 - .4 Refer to workmanship requirements of trade associations.
 - .5 Test materials in accordance with applicable standards.
 - .6 Provide field samples and mock-ups to establish acceptable level of quality and a basis for judging work.
 - .7 Follow inspection requirements.
- .5 Related work described elsewhere:
 - .1 Provisions of trade associations.
 - .2 Manufacturer's printed instructions.
 - .3 Recommendations, methods and criteria for applications and installation of systems and assemblies.
 - .4 Various technical sections of these Contract specifications and drawings.
 - .5 Provisions of work installed under this Contract furnished by others.
- .6 Testing and inspection services are required to verify compliance with the Contract Documents. These services do not relieve the Contractor of their responsibility for compliance with the Contract's requirements.

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

1.2 CONTRACTOR RESPONSIBILITIES

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

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

1.3 PROJECT INSPECTOR

- .1 Owner will engage a qualified Inspector whose primary duty is to inspect the Work for compliance with the Contract Documents.
 - .1 The Inspector will report to the Owner.
- .2 Provide free access to all parts of the Work at all times, so as to allow continuous observation by the Inspector.
 - .1 Presence of the Inspector does not relieve the Contractor in any way from requirement to comply with the Contract Documents.
- .3 Provide Inspector minimum two (2) days notice of time when work that requires inspecting will be performed.
- .4 Provide reasonable facilities for Inspector's use in performing inspection duties, as specified in Section 01 52 00 – Construction Facilities.
- .5 Inspector shall have authority to stop the Work in the event Contract Documents are not being complied with, but is not authorized to change requirements contained in the Contract Documents.

1.4 QUALIFICATIONS

- .1 Project Superintendent

- .1 The Contractor shall engage a qualified person who is thoroughly trained and experienced in the duties of a Project Superintendent to oversee the total overall Work of this Contract.
- .2 Project Superintendent shall:
 - .1 Have a minimum ten (10) years construction experience, with a minimum of five (5) years being in commercial construction.
 - .2 Demonstrate successful completion of a minimum of five (5) projects of similar scope and budget through a resume and letters of recommendation.
 - .3 Exercise general supervision over the Work, have the decision-making authority of the Contractor, and be familiar with the specified requirements and methods to be used in the scheduling, supervision, performance and execution of the Work.
- .3 Project Superintendent's qualifications are subject to review and approval by the Owner, and shall not be reassigned until final acceptance of the Work, unless permitted in writing by the Owner.
- .2 Subcontractors
 - .1 Trade subcontractors involved in work of this Project shall be administered, supervised and directed by at least one qualified journeyman foreman who is thoroughly trained and skilled in the arts generic to their trade and such qualifications may be subject to review by the Owner.
- .3 Workers
 - .1 Workers engaged in the performance of work of this Project shall be skilled and knowledgeable in methods and craftsmanship needed to produce required quality levels for workmanship in completed work.
 - .2 Workers shall be thoroughly trained and experienced in the installation of the specified and selected products, and who are completely familiar with the requirements of their respective work and this Work.
- .4 Fabricators, Suppliers, Installers and Personnel
 - .1 A firm or individual experienced in producing, installing, erecting or assembling products similar to those indicated for this Project, and with a record of successful in-service performance.
 - .2 Fabricators, erectors, suppliers, installers, and applicators shall have not less than five (5) years continuous experience in the

execution of their respective duties, and their qualifications may be subject to review and approval by the Owner.

.5 Manufacturer

- .1 A firm experienced in manufacturing products or systems similar to those indicated for this Project, and with a record of successful in-service performance.

1.5 QUALITY CONTROL

- .1 The Owner may provide inspections, tests and similar quality control services, specified in individual Specification Sections and are required by governing authorities, except where they are specifically indicated to be the Contractor's responsibility.
 - .1 The Owner may employ and pay an independent agency to perform specified quality control services.
- .2 The Contractor shall corporate with agencies performing required inspections, tests and similar services, and provide reasonable auxiliary services as requested. Auxiliary services required but are not limited to:
 - .1 Providing access to the Work and furnishing incidental labour and facilities necessary to facilitate inspections and tests.
 - .2 Taking adequate quantities of representative samples of materials that require testing or assisting the agency in taking samples.
 - .3 Providing facilities for storage and curing of test samples, and delivery of samples to testing laboratories.
 - .4 Security and protection of samples and test equipment at the Project site.
- .3 Notify the agency sufficiently in advance of operations to permit assignment of personnel.
- .4 The Contractor is responsible for retesting costs where results of required inspections, tests or similar services prove unsatisfactory and do not meet the requirements of the Contract Documents, regardless of whether the original test was the Contractor's responsibility.
 - .1 Cost of retesting construction revised or replaced by the Contractor is the Contractor's responsibility.
- .5 The independent testing agency shall corporate with the Construction Manager and Contractor in performance of its duties, and shall provide qualified personnel to perform required inspections and tests.

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Section 01 43 00 – Quality Assurance

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

1.6 REPAIR AND PROTECTION

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

1.7 COVERED WORK

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

1.8 NON-CONFORMING, REPERFORMANCE AND REMEDIAL WORK

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

arrange for an independent reperformance of the test at their own expense or correct the non-conforming work and perform a retest.

- .4 The Owner reserves the right to request that the Contractor perform additional inspection and testing to determine the full extent of defects revealed by the Quality Control and Quality Assurance programs.
- .5 The Contractor shall perform retesting and remedial work until the Work meets Contract requirements.

1.9 CONFLICTING REQUIREMENTS

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

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

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Section 01 43 00 – Quality Assurance

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PART 1 **GENERAL**

1.1 **SECTIONS INCLUDE**

- .1 Inspection and testing, administrative and enforcement requirements.
- .2 Tests and mix designs.
- .3 Mock-ups.
- .4 Mill tests.
- .5 Equipment and system adjust and balance.

1.2 **RELATED SECTIONS**

- .1 Section 01 21 00 – Allowances.
- .2 Section 01 33 00 – Submittal Procedures.
- .3 Section 01 43 39 – Mock Up Requirements.
- .4 Section 01 78 00 – Closeout Submittals.

1.3 **INSPECTION**

- .1 Allow Owner access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.
- .2 Give 48 hours notice requesting inspection if Work is designated for special tests, inspections or approvals by Owner's instructions.
- .3 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.
- .4 Owner may order any part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction. If such Work is found in accordance with Contract Documents, Owner shall pay cost of examination and replacement.

1.4 INDEPENDENT INSPECTION AGENCIES

- .1 Independent Inspection/Testing Agencies will be engaged by Owner for purpose of inspecting and/or testing portions of Work.
- .2 Allocated costs: to Section 01 21 00 – Allowances and Section 01 29 83 – Payment Procedures: Testing Laboratory Services.
- .3 Provide equipment required for executing inspection and testing by appointed agencies.
- .4 Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.
- .5 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Owner at no cost to Owner. Pay costs for retesting and reinspection.

1.5 ACCESS TO WORK

- .1 Allow inspection/testing agencies access to Work, off site manufacturing and fabrication plants.
- .2 Co-operate to provide reasonable facilities for such access.

1.6 PROCEDURES

- .1 Notify appropriate agency and Owner in advance of requirement for tests, in order that attendance arrangements can be made.
- .2 Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in an orderly sequence so as not to cause delay in Work.
- .3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.

1.7 REJECTED WORK

- .1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by Owner as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.

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- .2 Make good other Contractor's work damaged by such removals or replacements promptly.
- .3 If in opinion of Owner it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Owner may deduct from Contract Price difference in value between Work performed and that called for by Contract Documents, amount of which shall be determined by Owner.

1.8 REPORTS

- .1 Submit 3 copies of inspection and test reports to Owner, plus electronic copies in PDF format.
- .2 Provide copy to Subcontractor of work being inspected or tested, manufacturer or fabricator of material being inspected or tested.
- .3 Include copy of all inspection and test reports in Commissioning Manuals.

1.9 MOCK-UPS

- .1 Refer to Section 01 43 39 for Mock Up Requirements.

1.10 EQUIPMENT AND SYSTEMS

- .1 Submit adjustment and balancing reports for mechanical, electrical and building equipment systems.
- .2 Mechanical – coordinate with mechanical division.
- .3 Electrical – Coordinate with electrical division.

1.11 FIRE SEPARATIONS

- .1 Provide fire separation labelling/stenciling as per Sections 09 91 23 – Interior Painting and 09 01 90.63 – Interior Re-Painting.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

Ver. 10/22

PART 1 **GENERAL**

1.1 **SECTION INCLUDES**

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

1.2 **RELATED SECTIONS**

- .1 Section 01 45 00 – Quality Control.
- .2 Section 01 73 00 – Execution.

1.3 **REFERENCES**

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

1.4 **QUALITY**

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

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- .4 Within seven (7) working days of written request by Owner, submit following information for material and equipment proposed for supply:
 - .1 Name and address of manufacturer.
 - .2 trade name, model and catalogue number,
 - .3 performance, descriptive and test data,
 - .4 manufacturer's installation or application instructions,
 - .5 evidence of arrangements to procure.
- .5 Use products of one manufacturer for material and equipment of same type or classification unless otherwise specified.
- .6 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

1.5 AVAILABILITY

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

1.6 STORAGE, HANDLING AND PROTECTION

- .1 Handle and store products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.
- .2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.
- .3 Store products subject to damage from weather in weatherproof enclosures.
- .4 Store cementitious products clear of earth or concrete floors, and away from walls.

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- .5 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.
- .6 Store sheet materials, lumber on flat, solid supports and keep clear of ground. Slope to shed moisture.
- .7 Store and mix paints in heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.
- .8 Remove and replace damaged products at own expense and to satisfaction of Owner.
- .9 Touch-up damaged factory finished surfaces to Owner's satisfaction. Use touch-up materials to match original. Do not paint over name plates.

1.7 TRANSPORTATION

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

1.8 MANUFACTURER'S INSTRUCTIONS

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

1.9 QUALITY OF WORK

- .1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify Owner if required Work is such as to make it impractical to produce required results.
- .2 Do not employ anyone unskilled in their required duties. Owner reserves right to require dismissal from site, workers deemed incompetent or careless.

- .3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Owner, whose decision is final.

1.10 CO-ORDINATION

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

1.11 CONCEALMENT

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

1.12 REMEDIAL WORK

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

1.13 LOCATION OF FIXTURES

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

1.14 FASTENINGS GENERAL

- .1 Provide metal fastenings and accessories in same texture, colour and finish as base metal in which they occur. Prevent electrolytic action between dissimilar metals. Use non-corrosive fasteners, anchors and spacers for securing exterior work, unless stainless steel or other material is specifically requested in affected specification section.
- .2 Space anchors within individual load limit or shear capacity and ensure they provide positive permanent anchorage. Wood plugs are not acceptable.
- .3 Conceal fasteners where indicated. Space evenly and lay out neatly.
- .4 Fastenings which cause Spalding or cracking are not acceptable.
- .5 Obtain Owner's approval before using explosive actuated fastening devices. If approval is obtained comply with CSA Z166.

1.15 FASTENINGS - EQUIPMENT

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

1.16 PROTECTION OF WORK IN PROGRESS

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

1.17 EXISTING UTILITIES

- .1 When breaking into or connecting to existing services or utilities, execute work at times directed by local governing authorities, with minimum of disturbance to work.

- .2 Protect, relocate or maintain existing active services. When services are encountered, cap off in manner approved by authority having jurisdiction. Stake and record location of capped service.
- .3 Submit schedule to and obtain approval from Owner for any shut-down or closure of active services or facility. Adhere to approved schedule and provide notice to affected parties.
- .4 Where unknown services are encountered, immediately advise Owner and confirm findings in writing.
- .5 Remove abandoned services lines within 2.0 m of structures. Cap or otherwise seal lines at cut-off points as directed by Owner.

1.18 SELECTION OF MATERIAL AND EQUIPMENT

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

manufacturer an independent laboratory reporting, showing that material or equipment meets or exceeds the specified requirements.

1.19 SUBSTITUTION OF MATERIAL AND EQUIPMENT

- .1 Substitution prior to Tender closing will be considered by Owner only if the conditions of Section 01 25 00 – Substitution Procedures are met.
- .2 **After Contract award** substitutions of material or equipment, other than as selected by Contractor from those specified, will be considered by Owner only if the conditions of Section 01 25 00 – Substitution Procedures are met.
- .3 Requests for substitutions after Contract award must be accompanied by sufficient information in the form of shop drawings, manufacturer's literature, samples or other data to permit proper investigation of the substitutes used. Requests must also include statements of respective costs of material or equipment originally specified and the proposed substitution.
- .4 Should a proposed substitution be accepted after Contract award either in part or in whole, assume full responsibility and costs when substitution affects other work on Project. Contractor to pay for design or drawing changes required as a result of the substitution.
- .5 Amounts of all credits arising from approval of substitutions after Contract award will be determined by Owner and the Contract amount will be reduced accordingly.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

PART 1 **GENERAL**

1.1 **SECTION INCLUDES**

- .1 Field engineering survey services to measure and stake site.
- .2 Survey services to establish and confirm inverts for Work.
- .3 Recording of subsurface conditions found.

1.2 **QUALIFICATIONS OF SURVEYOR**

- .1 Qualified registered land surveyor, licensed to practise in the Province of Newfoundland and Labrador.

1.3 **SURVEY REFERENCE POINTS**

- .1 Existing base horizontal and vertical control points are designated on drawings.
- .2 Locate, confirm and protect control points prior to starting site work. Preserve permanent reference points during construction.
- .3 Make no changes or relocations without prior written notice to Owner.
- .4 Report to Owner when reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.
- .5 Require surveyor to replace control points in accordance with original survey control.

1.4 **SURVEY REQUIREMENTS**

- .1 Establish permanent bench marks on site, referenced to established bench marks by survey control points. Record locations, with horizontal and vertical data in Project Record Documents.
- .2 Establish lines and levels, locate and lay out, by instrumentation.
- .3 Stake for grading, fill placement.
- .4 Establish pipe invert elevations.
- .5 Stake batter boards for foundations.

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- .6 Establish foundation column locations and floor elevations.
- .7 Establish lines and levels for mechanical and electrical work.

1.5 EXISTING SERVICES

- .1 Where work involves breaking into or connecting to existing services, carry out work at times directed by authorities having jurisdiction, with minimum of disturbance to pedestrian and vehicular traffic.
- .2 Before commencing work, establish location and extent of service lines in area of Work and notify Owner of findings.
- .3 Remove abandoned service lines within 2.0 m of structures. Cap or otherwise seal lines at cut-off points as directed by Owner.

1.6 LOCATION OF EQUIPMENT AND FIXTURES

- .1 Location of equipment, fixtures and outlets indicated or specified are to be considered as approximate.
- .2 Locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space and in accordance with manufacturer's recommendations for safety, access and maintenance.
- .3 Inform Owner of impending installation and obtain approval for actual location.
- .4 Submit field drawings to indicate relative position of various services and equipment when required by Owner.

1.7 RECORDS

- .1 Maintain a complete, accurate log of control and survey work as it progresses.
- .2 Record locations of maintained, re-routed and abandoned service lines.

1.8 SUBMITTALS

- .1 Submit name and address of Surveyor to Owner.
- .2 On request of Owner, submit documentation to verify accuracy of field engineering work.

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- .3 Submit certificate signed by surveyor certifying and noting those elevations and locations of completed Work that conform and do not conform with Contract Documents.

1.9 SUBSURFACE CONDITIONS

- .1 Promptly notify Consultant in writing if subsurface conditions at Place of Work differ materially from those indicated in Contract Documents, or a reasonable assumption of probable conditions based thereon.
- .2 After prompt investigation, should Owner determine that conditions do differ materially, instructions will be issued for changes in Work.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Requirements and limitations for cutting and patching the Work.

1.2 RELATED SECTIONS

- .1 Section 01 11 00 - Summary of Work.
- .2 Section 01 33 00 - Submittal Procedures.

1.3 SUBMITTALS

- .1 Submit written request in advance of cutting or alteration which affects:
 - .1 Structural integrity of any element of Project.
 - .2 Integrity of weather-exposed or moisture-resistant elements.
 - .3 Efficiency, maintenance, or safety of any operational element.
 - .4 Visual qualities of sight-exposed elements.
 - .5 Work of Owner or separate contractor.
- .2 Include in request:
 - .1 Identification of Project.
 - .2 Location and description of affected Work.
 - .3 Statement on necessity for cutting or alteration.
 - .4 Description of proposed Work, and products to be used.
 - .5 Alternatives to cutting and patching.
 - .6 Effect on Work of Owner or separate contractor.
 - .7 Written permission of affected separate contractor.
 - .8 Date and time work will be executed.

1.4 PREPARATION

- .1 Inspect existing conditions, including elements subject to damage or movement during cutting and patching.
- .2 After uncovering, inspect conditions affecting performance of Work.
- .3 Beginning of cutting or patching means acceptance of existing conditions.

- .4 Provide supports to assure structural integrity of surroundings; provide devices and methods to protect other portions of project from damage.
- .5 Provide protection from elements for areas which may be exposed by uncovering work; maintain excavations free of water.
- .6 Obtain Owner's approval before cutting, boring or sleeving load-bearing members.

1.5 EXECUTION

- .1 Execute cutting, fitting, and patching including excavation and fill, to complete Work.
- .2 Fit several parts together, to integrate with other Work.
- .3 Uncover Work to install ill-timed Work.
- .4 Remove and replace defective and non-conforming Work.
- .5 Provide openings in non-structural elements of Work for penetrations of mechanical and electrical Work.
- .6 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.
- .7 Employ original installer to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.
- .8 Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools not allowed on masonry work without prior approval.
- .9 Restore work with new products in accordance with requirements of Contract Documents.
- .10 Fit Work to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- .11 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with firestopping material in accordance with Section 07 84 00 - Firestopping, full thickness of the construction element.
- .12 Refinish surfaces to match adjacent finishes: For continuous surfaces refinish to nearest intersection; for an assembly, refinish entire unit.

- .13 Conceal pipes, ducts and wiring in floor, wall and ceiling construction of finished areas except where indicated otherwise.
- .14 Make cuts with clean, true, smooth edges.
- .15 Where new work connects with existing, and where existing work is altered, cut, patch and make good to match existing work.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

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.

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- .10 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.
- .11 Provide and use marked separate bins for recycling. Refer to Section 01 74 21 – Construction/Waste Management and Disposal.
- .12 Dispose of waste materials and debris at designated dumping areas off site.

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 Owner. 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.

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

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

PART 1 **GENERAL**

1.1 **SECTION INCLUDES**

- .1 Text, schedules and procedures for systematic Waste Management Program for construction, deconstruction, demolition, and renovation projects, including:
 - .1 Diversion of Materials.
 - .2 Waste Audit (WA) - Schedule A.
 - .3 Waste Reduction Workplan (WRW) - Schedule B.
 - .4 Demolition Waste Audit (DWA) - Schedule C.
 - .5 Cost/Revenue Analysis Workplan (CRAW) - Schedule D.
 - .6 Materials Source Separation Program (MSSP).
 - .7 Canadian Governmental Responsibility for the Environment Resources - Schedule E.

1.2 **DEFINITIONS**

- .1 Demolition Waste Audit (DWA): Relates to actual waste generated from project.
- .2 Materials Source Separation Program (MSSP): Consists of series of ongoing activities to separate reusable and recyclable waste material into material categories from other types of waste at point of generation.
- .3 Recyclable: Ability of product or material to be recovered at end of its life cycle and re-manufactured into new product for reuse by others.
- .4 Recycle: Process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.
- .5 Recycling: Process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for purpose of using in altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
- .6 Reuse: Repeated use of product in same form but not necessarily for same purpose. Reuse includes:

- .1 Salvaging reusable materials from re-modelling projects, before demolition stage, for resale, reuse on current project or for storage for use on future projects.
- .2 Returning reusable items including pallets or unused products to vendors.
- .7 Salvage: Removal of structural and non-structural materials from deconstruction/disassembly projects for purpose of reuse or recycling.
- .8 Separate Condition: Refers to waste sorted into individual types.
- .9 Source Separation: Acts of keeping different types of waste materials separate beginning from first time they became waste.

1.3 MATERIALS SOURCE SEPARATION PROGRAM (MSSP)

- .1 Prepare MSSP and have ready for use prior to project start-up.
- .2 Implement MSSP for waste generated on project in compliance with approved methods and as reviewed by authorities having jurisdiction.
- .3 Provide on-site facilities for collection, handling, and storage of anticipated quantities of reusable and recyclable materials.
- .4 Provide containers to deposit reusable and recyclable materials.
- .5 Locate containers in locations, to facilitate deposit of materials without hindering daily operations.
- .6 Locate separated materials in areas which minimize material damage.
- .7 Collect, handle, store on-site, and transport off-site, salvaged materials in separate condition.
 - .1 Transport to recycling facility.

1.4 STORAGE, HANDLING AND PROTECTION

- .1 Unless specified otherwise, materials for removal become Contractor's property.
- .2 Protect, stockpile, store and catalogue salvaged items.
- .3 Separate non-salvageable materials from salvaged items. Transport and deliver non-salvageable items to approved local facility.

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- .4 Protect structural components not removed for demolition from movement or damage.
- .5 Support affected structures. If safety of building is endangered, cease operations and immediately notify Department having jurisdiction.
- .6 Protect surface drainage, mechanical and electrical from damage and blockage.
- .7 Separate and store materials produced during dismantling of structures in designated areas.
- .8 Prevent contamination of materials to be salvaged and recycled and handle materials in accordance with requirements for acceptance by designated facilities.
- .1 On-site source separation is recommended.

1.5 DISPOSAL OF WASTES

- .1 Do not bury rubbish or waste materials.
- .2 Do not dispose of any waste into waterways, storm, or sanitary sewers.
- .3 Remove materials from deconstruction as deconstruction/disassembly Work progresses.
- .4 Prepare project summary to verify destination and quantities on a material-by-material basis as identified in pre-demolition material audit.

1.6 USE OF SITE AND FACILITIES

- .1 Execute work with least possible interference or disturbance to normal use of premises.
- .2 Provide security measures approved by Owner.

1.7 SCHEDULING

- .1 Coordinate Work with other activities at site to ensure timely and orderly progress of Work.

PART 2 **PRODUCTS (NOT APPLICABLE)**

PART 3 **EXECUTION**

3.1 **APPLICATION**

- .1 Handle waste materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes.

3.2 **CLEANING**

- .1 Remove tools and waste materials on completion of Work, and leave work area in clean and orderly condition.
- .2 Clean-up work area as work progresses.
- .3 Source separate materials to be reused/recycled into specified sort areas.

3.3 **DIVERSION OF MATERIALS**

- .1 From following list, separate materials from general waste stream and stockpile in separate piles or containers, as reviewed by Owner and consistent with applicable fire regulations.
 - .1 Mark containers or stockpile areas.
 - .2 Provide instruction on disposal practices.
- .2 On-site sale or distribution of salvaged materials to third parties is not permitted.

END OF SECTION

PART 1 **GENERAL**

1.1 **RELATED SECTIONS**

- .1 Section 01 74 00 - Cleaning.
- .2 Section 01 78 00 - Closeout Submittals.

1.2 **FINAL INSPECTION AND DECLARATION PROCEDURES**

- .1 Contractor's Inspection: The Contractor and all Subcontractors shall conduct an inspection of Work, identify deficiencies and defects; repair as required. Notify the Owner in writing of satisfactory completion of the Contractor's Inspection and that corrections have been made. Request an Owner's Consultant's Inspection.
- .2 Owner's Inspection: Owner and the Contractor will perform an inspection of the Work to identify obvious defects or deficiencies. The contractor shall correct Work accordingly.
- .3 Completion: submit written certificate that the following have been performed:
 - .1 Work has been completed and inspected for compliance with Contract Documents.
 - .2 Defects have been corrected and deficiencies have been completed.
 - .3 Equipment and systems have been tested, adjusted and balanced and are fully operational.
 - .4 Certificates required by Fire Commissioner, Utility companies have been submitted.
 - .5 Operation of systems have been demonstrated to Owner's personnel.
 - .6 Work is complete and ready for Final Inspection.
- .4 Final Inspection: When items noted above are completed, request final inspection of Work by the Owner, representative of MUN and the Contractor. If Work is deemed incomplete by the Owner, complete outstanding items and request a reinspection.
- .5 Declaration of Substantial Performance: When the Owner considers deficiencies and defects have been corrected and it appears requirements of Contract have been substantially performed, make application for

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Certificate of Substantial Performance. Refer to General Conditions for specifics to application.

- .6 Commencement of Lien and Warranty Periods: The date of MUN acceptance of the submitted declaration of Substantial Performance shall be the date for commencement for the warranty period and commencement of the lien period.
- .7 Declaration of Total Performance: When the Owner considers final deficiencies and defects have been corrected and it appears requirements of the Contract have been totally performed, make application for certificate of Total Performance. Refer to General Conditions for specifics to application. If Work is deemed incomplete by the Consultant, complete the outstanding items and request a reinspection.

1.3 REINSPECTION

- .1 Should status of work require reinspection by Owner due to failure of work to comply with Contractor's claims for inspection, Owner will deduct amount of compensation for reinspection services from payment to Contractor.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

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

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 45 00 - Quality Control.
- .3 Section 01 71 00 - Examination and Preparation.
- .4 Section 01 77 00 - Closeout Procedures.

1.3 SUBMISSION

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

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- .7 If requested, furnish evidence as to type, source and quality of products provided.
- .8 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.
- .9 Pay costs of transportation.

1.4 FORMAT

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

1.5 CONTENTS - EACH VOLUME

- .1 Table of Contents: provide title of project; names, addresses, and telephone numbers of Consultant and Contractor with name of responsible parties; schedule of products and systems, indexed to content of volume.
- .2 For each product or system:

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- .1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
- .3 Product Data: mark each sheet to clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information.
- .4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
- .5 Typewritten Text: as required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00 - Quality Control.
- .6 Training: Provide training on all equipment operations.

1.6 AS-BUILTS AND SAMPLES

- .1 In addition to requirements in General Conditions, maintain at the site for Owner one record copy of:
 - .1 Contract Drawings.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Change Orders and other modifications to the Contract.
 - .5 Reviewed shop drawings, product data, and samples.
 - .6 Field test records.
 - .7 Inspection certificates.
 - .8 Manufacturer's certificates.
- .2 Store record documents and samples in field office apart from documents used for construction. Provide files, racks, and secure storage.
- .3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual. Label each document "PROJECT RECORD" in neat, large, printed letters.
- .4 Maintain record documents in clean, dry and legible condition. Do not use record documents for construction purposes.
- .5 Keep record documents and samples available for inspection by Owner.

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1.7 RECORDING ACTUAL SITE CONDITIONS

- .1 Record information on set of blue line opaque drawings, provided by Owner.
- .2 Provide felt tip marking pens, maintaining red color pens for recording information.
- .3 Record information concurrently with construction progress. Do not conceal Work until required information is recorded.
- .4 Contract Drawings and shop drawings: legibly mark each item to record actual construction, including:
 - .1 Measured depths of elements of foundation in relation to finish first floor datum.
 - .2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - .3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
 - .4 Field changes of dimension and detail.
 - .5 Changes made by change orders.
 - .6 Details not on original Contract Drawings.
 - .7 References to related shop drawings and modifications.
- .5 Specifications: legibly mark each item to record actual construction, including:
 - .1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
 - .2 Changes made by Addenda and change orders.
- .6 Other Documents: submit manufacturer's certifications, inspection certifications, field test records, required by individual specifications sections.
- .7 At completion of project, provide all recorded information on print drawings. Transfer recorded information to AutoCAD files in DWG format. Submit DWG files, also with electronic files in PDF format as part of the Closeout Submittals.

1.8 EQUIPMENT AND SYSTEMS

- .1 Each Item of Equipment and Each System: include description of unit or system, and component parts. Give function, normal operation characteristics, and limiting conditions. Include performance curves, with

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engineering data and tests, and complete nomenclature and commercial number of replaceable parts.

- .2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.
- .3 Include installed colour coded wiring diagrams.
- .4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
- .5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- .6 Provide servicing and lubrication schedule, and list of lubricants required.
- .7 Include manufacturer's printed operation and maintenance instructions.
- .8 Include sequence of operation by controls manufacturer.
- .9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- .10 Provide installed control diagrams by controls manufacturer.
- .11 Provide Contractor's coordination drawings, with installed colour coded piping diagrams.
- .12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- .13 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- .14 Include test and balancing reports
- .15 Additional requirements: As specified in individual specification sections.

1.9 MATERIALS AND FINISHES

- .1 Building Products, Applied Materials, and Finishes: include product data, with catalogue number, size, composition, and colour and texture designations. Provide information for re-ordering custom manufactured products.

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

1.10 SPARE PARTS

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

1.11 MAINTENANCE MATERIALS

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

1.12 SPECIAL TOOLS

- .1 Provide special tools, in quantities specified in individual specification section.
- .2 Provide items with tags identifying their associated function and equipment.

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- .3 Deliver to project site place and store.
- .4 Receive and catalogue all items. Submit inventory listing to Owner.
Include approved listings in Maintenance Manual.

1.13 STORAGE, HANDLING AND PROTECTION

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

1.14 WARRANTIES AND BONDS

- .1 Develop warranty management plan to contain information relevant to Warranties.
- .2 Submit warranty management plan to Owner's approval.
- .3 Warranty management plan to include required actions and documents to assure that Owner receives warranties to which it is entitled.
- .4 Provide plan in narrative form and contain sufficient detail to make it suitable for use by future maintenance and repair personnel.
- .5 Assemble approved information in binder and submit upon acceptance of work. Organize binder as follows:
 - .1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.
 - .2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
 - .3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of the applicable item of work.

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- .4 Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Substantial Performance is determined.
- .5 Verify that documents are in proper form, contain full information, and are notarized.
- .6 Co-execute submittals when required.
- .7 Retain warranties and bonds until time specified for submittal.
- .6 Include information contained in warranty management plan as follows:
 - .1 Roles and responsibilities of personnel associated with warranty process, including points of contact and telephone numbers within the organizations of Contractors, subcontractors, manufacturers or suppliers involved.
 - .2 Listing and status of delivery of Certificates of Warranty for extended warranty items, to include roofs, HVAC balancing, pumps, motors, transformers, and commissioned systems such as fire protection, alarm systems, sprinkler systems, lightning protection systems.
 - .3 Provide list for each warranted equipment, item, feature of construction or system indicating:
 - .1 Name of item.
 - .2 Model and serial numbers.
 - .3 Location where installed.
 - .4 Name and phone numbers of manufacturers or suppliers.
 - .5 Names, addresses and telephone numbers of sources of spare parts.
 - .6 Warranties and terms of warranty: include one-year overall warranty of construction. Indicate items that have extended warranties and show separate warranty expiration dates.
 - .7 Cross-reference to warranty certificates as applicable.
 - .8 Starting point and duration of warranty period.
 - .9 Summary of maintenance procedures required to continue warranty in force.
 - .10 Cross-Reference to specific pertinent Operation and Maintenance manuals.
 - .11 Organization, names and phone numbers of persons to call for warranty service.
 - .12 Typical response time and repair time expected for various warranted equipment.
 - .4 Procedure and status of tagging of equipment covered by extended warranties.

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- .5 Post copies of instructions near selected pieces of equipment where operation is critical for warranty and/or safety reasons.
- .7 Respond in a timely manner to oral or written notification of required construction warranty repair work.
- .8 Written verification will follow oral instructions. Failure to respond will be cause for the Owner to proceed with action against Contractor.

1.15 PRE-WARRANTY CONFERENCE

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

1.16 WARRANTY TAGS

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

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

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.

1.2 **SUBMITTALS**

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop drawings; submit drawings stamped and signed for approval by Owner.
- .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 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 for approval. Submission of individual data will not be accepted unless directed by Owner.
 - .2 Make changes as required and re-submit as directed by Owner.
- .7 Additional data:
 - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
- .8 Site records:
 - .1 Owner will provide one (1) set of reproducible mechanical drawings or AutoCAD files. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to

- existing mechanical systems, control systems and low voltage control wiring.
- .2 Transfer information weekly to 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 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 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.4 MAINTENANCE

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

- .3 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Waste Management and Disposal:
 - .1 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.

PART 3 EXECUTION

3.1 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.

3.2 CLEANING

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

3.3 FIELD QUALITY CONTROL

- .1 Site Tests: conduct following tests in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 - SUBMITTALS.
 - .1 Perform tests as specified in other sections of this specification.
- .2 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of

product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.

- .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
- .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.4 DEMONSTRATION

- .1 Owner 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 may record these demonstrations on video tape for future reference.

3.5 PROTECTION

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

END OF SECTION

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 22 07 16 – Plumbing 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 Calcium Silicate Insulation Block and Pipe.
 - .6 ASTM C547 Standard Specification for Mineral Fibre Pipe Insulation.

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- .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) Jacketing 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 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° C mean temperature when tested in accordance with ASTM C335.

- .3 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.
- .4 TIAC Code A-6: Flexible unicellular tubular elastomer.
 - .1 Insulation: with vapour retarder jacket to ASTM C534.
 - .2 Jacket: to CGSB 51-GP-52Ma.
 - .3 Maximum "k" factor: 0.039 W/m – °C.
 - .4 To be certified by manufacturer to be free of potential stress corrosion cracking corrodants.
 - .5 Flame spread index less than 25, and smoke developed index less than 50.
- .5 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 CAN/ULC-S702.
 - .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/m².

2.8 JACKETS

- .1 Polyvinyl Chloride (PVC):
 - .1 One-piece moulded type and sheet to CAN/CGSB-51.53 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/m² 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 manufacturer's instructions and this specification.

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

3.4 REMOVABLE, PRE-FABRICATED, INSULATION AND ENCLOSURES

- .1 See Section 22 07 16 – Plumbing 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.

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- .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
Domestic CWS		A-3	25	25	25	25	25	25

- .7 Notes:
 - .1 All sections of the piping to be insulated to prevent condensation including but not limited to fitting, valves, unions, etc. Insulate smaller components with A-6 tape style.
- .8 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 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 for Mechanical.
- .6 Section 22 05 00 – Common Work Results for Plumbing.
- .7 Section 22 07 16 – Plumbing Equipment Insulation.
- .8 Section 22 07 19 – Plumbing Piping Insulation.
- .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 33 11 16.01 - Incoming Site Water Utility Distribution Piping.

1.2 **REFERENCES**

- .1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers International (ASME).
 - .1 ANSI/ASME B16.15, Cast Bronze Threaded Fittings, Classes 125 and 250.
 - .2 ANSI/ASME B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.
 - .3 ANSI/ASME B16.22, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
 - .4 ANSI/ASME B16.24, Cast Copper Alloy Pipe Flanges and Flanged Fittings, Class 150, 300, 400, 600, 900, 1500 and 2500.

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- .2 American National Standards Institute/National Sanitation Foundation (ANSI/NSF).
 - .1 ANSI/NSF 61, Drinking Water System Components.
- .3 American Society for Testing and Materials International (ASTM).
 - .1 ASTM A 307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .2 ASTM A536, Standard Specification for Ductile Iron Castings.
 - .3 ASTM B 88M, Standard Specification for Seamless Copper Water Tube (Metric).
 - .4 ASTM F 492, Standard Specification for Propylene and Polypropylene (PP) Plastic-Lined Ferrous Metal Pipe Fittings.
- .4 American Water Works Association (AWWA).
 - .1 AWWA C111, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
 - .2 AWWA C606, Grooved and Shouldered Joints.
- .5 Canadian Standards Association (CSA International).
 - .1 CSA B242, Groove and Shoulder Type Mechanical Pipe Couplings.
- .6 Department of Justice Canada (Jus).
 - .1 Canadian Environmental Protection Act (CEPA).
- .7 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
 - .1 Safety Data Sheets (SDS).
- .8 Manufacturer's Standardization Society 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.
- .9 National Research Council (NRC)/Institute for Research in Construction.
 - .1 NRCC 38728, National Plumbing Code of Canada (NPC).
- .10 Transport Canada (TC).

- .1 Transportation of Dangerous Goods Act (TDGA).

1.3 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature and datasheets for insulation and adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Submit WHMIS SDS - Safety Data Sheets in accordance with Section 01 33 00 - Submittal Procedures.
- .4 Closeout Submittals:
 - .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
- .5 Grooved joint couplings and fittings to be indicated on product submittals and to be specifically identified with the applicable style or series designation.

1.4 HEALTH AND SAFETY

- .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.5 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 Separate for reuse and recycling and place in designated containers Steel, Metal, Plastic waste in accordance with Waste Management Plan.
- .4 Place materials defined as hazardous or toxic in designated containers.
- .5 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal regulations.

- .6 Fold up metal banding, flatten and place in designated area for recycling.

1.6 WARRANTY

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

PART 2 PRODUCTS

2.1 PIPING

- .1 Domestic hot, cold and recirculation systems, within building.
 - .1 Above ground: copper tube, hard drawn, type L: to ASTM B88M.
 - .2 Buried or embedded: copper tube, soft annealed, type K: to ASTM B88M, in long lengths and with no buried joints.

2.2 FITTINGS

- .1 Bronze pipe flanges and flanged fittings, Class 150 and 300: to ANSI/ASME B16.24.
- .2 Cast bronze threaded fittings, Class 125 and 250: to ANSI/ASME B16.15.
- .3 Cast copper, solder type: to ANSI/ASME B16.18.
- .4 Wrought copper and copper alloy, solder type: to ANSI/ASME B16.22.
- .5 NPS2 and larger: roll grooved to CSA B242. Cast bronze to ANSI/ASME B16.18 or wrought copper ANSI/ASME B16.22.
 - .1 Fittings to be manufactured to copper-tube dimensions. Flaring of tube or fitting ends to accommodate IPS sized couplings is not permitted.
- .6 NPS 1 ½ and under: Cast copper, ANSI/ASME B16.18 or wrought copper, ANSI/ASME B16.22; with 301 stainless steel internal components, EPDM seal, and push-to-connect or press fit joints, for hard drawn copper tube type L or K, rated for 1300 kPa at ASTM B88.

2.3 JOINTS

- .1 Rubber gaskets, latex-free, 1.6 mm thick: to ANSI/AWWA C111.
- .2 Bolts, nuts, hex head and washers: to ASTM A307, heavy series.
- .3 Solder: 95/5 tin copper alloy lead free.
- .4 Teflon tape: for threaded joints.
- .5 Grooved couplings: designed with angle bolt pads to provide rigid joint, complete with EPDM flush seal gasket. Gasket to be classified in accordance with ANSI/NSF 61 for potable water service. Couplings to be manufactured to copper-tube dimensions. Flaring of tube or fitting ends to accommodate IPS sized couplings is not permitted.
- .6 Dielectric connections between dissimilar metals: dielectric fitting to ASTM F492, complete with thermoplastic liner.

2.4 GATE VALVES

- .1 NPS2 and under, soldered:
 - .1 Rising stem: to MSS-SP-80, Class 125, 860 kPa, bronze body, screw-in bonnet, solid wedge disc as specified Section 23 05 23.01 – Valves - Bronze.
- .2 NPS2 and under, screwed:
 - .1 Rising stem: to MSS-SP-80, Class 125, 860 kPa, bronze body, screw-in bonnet, solid wedge disc as specified Section 23 05 23.01 – Valves - Bronze.
- .3 NPS2-1/2 and over, in mechanical rooms, flanged:
 - .1 Rising stem: to MSS-SP-70, Class 125, 860 kPa, flat flange faces, cast-iron body, OS&Y bronze trim specified Section 23 05 23.02 – Valves – Cast Iron.
- .4 NPS2-1/2 and over, other than mechanical rooms, flanged:
 - .1 Non-rising stem: to MSS-SP-70, Class 125, 860 kPa, flat flange faces, cast-iron body, bronze trim, bolted bonnet specified Section 23 05 23.02 – Valves – Cast Iron.

2.5 GLOBE VALVES

- .1 NPS2 and under, soldered:
 - .1 To MSS-SP-80, Class 125, 860 kPa, bronze body, renewable composition disc, screwed over bonnet as specified Section 23 05 23.01 – Valves – Bronze.
 - .2 Lockshield handles: as indicated.
- .2 NPS2 and under, screwed:
 - .1 To MSS-SP-80, Class 150, 1 MPa, bronze body, screwed over bonnet, renewable composition disc as specified Section 23 05 23.01 – Valves – Bronze.
 - .2 Lockshield handles: as indicated.

2.6 SWING CHECK VALVES

- .1 NPS 2 and under, soldered:
 - .1 To MSS-SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat as specified Section 23 05 23.01 – Valves - Bronze.
- .2 NPS2 and under, screwed:
 - .1 To MSS-SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat as specified Section 23 05 23.01 – Valves - Bronze.
- .3 NPS 2 and under, push-to-connect, lift-disc type:
 - .1 To MSS-SP-80, 1380 kPa CWP, bronze body, stainless steel disc, spring, and shaft, suitable for installation in horizontal or vertical lines.
- .4 NPS2-1/2 and over, flanged:
 - .1 To MSS-SP-71, Class 125, 860 kPa, cast iron body, flat flange faces, or renewable seat, bronze disc, bolted cap specified Section 23 05 23.02 – Valves – Cast Iron.

2.7 BALL VALVES

- .1 NPS2 and under:
 - .1 As specified Section 23 05 23.01 – Valves - Bronze.

2.8 BUTTERFLY VALVES

- .1 NPS21/2 and over lug:
 - .1 To MSS-SP-67, Class 200, 1.4 MPa.
 - .2 As specified in Section 23 05 23.05 – Butterfly Valves.
- .2 NPS21/2 and over, grooved ends:
 - .1 Class 300, 2.1 MPa as specified in Section 23 05 23.05 – Butterfly Valves.

PART 3 EXECUTION

3.1 INSTALLATION

- .1 Install in accordance with Canadian Plumbing Code and local authority having jurisdiction.
- .2 Install pipe work in accordance with Section 23 05 05 – Installation of Pipework and by certified journeyman supplemented as specified herein.
- .3 Assemble piping using fittings manufactured to ANSI standards.
- .4 Grooved joint couplings and fittings to be installed in accordance with the manufacturer's written installation instructions. Grooved ends to be clean and free from indentations, projections, and roll marks in the area from pipe end to groove. Gaskets to be verified as suitable for the intended service prior to installation. Gaskets to be molded and produced by the coupling manufacturer. The grooved coupling manufacturer's factory trained representative to 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 to periodically visit the jobsite and review installation. Contractor to remove and replace any joints deemed improperly installed.
- .5 Push-to Connect Piping: Prepare copper tube and install in strict accordance with installation instructions. Pipe ends to be cleaned, free from indentations, projections, burrs, and foreign matter. Use a tube preparation tool 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.

- .6 Install CWS piping below and away from HWS and HWR and other hot piping so as to maintain temperature of cold water as low as possible.
- .7 Connect to fixtures and equipment in accordance with manufacturer's written instructions unless otherwise indicated.
- .8 Buried Tubing
 - .1 Lay in well compacted washed sand in accordance with AWWA Class B bedding.
 - .2 Bend tubing without crimping or constriction. Minimize use of fittings.

3.2 VALVES

- .1 Isolate equipment, fixtures and branches with butterfly or ball valves.
- .2 Balance recirculation system using lockshield globe valves. Mark settings and record on as-built drawings on completion.

3.3 PRESSURE TESTS

- .1 Conform to requirements of Section 21 05 01 - Common Work Results for Mechanical.
- .2 Test pressure: greater of 1 ½ times maximum system operating pressure or 860 kPa.

3.4 FLUSHING AND CLEANING

- .1 Flush entire system for 8 h. Ensure outlets flushed for 2 h. Let stand for 24 h, then draw one sample off longest run. Submit to testing laboratory for bacteriological testing to verify that system is clean to Provincial potable water guidelines. Let system flush for additional 2 h, then draw off another sample for testing.

3.5 PRE-START-UP INSPECTIONS

- .1 Systems to be complete, prior to flushing, testing and start-up.
- .2 Verify that system can be completely drained.
- .3 Ensure that pressure booster systems are operating properly.

- .4 Ensure that air chambers, expansion compensators are installed properly.

3.6 DISINFECTION

- .1 Flush out, disinfect and rinse system to requirements of authority having jurisdiction and approval of Owner.
- .2 Coordinate with Section 33 11 16 – Site Water Utility Distribution Piping and Section 33 11 16.01 – Incoming Site Water Utility Distribution Piping.
- .3 Upon completion, provide laboratory test reports on water quality to Owner.

3.7 START-UP

- .1 Timing: Start up after:
 - .1 Pressure tests have been completed.
 - .2 Disinfection procedures have been completed.
 - .3 Water treatment systems operational.
- .2 Provide continuous supervision during start-up.
- .3 Start-up procedures:
 - .1 Establish circulation and ensure that air is eliminated.
 - .2 Check pressurization to ensure proper operation and to prevent water hammer, flashing and/or cavitation.
 - .3 Bring HWS storage tank up to design temperature slowly.
 - .4 Monitor HWS and HWR piping systems for freedom of movement, pipe expansion as designed.
 - .5 Check control, limit, safety devices for normal and safe operation.
- .4 Rectify start-up deficiencies.

END OF SECTION

Part 1 GENERAL

1.1 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 for Mechanical.
- .6 Section 22 05 00 – Common Work Results for Plumbing.
- .7 Section 22 07 16 – Plumbing Equipment Insulation.
- .8 Section 22 07 19 – Plumbing Piping Insulation.
- .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 33 11 16.01 - Incoming Site Water Utility Distribution Piping.

1.2 REFERENCES

- .1 American National Standards Institute (ANSI)
 - .1 ANSI B16.1, Cast Iron Pipe Flanges and Flange Fittings, Class 25, 125, 250 and 800.
- .2 Canadian Standard Association (CSA)
 - .1 CSA B137.5, Crosslinked Polyethylene (PEX) Tubing Systems for Pressure Applications.
 - .2 CSA B137.6, CPVC Pipe, Tubing and Fittings for Both Hot and Cold Water Distribution Systems.
- .3 National Sanitation Foundation (NSF)

- .1 NSF61 Potable Water Listing.
- .4 Underwriters Listing of Canada (ULC)
 - .1 CAN/ULC S101, Fire Endurance Tests of Buildings Construction and Materials.
 - .2 CAN/ULC S102.2, Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings and Miscellaneous Materials and Assemblies.
 - .3 CAN/ULC S115, Standard Method of Fire Tests of Firestop Systems.
- .5 American Society for Testing and Materials International, (ASTM).
 - .1 ASTM A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .2 ASTM B88M, Standard Specification for Seamless Copper Water Tube (Metric).
 - .3 ASTM D1784 Standard Specification for Rigid Poly (Vinyl Chloride) PVC Compounds and Chlorinated Poly (Vinyl Chloride) CPVC compounds.
 - .4 ASTM D2467, Standard Specification for Poly (Vinyl Chloride) PVC Plastic Pipe Fittings, Schedule 80.
 - .5 ASTM F437 Standard Specification for Threaded Chlorinated Poly (Vinyl Chloride) CPVC Plastic Pipe Fittings Schedule 80.
 - .6 ASTM F439 Standard Specification for Chlorinated Poly (Vinyl Chloride) CPVC Plastic Pipe Fittings Schedule 80.
 - .7 ASTM F441/441M Standard Specification for Chlorinated Poly (Vinyl Chloride) CPVC Plastic Pipe Schedules 40 and 80.
 - .8 ASTM F876 Standard Specification for Crosslinked Polyethylene (PEX) Tubing.
 - .9 ASTM F877 Standard Specification for Crosslinked Polyethylene (PEX) Hot and Cold Water Distribution System.
- .6 Department of Justice Canada (Jus).
 - .1 Canadian Environmental Protection Act (CEPA).
- .7 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
 - .1 Safety Data Sheets (SDS).
- .8 Manufacturer's Standardization Society 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-110 Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends
- .9 National Research Council (NRC)/Institute for Research in Construction.
 - .1 NRCC, National Plumbing Code of Canada (NPC).
- .10 Transport Canada (TC).
 - .1 Transportation of Dangerous Goods Act (TDGA).

1.3 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit product data for following: valves.
- .3 Submit WHMIS SDS - Safety Data Sheets in accordance with Section 01 33 00 - Submittal Procedures.
- .4 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 HEALTH AND SAFETY

- .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.5 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 Separate for reuse and recycling and place in designated containers Steel, Metal, Plastic waste in accordance with Waste Management Plan.

- .4 Place materials defined as hazardous or toxic in designated containers.
- .5 Handle and dispose of hazardous materials in accordance with CEPA, TDGA , Regional and Municipal regulations.
- .6 Fold up metal banding, flatten and place in designated area for recycling.

PART 2 PRODUCTS

2.1 PIPING

- .1 Domestic hot, cold and recirculation systems, within building.
 - .1 Above ground: NPS ½ to 4 CPVC to SDR11 with IPS outside dimensions: CSA B 137.6, ASTM D1784 cell class of 24448 and NSF 61. NPS ½ to 3 PEX to SDR9: CSA B137.5, ASTM F876 and ASTM F877.
 - .2 Buried or embedded:
 - .1 Copper tube, soft annealed, type K: to ASTM B88M, in long lengths and with no buried joints.
 - .2 UO to NPS 3: PEX Tubing to ASTM F876 and F877 and certified to NSF61 rated at 93° at 551kPa, 82°C at 690 kPa, 23°C at 1100 kPa, certified to be used for hot or cold water service.

2.2 FITTINGS

- .1 CPVC Fittings: to CSA B137.6, ASTM D1784 Cell Class of 23447 and NSF 61.
- .2 CPVC Flanges: to ASTM F1970 and ASTM D2467.
 - .1 Flanged CPVC: 1034 kPa at 23°C, 517 kPa at 60°C not to be used above 60°C.
 - .2 Bolt hole patterns to ANSI B16.1 class 125, threads to be tapered iron pipe size threads to ANSI B2.1
- .3 Transition points: as recommended by manufacturer.
- .4 PEX fittings certified to CSA B137.5, ASTM F876 and ASTM F877, and certified to be used with PEX tubing.

2.3 SUPPORT TRAY

- .1 Provide manufacturer galvanized support tray for all suspended piping.

2.4 JOINTS

- .1 Rubber gaskets, elastomeric, full face, hardness of 50 to 70 durometer.
- .2 Bolts, nuts, hex head and washers: to ASTM A307, heavy series.
- .3 Solder: 95/5 tin copper alloy lead free for copper pipe.
- .4 Teflon tape: for threaded joints.
- .5 Solvent weld with primer to ASTM F493.
 - .1 Pressure rating 690 kPa at 82°C, 2760 kPa at 23°C

2.5 GATE VALVES

- .1 NPS2 and under, soldered:
 - .1 Rising stem: to MSS-SP-80, Class 125, 860 kPa, bronze body, screw-in bonnet, solid wedge disc as specified Section 23 05 23.01 – Valves - Bronze.
- .2 NPS2 and under, screwed:
 - .1 Rising stem: to MSS-SP-80, Class 125, 860 kPa, bronze body, screw-in bonnet, solid wedge disc as specified Section 23 05 23.01 – Valves - Bronze.
- .3 NPS2-1/2 and over, in mechanical rooms, flanged:
 - .1 Rising stem: to MSS-SP-70, Class 125, 860 kPa, flat flange faces, cast-iron body, OS&Y bronze trim specified Section 23 05 23.02 – Valves – Cast Iron.
- .4 NPS2-1/2 and over, other than mechanical rooms, flanged:
 - .1 Non-rising stem: to MSS-SP-70, Class 125, 860 kPa, flat flange faces, cast-iron body, bronze trim, bolted bonnet specified Section 23 05 23.02 – Valves – Cast Iron.

2.6 GLOBE VALVES

- .1 NPS2 and under, soldered:

- .1 To MSS-SP-80, Class 125, 860 kPa, bronze body, renewable composition disc, screwed over bonnet as specified Section 23 05 23.01 – Valves – Bronze.
- .2 Lockshield handles: as indicated.
- .2 NPS2 and under, screwed:
 - .1 To MSS-SP-80, Class 150, 1 MPa, bronze body, screwed over bonnet, renewable composition disc as specified Section 23 05 23.01 – Valves – Bronze.
 - .2 Lockshield handles: as indicated.

2.7 SWING CHECK VALVES

- .1 NPS 2 and under, soldered:
 - .1 To MSS-SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat as specified Section 23 05 23.01 – Valves - Bronze.
- .2 NPS2 and under, screwed:
 - .1 To MSS-SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat as specified Section 23 05 23.01 – Valves - Bronze.
- .3 NPS2-1/2 and over, flanged:
 - .1 To MSS-SP-71, Class 125, 860 kPa, cast iron body, flat flange faces, or renewable seat, bronze disc, bolted cap specified Section 23 05 23.02 – Valves – Cast Iron.

2.8 BALL VALVES

- .1 NPS2 and under:
 - .1 As specified Section 23 05 23.01 – Valves - Bronze.
 - .2 CPVC to ASTM D 1784 Cell Class of 23447 and NSF 61.
 - .1 Rating 1599 kPa at 23° C and 717 kPa at 60° C
 - .2 O-rings: EPDM
 - .3 ENDS: socket, flanged, threaded
 - .4 Seats: Teflon PTFE
 - .5 Seals: EPDM
 - .6 Full port, downstream union nut for full blocking
 - .7 Ball: CPVC

2.9 BUTTERFLY VALVES

- .1 NPS21/2 and over lug:
 - .1 To MSS-SP-67, Class 200, 1.4 MPa.
 - .2 As specified in Section 23 05 23.05 – Butterfly Valves.
- .2 NPS21/2 and over, grooved ends:
 - .1 Class 300, 2.1 MPa as specified in Section 23 05 23.05 – Butterfly Valves.

PART 3 EXECUTION

3.1 INSTALLATION

- .1 Install in accordance with Canadian Plumbing Code and local authority having jurisdiction.
- .2 Install pipe work in accordance with Section 23 05 05 – Installation of Pipework and manufacturers' recommendations by certified journey person supplemented as specified herein.
- .3 Assemble piping using fittings manufactured to ANSI standards.
- .4 Install CWS piping below and away from HWS and HWR and other hot piping so as to maintain temperature of cold water as low as possible.
- .5 Connect to fixtures and equipment in accordance with manufacturer's written instructions unless otherwise indicated.
- .6 Buried Tubing
 - .1 Lay in well compacted washed sand in accordance with AWWA Class B bedding.
 - .2 Bend tubing without crimping or constriction. Minimize use of fittings.
- .7 Do not install in vertical shafts.

3.2 VALVES

- .1 Isolate equipment, fixtures and branches with butterfly or ball valves.

- .2 Balance recirculation system using lockshield globe valves. Mark settings and record on as-built drawings on completion.

3.3 PRESSURE TESTS

- .1 Conform to requirements of Section 21 05 01 - Common Work Results for Mechanical.
- .2 Test pressure: greater of 1 ½ times maximum system operating pressure or 860 kPa.

3.4 FLUSHING AND CLEANING

- .1 Flush entire system for 8 h. Ensure outlets flushed for 2 h. Let stand for 24 h, then draw one sample off longest run. Submit to testing laboratory for bacteriological testing to verify that system is clean to Provincial potable water guidelines. Let system flush for additional 2 h, then draw off another sample for testing.

3.5 PRE-START-UP INSPECTIONS

- .1 Systems to be complete, prior to flushing, testing and start-up.
- .2 Verify that system can be completely drained.
- .3 Ensure that pressure booster systems are operating properly.
- .4 Ensure that air chambers, expansion compensators are installed properly.

3.6 START-UP

- .1 Timing: Start up after:
 - .1 Pressure tests have been completed.
 - .2 Disinfection procedures have been completed.
 - .3 Water treatment systems operational.
- .2 Provide continuous supervision during start-up.
- .3 Start-up procedures:
 - .1 Establish circulation and ensure that air is eliminated.

- .2 Check pressurization to ensure proper operation and to prevent water hammer, flashing and/or cavitation.
- .3 Bring HWS storage tank up to design temperature slowly.
- .4 Monitor HWS and HWR piping systems for freedom of movement, pipe expansion as designed.
- .5 Check control, limit, safety devices for normal and safe operation.
- .4 Rectify start-up deficiencies.

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.

1.2 **SUBMITTALS**

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop drawings; submit drawings stamped and signed for approval by Owner.
- .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 before final inspection.
 - .3 Operation data to include:
 - .1 Control schematics for systems including environmental controls.

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- .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 for approval. Submission of individual data will not be accepted unless directed by Owner.
 - .2 Make changes as required and re-submit as directed by Owner.
- .7 Additional data:
 - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
- .8 Site records:
 - .1 Owner will provide one (1) set of reproducible mechanical drawings or AutoCAD files. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.

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- .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 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 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.4 MAINTENANCE

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

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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.

PART 3 EXECUTION

3.1 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.
- .4 Paint all new cooling tower exposed piping to match existing. Paint all existing piping located in cooling tower room.

3.2 CLEANING

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

3.3 FIELD QUALITY CONTROL

- .1 Site Tests: conduct following tests in accordance with Section 01 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:

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- .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.
- .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
- .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.4 DEMONSTRATION

- .1 Owner 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 may record these demonstrations on video tape for future reference.

3.5 PROTECTION

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

END OF SECTION

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:

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- .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° 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.

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- .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.

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- .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.

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- .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 journeyman.
- .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.

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- .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:

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- .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.

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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)

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- .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.(Not required for cooling tower or chilled water piping)
- .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.

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- .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.

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- .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. (Not required for cooling tower or chilled water piping)
- .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. (Not required for cooling tower or chilled water piping)

3.4 SPECIALIST EXAMINATIONS AND TESTS

- .1 General (Not required for cooling tower or chilled water piping)
 - .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.
- .5 Full radiographic tests for piping systems. (Not required for cooling tower or chilled water piping)
 - .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.
- .6 Magnetic particle tests for piping systems as indicated.

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

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Section 23 05 19.13 – Thermometers and Pressure Gauges
– Piping Systems

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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

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– Piping Systems

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.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 from 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 ± 1 scale division, 225 mm scale length: to CAN/CGSB14.4 or ASME B40.200.

2.3 REMOTE READING THERMOMETERS

- .1 100 mm diameter liquid filled or vapor activated dial type: to CAN/CGSB-14.4 or ASME B40.200, accuracy within one scale division, brass

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movement, stainless steel capillary, stainless steel spiral armour, stainless steel bulb and polished brass or stainless steel case for wall mounting.

2.4 THERMOMETER WELLS

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

2.5 PRESSURE GAUGES

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

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- .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.

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- .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

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- .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.

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- .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.

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- .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:

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- .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, Class 150:
 - .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.

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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 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.

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- .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 iron, 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 B16.1, Cast Iron Pipe Flanges and Flanged Fittings.
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A 49, Specification for Heat-Treated Carbon Steel Joint Bars.
 - .2 ASTM A 126, Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
 - .3 ASTM B 61, Specification for Steam or Valve Bronze Castings.
 - .4 ASTM B 62 – Specification for Composition Bronze or Ounce Metal Castings.
 - .5 ASTM B 85, Specification for Aluminum-Alloy Die Castings.
 - .6 ASTM B 209, Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- .3 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS).
 - .1 MSS SP-67, Butterfly Valves.
 - .2 MSS SP-70, Cast Iron Gate Valves, Flanged and Threaded Ends.

- .3 MSS SP-71, Grey Iron Swing Check Valves, Flanged and Threaded Ends
- .4 MSS SP-82, Valve Pressure Testing Methods
- .5 MSS SP-85, Cast Iron Globe and Angle Valves, Flanged and Threaded 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 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:
 - .1 Valve seats: one for every 10 valves each size. Minimum 1.
 - .2 Discs: one for every 10 valves, each size. Minimum 1.
 - .3 Stem packing: one for every 10 valves, each size. Minimum 1.

- .4 Valve handles: 2 of each size.
- .5 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 Standard specifications:
 - .1 Gate valves: MSS SP-70.
 - .2 Globe valves: MSS SP-85.
 - .3 Check valves: MSS SP-71.
- .3 Requirements common to valves, unless specified otherwise:
 - .1 Body, bonnet: cast iron to ASTM B209 Class B.
 - .2 Connections: flanged ends, plain face, to ANSI B16.1.
 - .3 Inspection and pressure testing: to MSS SP-82.
 - .4 Bonnet gasket: non-asbestos.
 - .5 Stem: to have precision-machined Acme or 60°V threads, top screwed for handwheel nut.
 - .6 Stuffing box: non-galling two-piece ball-jointed packing gland, gland bolts and nuts.
 - .7 Gland packing: non-asbestos.
 - .8 Handwheel: Die-cast aluminum alloy to ASTM B85 or malleable iron to ASTM A49. Nut of bronze to ASTM B62.
 - .9 Identification tag: with catalogue number, size, other pertinent data.
- .4 All products to have Canadian Registration Numbers (CRN).
- .5 Bronze trim for steam, water, air or glycol service, iron trim for oil, gas or gasoline.
- .6 Acceptable Product: Crane, Jenkins, Milwaukee, Newman Hattersley, Kitz, M.A. Stewart, NIBCO.

2.2 GATE VALVES

- .1 NPS 2 1/2 - 8, non rising stem, inside screw, bronze or iron trim, solid wedge disc:

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- .1 Body and multiple-bolted bonnet: with bosses in body and bonnet for taps and drains, full length disc guides designed to ensure correct re-assembly, Class 125.
- .2 Bronze Trim:
 - .1 Disc: Solid offset taper wedge, bronze to ASTM B62.
 - .2 Seat rings: renewable bronze to ASTM B62, screwed into body.
 - .3 Stem: bronze to ASTM B62.
- .3 Iron Trim:
 - .1 Disc: Solid offset taper wedge, cast iron to ASTM A126 Class B, secured to wrought steel stem.
 - .2 Seat: Integral with body.
 - .3 Stem: wrought steel.
 - .4 Operator: Handwheel
- .2 NPS 10 - 24, non rising stem, inside crew, bronze or iron trim, solid wedge disc:
 - .1 Body and multiple-bolted bonnet: cast iron to ASTM A126 Class B for sizes up to NPS 14, Class C for sizes NPS 16 and over, with bosses in body and bonnet for taps and drains, full length disc guides designed to ensure correct re-assembly, body tie ribs between bonnet and end flanges.
 - .2 Pressure ratings: Class 125.
 - .3 Bronze Trim:
 - .1 Disc: Solid offset taper wedge, with bronze rings to ASTM B62 rolled into cast iron disc, secured to stem.
 - .2 Seat rings: renewable bronze to ASTM B62 screwed into body.
 - .3 Stem: bronze to ASTM B62.
 - .4 Iron Trim:
 - .1 Disc: Solid offset taper wedge, cast iron secured to stem.
 - .2 Seat: integral with body up to NPS 14, renewable nodular iron on other sizes.
 - .3 Stem: wrought steel.
 - .4 Operator: Handwheel
- .3 NPS 2 1/2-8, outside screw and yoke (OS&Y), bronze or iron trim, solid wedge disc:
 - .1 Body and multiple-bolted bonnet: with bosses in body and bonnet for taps and drains, full length disc guides designed to ensure

- correct re-assembly, yoke, yoke hub, yoke sleeve and nut, Class 125.
- .2 Bronze Trim:
 - .1 Disc: Solid offset taper wedge, bronze to ASTM B62 up to NPS 3, cast iron with bronze disc rings on other sizes, secured to stem through integral forged T-head disc-stem connection.
 - .2 Seat rings: renewable bronze screwed into body.
 - .3 Stem: manganese-bronze.
 - .3 Iron Trim:
 - .1 Disc: Solid offset taper all-cast iron, secured to stem through integral forged T-head disc-stem connection.
 - .2 Seat rings: integral with body.
 - .3 Stem: nickel-plated steel for iron trim.
 - .4 Pressure-lubricated operating mechanism.
 - .5 Operator: Handwheel.
- .4 NPS 10 - 24, outside screw and yoke (OS&Y), bronze or iron trim, solid wedge disc:
- .1 Body and multiple-bolted bonnet: NPS 10 - 14: cast iron to ASTM A126 Class B; NPS 16 - 24: cast iron to ASTM A126 Class C. With bosses in body and bonnet for taps and drains, full length disc guides designed to ensure correct re-assembly, body tie ribs between bonnet and end flanges, yoke, yoke hub, yoke sleeve and nut.
 - .2 Pressure ratings: Class 125.
 - .1 NPS 10-12: WP = 1.4 MPa CWP
 - .2 NPS 14-24: WP = 1.03 MPa CWP
 - .3 Bronze Trim
 - .1 Disc: Solid offset taper wedge, bronze disc rings to ASTM B62 rolled into cast iron disc, secured to stem through integral forged T-head disc-stem connection.
 - .2 Seat rings: renewable bronze to ASTM B62 screwed into body.
 - .3 Stem: manganese-bronze.
 - .4 Iron Trim:
 - .1 Disc: Solid offset taper all-cast iron, secured to stem through integral forged T-head disc-stem connection.

- .2 Seat: integral with body up to NPS 14, renewable nodular iron on other sizes.
- .3 Stem: nickel-plated steel.
- .5 Pressure-lubricated operating mechanism.
- .6 Operator: Handwheel.

2.3 UNDERWRITERS APPROVED GATE VALVE

- .1 NPS 2 1/2 - 14, OS&Y:
 - .1 Approvals: UL and FM approved for fire service.
 - .2 UL and FM Label: on valve yoke.
 - .3 Body, Bonnet: cast iron to ASTM A126 Class B. Wall thicknesses to ANSI B16.1 and ULC C-262 (B).
 - .4 Bonnet bushing, yoke sleeve: bronze, to FM requirements.
 - .5 Packing gland: bronze.
 - .6 Stem: manganese bronze. Diameter to ULC C-262 (B).
 - .7 Stuffing box dimensions, gland bolt diameter: to ULC C-262 (B).
 - .8 Bosses for bypass valve, drain: on NPS 4 and over.
 - .9 Disc: solid taper wedge. Up to NPS 3: bronze. NPS 4 and over: cast iron with bronze disc rings.
 - .10 Disc seat ring: self-aligning, Milwood undercut on NPS 3 - 12.
 - .11 Pressure rating:
 - .1 NPS 2-1/2 - 12: 1.7 MPa CWP
 - .2 NPS 14: 1.2 MPa CWP
 - .12 Operator: Handwheel.

2.4 GLOBE VALVES

- .1 NPS 2 ½ - 10, OSY:
 - .1 Body: with multiple-bolted bonnet.
 - .2 WP: 860 kPa steam, 1.4 MPa CWP
 - .3 Bonnet-yolk gasket: non-asbestos.
 - .4 Disc: bronze to ASTM B 62, fully guided from bottom, securely yet freely connected to stem for swivel action and accurate engagement with disc.
 - .5 Seat ring: renewable, regrindable, screwed into body.
 - .6 Stem: bronze to ASTM B 62.
 - .7 Operator: handwheel.

2.5 BYPASSES FOR GATE AND GLOBE VALVES

- .1 Locations: on valves as indicated.
- .2 Position of bypass valve on main valves: spindle uprights 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, trim, to Section 23 05 23.01 – Valves – Bronze. Pressure rating to match main valve.
 - .2 On globe valve: globe, with composition disc, bronze trim, to Section 23 05 23.01 - Valves – Bronze. Pressure rating to match main valve.

2.6 VALVE OPERATORS

- .1 Install valve operators as follows:
 - .1 Handwheel: on 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.

2.7 CHECK VALVES

- .1 Swing check valves, Class 125:
 - .1 Body and bolted cover: with tapped and plugged opening on each side for hinge pin. Flanged ends: plain faced with smooth finish.
 - .1 Up to NPS 16: cast iron to ASTM A126 Class B.
 - .2 NPS 18 and over: cast iron to ASTM A126 Class C.
 - .2 Ratings:
 - .1 NPS 2 1/2 - 12: 860 kPa steam; 1.4 MPa CWP.
 - .2 NPS 14 - 16: 860 kPa steam; 1.03 MPa CWP.
 - .3 NPS 18 and over: 1.03 MPa CWP.
 - .3 Bronze Trim
 - .1 Disc: Rotating for extended life.
 - .1 Up to NPS 6: bronze to ASTM B 62.
 - .2 NPS 8 and over: bronze-faced cast iron.

- .2 Seat rings: renewable bronze to ASTM B62 screwed into body.
- .3 Hinge pin, bushings: renewable bronze to ASTM B62.
- .4 Iron Trim
 - .1 Disc: A126 Class B, secured to stem, rotating for extended life.
 - .2 Seat: cast iron, integral with body.
 - .3 Hinge pin: exelloy; bushings: malleable iron.
- .5 Identification tag: fastened to cover.
- .6 Hinge: galvanized malleable iron.
- .2 Swing check valves, NPS 2 1/2 - 8 Class 250:
 - .1 Body and bolted cover: cast iron to ASTM A126 Class B with tapped and plugged opening on each side for hinge pin.
 - .2 Flanged ends: 2 mm raised face with serrated finish.
 - .3 Rating: 1.7 mPa steam; 3.4 MPa CWP.
 - .4 Disc: Rotating for extended life.
 - .1 Up to NPS 3: bronze to ASTM B61.
 - .2 NPS 4 - 8: Iron faced with ASTM B61 bronze.
 - .5 Seat rings: renewable bronze to ASTM B61, screwed into body.
 - .6 Hinge pin, bushings: renewable, bronze to ASTM B61.
 - .7 Hinge: galvanized malleable iron.
 - .8 Identification tag: fastened to cover.

2.8 SILENT CHECK VALVES

- .1 Body: malleable iron or ductile iron with integral seat.
- .2 Pressure rating: Class 125, WP = 860 kPa.
- .3 Connections: grooved ends or flanged.
- .4 Disc: bronze or stainless steel renewable rotating disc.
- .5 Seat: renewable, EPDM.
- .6 Stainless steel spring, heavy duty.
- .7 Grooved end check valves.

2.9 GROOVED END BUTTERFLY VALVES

- .1 Butterfly valves: to MSS-SP-67. Application: Isolating cells or section of multiple component equipment (eg. multi-section coils, multi-cell cooling towers).
 - .1 NPS2 and over: Grooved ends.
 - .2 2068 kPa WOG and be both bi-directional and dead end service capable to full rated pressure. Ductile iron body with blow-out proof stainless steel stems and nickel coated ductile iron disc. Seat shall be "EPDM" and have a full 360° continuous contact with the seating surface.
 - .3 Valve Operators: Lever, gear operator NPS6 and over.

PART 3 EXECUTION

3.1 INSTALLATION

- .1 Install rising stem valves in upright position with stem above horizontal. Ensure sufficient room for valve stem in fully open position.
- .2 Grooved end valves to be supplied by the same manufacture of the grooved fittings.
- .3 Grooved end valves to be installed in accordance with the manufacturer's written installation instructions. Grooved ends to be clean and free from indentations and projections. Gaskets to be verified as suitable for the intended service prior to installation. Gaskets to be molded and produced by the coupling manufacturer. The grooved coupling manufacturer's factory trained representative to 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 to periodically visit the jobsite and review installation. Contractor to remove and replace any joints deemed improperly installed.

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 Butterfly 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.

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 B16.1, Cast Iron Pipe Flanges and Flanged Fittings.
 - .3 ANSI/ASME B16.5, Pipe Flanges and Flanged Fittings.
 - .4 ANSI/ASME B16.11, Forged Fittings, Socket-Welding and Threaded.
 - .5 ANSI/ASME B16.25, Buttwelding Ends.
 - .6 ANSI/ASME B16.34, Valves – Flanged, Threaded and Welding Ends.
- .2 American National Standards Institute (ANSI)/American Petroleum Institute (API).
 - .1 ANSI/API 609, Lug-and Water-Type Butterfly Valves.
- .3 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM A 126, Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
 - .2 ASTM B 62, Specification for Composition Bronze or Ounce Metal Castings.
 - .3 ASTM B 209M, Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

- .4 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS).

- .1 MSS SP-67, Butterfly Valves.

1.4 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data: submit WHMIS MSDS – Material 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 product data in accordance with Section 01 33 00 – Submittal Procedures.
 - .3 Submit data for valves specified this section.
- .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:

- .1 Gaskets for flanges: one for every 10 flanged joints.

PART 2 PRODUCTS

2.1 BUTTERFLY VALVES - RESILIENT SEAT – 1.4 MPa.

- .1 Except for specialty valves, to be of single manufacturer.
- .2 To be suitable for dead-end service.
- .3 Canadian Registration Number (CRN) required for products.
- .4 Sizes: Wafer or Lug type: NPS 2 to 30.
- .5 Pressure rating for tight shut-off at temperatures up to maximum for seat material.
 - .1 NPS 2 - 12: 1.4 MPa CWP.
 - .2 NPS 14 - 30: 1.4 MPa CWP.
- .6 Minimum seat temperature ratings to 135°C.
- .7 Application: On-off operation.
- .8 Full lug body (threaded).
- .9 Operators:
 - .1 NPS 2 - 6: Handles capable of locking in any of ten (10) positions - 0° to 90°. Handle and release trigger - ductile iron. Return spring and hinge pin: carbon steel. Latchplate and mounting hardware: cadmium plated carbon steel. Standard coating: Black laquer.
 - .2 NPS 8 - 30: Manual enclosed gear operator.
- .10 Designed to comply with MSS SP-67 and API 609.
- .11 Compatible with ANSI Class 125/Class 150 flanges.
- .12 Construction:
 - .1 Body: ductile iron.
 - .2 Disc: aluminum bronze.
 - .3 Seat: EPDM.
 - .4 Shaft: 416 stainless steel.
 - .5 Taper pin: 316 SS.
 - .6 Key: carbon steel stainless.

- .7 O-Ring: Buna-N.
- .8 Bushings: Luberized bronze Teflon.

2.2 BUTTERFLY VALVES - RESILIENT SEAT -1.97 MPa

- .1 Sizes: Lug type: NPS 2 to 30.
- .2 Pressure rating: 1.97 MPa at 135EC.
- .3 Lug body: 150 ANSI bolt pattern.
- .4 Full lug body (threaded).
- .5 Application: for on-off service.
 - .1 Operators:
 - .2 NPS 2 - 6: Handles capable of locking in any of ten (10) positions - 0E to 90E. Handle and release trigger - ductile iron. Return spring and hinge pin: carbon steel. Latch plate and mounting hardware: cadmium plated carbon steel.
 - .3 NPS 8 - 24: Manual enclosed gear operator.
 - .4 Install parallel or perpendicular to pipeline.
- .6 Designed to comply with MSS SP-67 and API 609.
- .7 Compatible with ANSI B16.1 Class 125 (iron) and ANSI B16.5 Class 150 (steel) flanges.
- .8 Construction:
 - .1 Body: ductile iron.
 - .2 Disc: aluminum bronze.
 - .3 Seat: EPDM.
 - .4 Refer to manufacturer's literature for additional materials.
 - .5 Shaft: NPS 2 - 12: 416 stainless steel, NPS 14 - 48, 316 stainless steel.
 - .6 Taper pin: 316 SS.
 - .7 Blowout proof stem.
 - .8 O-Ring: Buna-N.
 - .9 Bushings: Teflon.
 - .10 Disc shall not be pinned to shaft.
 - .11 Bubble tight shutoff with downstream flanges removed, class 6 shutoff.

2.3 BUTTERFLY VALVES- 2.1 MPa

- .1 Sizes: grooved ends, NPS-2-12.
- .2 Pressure rating: 2.1 MPa WOG.
- .3 Body: Ductile Iron to ASTM A-536 with polypropylene coating.
- .4 Disc: Ductile Iron to ASTM A-536.
- .5 Disc coating: EPDM.
- .6 Body coating: Polyphenylene Sulfide Blend
- .7 Drive Hub Adapter and Operation Bracket: hot rolled steel, enamel coated.
- .8 Upper bearing/lower Trunnion seals: EPDM
- .9 Upper bearing/lower Trunnion: Navel brass or Bronze alloy.
- .10 Bolts and washers: Cold rolled steel, zinc plated.
- .11 Operator:
 - .1 NPS 2-3: two position manual handle
 - .2 NPS 3-6: Manual level lock
 - .3 NPS 8-12: Manual gear operator with handwheel
 - .4 Handwheel with chain operator: on valves installed more than 2400 mm above floor in boiler rooms and mechanical equipment rooms.

2.4 MOUNTING FLANGES:

- .1 Class 125 cast iron to ANSI B16.1 or Class 150 steel to B16.5 pipe flanges.

2.5 ELECTRIC ACTUATORS:

- .1 Operation: Designed to provide precise quarter turn electric operation.
 - .1 Torque range: Up to 1.130 N-m and speed ranges from 10 seconds to 30 seconds to move from fully open to fully closed.
 - .2 Gear train within actuator to provide smooth continuous rotary power stroke for accurate automatic valve positioning. Factory-set, field adjustable cam-actuated travel limit switches to provide precise control of shaft rotation.

- .2 Construction:
 - .1 Castings: Heavy duty industrial grade for rugged use.
 - .2 Actuators: continuous duty with high efficiency single phase reversing capacitor motor with thermal overload protection.
 - .3 Gears and pinions constructed from hardened steel.
 - .4 Gear train to be permanently lubricated.
 - .5 Mechanical brake to ensure that gear is locked in precise position.
- .3 Electrical
 - .1 Standard voltage: 120 VAC. 60 Hz.
 - .2 Control options: 4-20 Ma DC or 0-10 V DC.
 - .3 CSA approved.
 - .4 Electrical rating: NEMA IV.

PART 3 EXECUTION

3.1 PREPARATION

- .1 Valve and mating flange preparation.
 - .1 Inspect adjacent pipeline, remove rust, scale, welding slag, other foreign material.
 - .2 Ensure that valve seats and pipe flange faces are free of dirt or surface irregularities which may disrupt flange seating and cause external leakage.
 - .3 Install butterfly valves with disc in almost closed position.
 - .4 Inspect valve disc seating surfaces and waterway and eliminate dirt or foreign material.

3.2 INSTALLATION OF VALVES

- .1 Install in accordance with manufacturer's instructions.
- .2 Do not use gaskets between pipe flanges and valves unless instructed otherwise by valve manufacturer.
- .3 Verify suitability of valve for application by inspection of identification tag.
- .4 Mount actuator on to valve prior to installation.
- .5 Handle valve with care so as to prevent damage to disc and seat faces.

- .6 Valves in horizontal pipe lines should be installed with stem in horizontal position to minimize liner and seal wear.
- .7 Ensure that valves are centered between bolts before bolts are tightened and then opened and closed to ensure unobstructed disc movement. If interference occurs due, for example to pipe wall thickness, taper bore adjacent piping to remove interference.

3.3 ACTUATOR INSTALLATION

- .1 Air hoses or electrical connections to be made by actuator manufacturer.
- .2 Cycle valve operation from fully closed to fully open then back to fully closed.
- .3 At same time, check travel stop settings for proper disc alignment.

END OF SECTION

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Section 23 05 29 – Hangers and Supports for HVAC
Piping and Equipment

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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.

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- .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:

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- .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.

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- .7 Pipe attachments: material to MSS SP-58.
 - .1 Attachments for steel piping: carbon steel galvanized.
 - .2 Attachments for copper piping: copper plated black steel.
 - .3 Use insulation saddles for hot pipework.
 - .4 Oversize pipe hangers and supports for insulated pipes.
- .8 Adjustable clevis: material to MSS SP-69, UL listed FM approved, where required clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.
 - .1 Ensure "U" has hole in bottom for rivetting to insulation shields.
- .9 Yoke style pipe roll: carbon steel yoke, rod and nuts with cast iron roll, to MSS SP-69.
- .10 U-bolts: carbon steel to MSS SP-69 with 2 nuts at each end to ASTM A563.
 - .1 Finishes for steel pipework: galvanized.
 - .2 Finishes for copper, glass, brass or aluminum pipework: black with formed portion plastic coated or epoxy coated.
- .11 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP-69.

2.3 RISER CLAMPS

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

2.4 INSULATION PROTECTION SHIELDS

- .1 Insulated cold piping:
 - .1 64 kg/m³ density insulation plus insulation protection shield to: MSS SP-69, galvanized sheet carbon steel. Length designed for maximum 3.0 m span.
- .2 Insulated hot piping:

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- .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.

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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.

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- .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	

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Maximum Pipe Size: NPS	Maximum Spacing: Steel	Maximum Spacing: Copper
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

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Section 23 05 48 – Vibration and Seismic Controls for
HVAC Piping and Equipment

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PART 1 GENERAL

1.1 SUMMARY

- .1 Section includes:
 - .1 Vibration isolation materials and components, seismic control measures and their installation.

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 23 05 93 - Testing, Adjusting and Balancing for HVAC.

1.3 REFERENCES

- .1 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
 - .1 Safety Data Sheets (SDS)
- .2 National Fire Protection Association (NFPA)
 - .1 NFPA 13 - Standard for the Installation of Sprinkler Systems.
- .3 National Building Code of Canada (NBC)

1.4 SUBMITTALS

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

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- .2 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Shop drawings; submit drawings stamped and signed for approval by Owner.
 - .2 Provide separate shop drawings for each isolated system, system shop drawings complete with performance and product data.
 - .3 Provide detailed drawings of seismic control measures for equipment and piping.
- .3 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .2 Instructions: submit manufacturer's installation instructions.
 - .1 Owner will make available one (1) copy of systems supplier's installation instructions.
 - .3 Manufacturer's Field Reports: manufacturer's field reports specified.

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 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.

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PART 2 PRODUCTS

2.1 GENERAL

- .1 Size and shape of bases type and performance of vibration isolation to be as indicated.

2.2 ELASTOMERIC PADS

- .1 Rubber waffle or ribbed; 9 mm minimum thick; 30 durometer natural rubber; maximum loading 415 kPa.
 - .1 Application: Under cooling tower between tower and support frame.

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 vibration isolation equipment in accordance with manufacturer's instructions and adjust mountings to level equipment.
- .2 Ensure piping, ducting and electrical connections to isolated equipment do not reduce system flexibility and that piping, conduit and ducting passage through walls and floors do not transmit vibrations.
- .3 Unless indicated otherwise, support piping connected to isolated equipment with spring mounts or spring hangers with 25 mm minimum static deflection as follows:
 - .1 Up to NPS 4: first 3 points of support. NPS 5 to NPS 8: first 4 points of support. NPS 10 and Over: first 6 points of support.
 - .2 First point of support shall have a static deflection of twice deflection of isolated equipment, but not more than 50 mm.
- .4 Where isolation is bolted to floor use vibration isolation rubber washers.
- .5 Block and shim level bases so that ductwork and piping connections can be made to a rigid system at the operating level, before isolator

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adjustment is made. Ensure that there is no physical contact between isolated equipment and building structure.

3.3 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Services:
 - .1 Arrange with manufacturer's representative to review work of this Section and submit written reports to verify compliance with Contract Documents.
 - .2 Manufacturer's Field Services: consisting of product use recommendations and periodic site visits to review installation, scheduled as follows:
 - .1 After delivery and storage of Products.
 - .2 After preparatory work is complete but before installation commences.
 - .3 Twice during the installation, at 25 % and 60 % completion stages.
 - .4 Upon completion of installation.
 - .3 .3 Submit manufacturer's reports to Owner within three (3) days of manufacturer representative's review.
 - .4 Make adjustments and corrections in accordance with written report.
- .2 Inspection and Certification:
 - .1 Experienced and competent sound and vibration testing professional engineer to take vibration measurement for HVAC systems after start up and TAB of systems to Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
- .3 Provide Owner with notice 24 hours in advance of commencement of tests.
- .4 Establish adequacy of equipment isolation and acceptability of noise levels in occupied areas and where appropriate, remedial recommendations (including sound curves).
- .5 Submit complete report of test results including sound curves.

3.4 CLEANING

- .1 Proceed in accordance with Section 01 74 00 - Cleaning

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- .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 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°C and intermittent temperature of 200°C.
- .7 Colours and Legends:

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- .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		
Cooling Tower water supply	Green	COND. WTR. SUPPLY
Cooling Tower water return	Green	COND. WTR. RETURN
Domestic cold water supply	Green	DOM. CWS
Control air tubing	To Section 25 05 54 – EMCS: Identification	
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 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.

1.8 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.

1.9 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.

1.10 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%.

1.11 ACCURACY TOLERANCES

- .1 Measured values to be accurate to within plus or minus 2 % of actual values.

1.12 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.

1.13 SUBMITTALS

- .1 Submit, prior to commencement of TAB:
- .2 Proposed methodology and procedures for performing TAB if different from referenced standard.

1.14 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.

1.15 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.

1.16 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.

1.17 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.

1.18 COMPLETION OF TAB

- .1 TAB to be considered complete when final TAB Report received and approved by Owner.

1.19 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 Measure airflow from cooling tower incl. static profile.
- .7 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.
- .8 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).

1.20 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.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

PART 1 **GENERAL**

1.1 **RELATED SECTIONS**

- .1 Section 22 05 15 – Plumbing Specialities and Accessories.
- .2 Section 23 05 93 – Testing, Adjusting and Balancing for HVAC.
- .3 Section 23 08 02 – Cleaning and Start-up of Mechanical Piping Systems.
- .4 Section 23 11 13 – Facility Fuel-Oil Piping.
- .5 Section 22 11 18 – Domestic Water Piping Copper.
- .6 Section 23 21 13.02 – Hydronic Systems: Steel.
- .7 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.

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- .1 Pump operation.
- .2 Pressure bypass open/closed.
- .3 Control pressure failure.
- .4 Maximum heating demand.
- .5 Maximum cooling demand.
- .6 Cooling tower (and/or industrial fluid cooler) fan failure.
- .7 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 Cooling tower capacity test:
 - .1 Perform capacity test when ambient temperature is above 20°C:
 - .2 Test procedures:
 - .1 Set load or demand limiters on chillers to 100%
 - .2 After system has stabilized, record chilled water, condenser water, etc., flow rates and supply and return temperatures simultaneously.

1.6 REPORTS

- .1 Provide results in report.

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.

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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

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- .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:

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- .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.
- .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:

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- .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.

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- .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.

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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.

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- .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.

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- .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.

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- .6 Orifice flanges: slip-on raised face, 2100 kPa.
- .7 Flange gaskets: to AWWA C111
- .8 Pipe thread: taper.
- .9 Bolts and nuts: to ASME B18.2.1 and ASME B18.2.2.
- .10 Roll grooved coupling gaskets: NPS 2 to 8, type EHP, EPDM high performance, -40°C to +120°C for continuous operation, NPS 10 and above type EPDM, -30°C to +110°C for continuous acceptable on hot water, glycol water, chilled water and condenser water.

2.3 FITTINGS

- .1 Screwed fittings: malleable iron, to ASME B16.3, Class 150.
- .2 Pipe flanges and flanged fittings:
 - .1 Cast iron: to ASME B16.1, Class 125.
 - .2 Steel: to ASME B16.5.
- .3 Butt-welding fittings: steel, to ASME B16.9.
- .4 Unions: malleable iron, to ASTM A47/A47M and ASME B16.3.
- .5 Fittings for roll grooved piping: malleable iron to ASTM A47/A47M, ductile iron to ASTM A536.

2.4 VALVES

- .1 Connections:
 - .1 NPS2 and smaller: screwed ends.
 - .2 NPS2.1/2 and larger: Flanged or grooved ends.
- .2 Gate valves: to MSS-SP-70 and MSS-SP-80 Application: Isolating equipment, control valves, pipelines:
 - .1 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 2 1/2 and over:

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- .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

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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 $\frac{3}{4}$ 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.

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 journey person and authority having jurisdiction.
- .2 Clean, prime and paint all new piping installed to match existing.

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.

3.5 BALANCING

- .1 Balance water systems to within plus or minus 5 % of design output.
- .2 Refer to Section 23 05 93 – Testing, Adjusting and Balancing for HVAC, for applicable procedures.

3.6 GLYCOL CHARGING

- .1 Provide mixing tank and positive displacement pump for glycol charging.
- .2 Retest for concentration to ASTM E202 after cleaning.

3.7 PERFORMANCE VERIFICATION

- .1 In accordance with Section 23 08 01 – Performance Verification of Mechanical Systems.
- .2 Provide copies of test reports for Commissioning Manuals.

END OF SECTION

PART 1 **GENERAL**

1.1 **SUMMARY**

- .1 Section includes:
 - .1 Materials and installation of low-pressure metallic ductwork, joints and accessories.

1.2 **RELATED SECTIONS**

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 01 35 29.06 – Health and Safety Requirements
- .3 Section 01 74 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 journeyman 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 SEAL CLASSIFICATION

- .1 Classification as follows:

Maximum Pressure Pa

SMACNA Seal Class

Maximum Pressure Pa	SMACNA Seal Class
> 1000	A
750	B
500	C
250	C
125	C

- .2 Seal classification:
 - .1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant and tape.
 - .2 Class B: longitudinal seams, transverse joints and connections made airtight with sealant tape or combination thereof.
 - .3 Class C: transverse joints and connections made air tight with gaskets, sealant tape or combination thereof. Longitudinal seams unsealed.

2.2 SEALANT

- .1 Sealant: oil resistant, polymer type flame resistant duct sealant. Temperature range of minus 30°C to plus 93°C.

2.3 TAPE

- .1 Tape: polyvinyl treated, open weave fiberglass tape, 50 mm wide.

2.4 DUCT LEAKAGE

- .1 In accordance with SMACNA HVAC Duct Leakage Test Manual.

2.5 FITTINGS

- .1 Fabrication: to SMACNA.
- .2 Radiused elbows:
 - .1 Rectangular: Centreline radius: 1.5 times width of duct.
 - .2 Round: smooth radius or five piece. Centreline radius: 1.5 times diameter.
- .3 Mitred elbows, rectangular:
 - .1 To 400 mm: with single thickness turning vanes.
 - .2 Over 400 mm: with double thickness turning vanes.
- .4 Branches:

- .1 Rectangular main and branch: with radius on branch 1.5 times width of duct or 45° entry on branch.
- .2 Round main and branch: enter main duct at 45° with conical connection.
- .3 Provide volume control damper in branch duct near connection to main duct.
- .4 Main duct branches: with volume control damper.
- .5 Transitions:
 - .1 Diverging: 20° maximum included angle.
 - .2 Converging: 30° maximum included angle.
- .6 Offsets:
 - .1 Full short radiused elbows as indicated.
- .7 Obstruction deflectors: maintain full cross-sectional area. Maximum included angles: as for transitions.

2.6 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.

2.7 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.

2.8 HANGERS AND SUPPORTS

- .1 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct. Maximum size duct supported by strap hanger: 500 mm.
- .2 Hanger configuration: to SMACNA.
- .3 Hangers: galvanized steel angle with black steel rods to ASHRAE or SMACNA following table:

Duct Size (mm)	Angle Size (mm)	Rod Size (mm)
up to 750	25x25x3	6
751 to 1050	40x40x3	6
1051 to 1500	40x40x3	10
1501 to 2100	50x50x3	10
2101 to 2400	50x50x5	10
2401 and over	50 x 50 x 6	10

- .4 Upper hanger attachments:
- .1 For concrete: manufactured concrete inserts.
 - .2 For steel joist: manufactured joist clamp steel plate washer.
 - .3 For steel beams: manufactured beam clamps:

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)

Duct Size	Spacing
to 1500	3000
1501 and over	2500

3.3 SEALING AND TAPING

- .1 Apply sealant to outside of joint to manufacturer's recommendations.
- .2 Bed tape in sealant and recoat with minimum of one coat of sealant to manufacturers recommendations. Sealant and tape to be applied to full perimeter of duct.

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 40⁰C to plus 90⁰C, density of 1.3 kg/m².

2.3 ACCESS DOORS IN DUCTS

- .1 Non-insulated ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame.
- .2 Insulated ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame and 25 mm thick rigid glass fibre insulation.
- .3 Gaskets: neoprene.
- .4 Hardware:

- .1 Hold open devices.
- .2 300 x 300 mm glass viewing panels.
- .3 Up to 300 x 300 mm: two sash locks complete with safety chain.
- .4 301 to 450 mm: four sash locks complete with safety chain.
- .5 451 to 1000 mm: piano hinge and minimum two sash locks.
- .6 Doors over 1000 mm: piano hinge and two handles operable from both sides.
 - .1 Hold open devices.
 - .2 300 X 300 mm glass viewing panels.

2.4 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 **SECTION INCLUDES**

- .1 Open circuit, forced draft, counterflow cooling towers.

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 78 00 - Closeout Submittals.
- .4 Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment.

1.3 **REFERENCES STANDARDS**

- .1 ASHRAE 90.1-2019 – Energy Standard for Buildings Except Low-Rise Residential Buildings.
- .2 ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- .3 ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2018.
- .4 ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus 2018.
- .5 ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2018b.
- .6 ASTM D2794 - Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
- .7 CTI STD-201 OM - Operations Manual for Thermal Performance Certification of Evaporative Heat Rejection Equipment 2017.
- .8 CTI STD-201 RS - Performance Rating of Evaporative Heat Rejection Equipment 2017.

- .9 ISO 9001 - Quality management systems -- Requirements 2015.
- .10 NEMA MG 1 - Motors and Generators 2017.

1.4 SUBMITTALS

- .1 Product Data: Provide rated capacities, dimensions, weights and point loadings, accessories, required clearances, electrical requirements and wiring diagrams, and location and size of field connections.
- .2 Shop Drawings: Indicate suggested structural steel supports including dimensions, sizes, and locations for mounting bolt holes.
- .3 Manufacturer's Certificate: Certify that cooling tower performance, based on CTI STD-201 meets or exceeds specified requirements and submit performance curve plotting leaving water temperature against wet bulb temperature.
- .4 Manufacturer's Instructions: Submit manufacturer's complete installation instructions.
- .5 Operation and Maintenance Data: Include start-up instructions, maintenance data, parts lists, controls, and accessories.
- .6 Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

- .1 Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum 20 years of documented experience and ISO 9001 certification.
- .2 Installer Qualifications: Company specializing in performing the type of work specified in this section with minimum 20 years of experience and approved by manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Equipment will be factory-assembled, including cold water basin, heat transfer section, water distribution, fan drive system, and casing panels. For shipping, disassemble into as large as practical sub-assemblies to minimize field work for re-assembly.
- .2 Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.

1.7 WARRANTY

- .1 Provide complete all inclusive parts and labour 2 year warranty from date of substantial completion.
- .2 Fans, fan shafts, bearings, sheaves, gearboxes, drive shafts, couplings, and mechanical equipment support shall be warranted against defects in materials and workmanship for a period of seven (7) years after substantial.

1.8 EXTRA MATERIALS

- .1 Furnish following spare parts: One complete set of bearings for one cooling tower assembly.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- .1 Open Circuit, Forced Draft, Counterflow Cooling Towers:
 - .1 Refer to schedule for performance
- .2 Cooling tower to be supplied to replace existing towers. Existing towers are BAC VT0-116/M. Any modifications required to existing support structure, discharge ducting, piping etc. required to install new cooling towers to be contractors' responsibility. Contractor shall be responsible to confirm all dimensions prior to bidding.

2.2 MANUFACTURERS UNITS

- .1 Provide units suited for outdoor use, induced draft with vertical discharge of air. Units shall be shipped disassembled in protective crates. Crates and components must be clearly labeled with part numbers. Assembly of units will be completed onsite. Cold water basins will not have welded seams when shipped knocked down.
- .2 Manufacturer representative to confirm assembly and installation meet all arequirements.

2.3 COMPONENTS

- .1 Cold Water Basin:
 - .1 Heavy-gage 304 stainless steel with all edges given a protective coating of zinc-rich compound. Basin will include large area lift out

strainers with perforated openings sized smaller than the water distribution system nozzles and an anti-vortexing device to prevent air entrainment. The strainer and anti-vortexing device will be constructed of the same material as the basin to prevent dissimilar metal corrosion. Provide drain/clean-out connection. Basins constructed of 301 stainless steel are not acceptable.

.2 Casing Panels and Framework:

Thermosetting Hybrid Polymer Coated Steel

.1 Galvanized steel protected by a thermosetting hybrid polymer. The polymer to consist of G-235 (Z700 metric) hot-dip galvanized steel prepared in a four-step (clean, pre-treat, rinse, and dry) process with an electrostatically applied, thermosetting, hybrid polymer fuse-bonded to the substrate during a thermally activated curing stage and monitored by a 23-step quality assurance program. Other coatings must be submitted to the engineer for pre-approval. Approved equals must have undergone testing, resulting in the following results as a minimum:

- .1 When X-scribed to the steel substrate, unit to withstand 6000 hours of 5 percent salt spray per ASTM B117 without blistering, chipping, or loss of adhesion.
- .2 When X-scribed to the steel substrate, unit to withstand 6000 hours of exposure to acidic (pH=4.0) and alkaline (pH=11.0) water solutions at 95 degrees F (35 degrees C) without signs of chemical attack.
- .3 Unit to withstand impact of 160 in-lbs per ASTM D2794 without fracture or delamination of the polymer layer.
- .4 Unit to withstand 6000 hours of ultraviolet radiation equivalent to 120,000 hours of noontime sun exposure without loss of functional properties.
- .5 Unit to withstand 200 thermal shock cycles between minus 32°C and 82°C without loss of adhesion or other deterioration.
- .6 Unit to withstand 6000 hours of exposure to 60 psi (42,184 kg/m²) water jet without signs of wear or erosion.

.3 Fans: Forward curved centrifugal type mounted on steel shaft, with belt drive, bearings with ABMA STD 9 or ABMA STD 11 L-10 life at 40,000 hours, with extended grease fittings.

- .4 Motors and Drives:
 - .1 Motor: Single speed (1800 rpm), totally enclosed fan cooled (TEFC), cooling tower duty, inverter-duty type designed per NEMA Standard MG1, Section IV, Part 31. Motor will be located on a heavy-duty motor base, adjustable by a single threaded bolt-and-nut arrangement.
 - .2 Fan Drive System: Belt Drive designed for minimum 150 percent motor nameplate power. Removable steel screens or panels protect the fan drive and all moving parts.
- .5 Distribution Section: Polyvinyl chloride piping header and branches with non-clog ABS plastic spray nozzles. The branches and spray nozzles will be held in place by snap-in rubber grommets, allowing quick removal of individual nozzles or complete branches for cleaning or flushing.
- .6 Fill: Polyvinyl chloride plastic with flame spread index of 25 or less, when tested in accordance with ASTM E84. The fill will be suitable for use as a working platform and will be provided and performance tested by the cooling tower manufacturer to assure single source responsibility and control of the final product. The fill will be able to withstand a water temperature of 140°F (60.0° C).
- .7 Basin Water Level Control:
 - .1 Electric water level control with NEMA 4 enclosure, solid state controls, LED status light, and stainless steel water level sensing electrodes. Number and position of probes provided to sense the following: high water level, low water level, high water alarm level, low water alarm level, heater safety cutout, and automatic solenoid valve. Include all necessary mounting hardware.

2.4 ACCESSORIES

- .1 Provide oversized rectangular access doors will be provided for easy access to the make-up water assembly and suction strainer for routine maintenance.
- .2 Vibration Switch
 - .1 Provide a mechanical local reset vibration switch. The mechanical vibration cutout switch will be guaranteed to trip at a point so as not to cause damage to the cooling tower. To ensure this, the trip point

will be set in a frequency range of 0 to 3,600 RPM and a trip point of 0.2 to 2.0 g's.

- .2 Provide an electronic remote reset vibration switch with contact for BAS monitoring. Wiring will be by the installing contractor. The electronic vibration cutout switch will be set to trip at a point so as not to cause damage to the cooling tower. To ensure this, the trip point will be set in a frequency range of 2 to 1000 Hertz and a trip point of 0.45 in/sec (0.0114 m/sec).

PART 3 EXECUTION

3.1 INSTALLATION

- .1 Install in accordance with manufacturer's instructions.
- .2 Manufacturer representative to confirm assembly and installation meet all requirements.
- .3 Provide the services of the manufacturer's field representative to supervise rigging, hoisting, and installation, allowing for minimum of one eight-hour day per tower.
- .4 Provide all temporary rigging, platforms, etc. to lift all components in place. Engage and provide structural engineer signoff on lifting plans, temporary support and attachments points to any existing structure.
- .5 Install tower on structural steel beams as instructed by manufacturer.
- .6 Secure to support structure per manufacturer requirements
- .7 Connect condenser water piping to tower. Pitch condenser water supply to tower and condenser water suction away from tower.
- .8 Connect make-up water piping to tower. Pitch to tower.
- .9 Connect overflow and drain to acceptable discharge point as indicated.

3.2 FIELD QUALITY CONTROL

- .1 See Section Quality Requirements, for additional requirements.
- .2 Provide the services of the manufacturer's field representative to inspect tower after installation and submit report prior to start-up, verifying installation is in accordance with specifications and manufacturer's recommendations.

3.3 SYSTEM STARTUP

- .1 Start-up tower in presence of and instruct Owner 's operating personnel.
- .2 Provide start-up report

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 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:

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- .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 Intent are still applicable.
- .2 Commissioning personnel to be fully aware of and qualified to interpret Design Criteria and Design Intent.

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 Confirm all controls and systems function as intended.
- .2 Correct deficiencies, re-test in presence of Owner until satisfactory performance is obtained.
- .3 Acceptance of tests will not relieve Contractor from responsibility for ensuring that complete systems meet every requirement of Contract.
- .4 Perform tests as required.

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 Debug system software.

- .3 Optimize operation and performance of systems by fine-tuning PID values and modifying CDLs as required.
- .4 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:

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- .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.

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- .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.

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 4 hour program at time mutually agreeable to Contractor and Owner.
 - .1 Train O&M personnel in functional operations and procedures to be employed for system operation.
 - .2 Include overview of system architecture, communications, operation of computer and peripherals, report generation.
 - .3 Include detailed training on operator interface functions for control of mechanical systems, CDL's for each system, and elementary preventive maintenance.
 - .4 Identification of Control Components.
 - .5 Detailed discussion of sequences of operation
 - .6 Walk through of mechanical systems.

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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 09 91 23 - Interior Painting.
- .6 Section 25 01 11 - EMCS: Start-up, Verification and Commissioning.
- .7 Section 25 01 12 - EMCS: Training.
- .8 Section 25 05 02 - EMCS: Submittals and Review Process.
- .9 Section 25 05 03 - EMCS: Project Record Documents.
- .10 Section 25 05 54 - EMCS: Identification.
- .11 Section 25 05 60 - EMCS: Field Installation.

- .12 Section 25 08 20 - EMCS: Warranty and Maintenance.
- .13 Section 25 10 01 - EMCS: Local Area Network (LAN).
- .14 Section 25 10 02 - EMCS: Operator Work Station (OWS).
- .15 Section 25 30 01 - EMCS: Building Controllers
- .16 Section 25 30 02 - EMCS: Field Control Devices.
- .17 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-definitions).
 - .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 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.
- .2 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.
- .3 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.
- .4 Submit written request for permission to disconnect controls and to obtain equipment downtime before proceeding with Work.
- .5 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.
- .6 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 Honeywell EBI
- .2 Proposed system to have communication capability utilizing BACnet Protocol.
- .3 Panel to be NEMA rated to suit environmental requirements.
- .4 Panels to have hinged doors equipped with standard keyed-alike cabinet locks, keyed to same key.
- .5 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.
- .6 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.
- .7 All control panels to be provided with an internally mounted 120 volt duplex power receptacle.
- .8 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.
- .9 Provide low voltage transformers in panels or elsewhere as required.
- .10 Provide adaptors between metric and imperial components.
- .11 Provide new control panels as needed to accommodate the new points.
- .12 Update all graphics to include new points and overall system arrangement.
- .13 Upgrade any existing EBI systems needed to accommodate the work under this project.

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, cooling 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. Point naming to be per MUN

requirements.

- .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. - Orange
- .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 Pneumatic:
 - .1 Pneumatic tubing, valves and fittings for field control devices.
- .3 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.

- .4 VAV Terminal Units.
 - .1 Air flow probe for VAV boxes to be supplied and installed under Mechanical Division. Air flow dp sensor, actuator and associated VAV controls to be supplied and installed by EMCS contractor. Tubing from air probe to dp sensor as well as installation and adjustment of air flow sensors and actuators to be the responsibility of EMCS contractor. Coordinate air flow adjustments with balancing trade.
- .5 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 SPECIAL SUPPORTS

- .1 Structural grade steel, primed and painted after construction and before installation.

2.2 PIPING FOR PNEUMATIC CONTROL SYSTEMS

- .1 Copper:

- .1 Tubing: Type L Hard Drawn
 - .1 Fittings: wrought copper solder type to ANSI/ASME B16.22, and 95.5 antimonial tin solder. At instruments use compression fittings.
 - .2 At panels and junction boxes where there is a transition from plastic to copper use bulkhead fittings.
- .2 Plastic:
 - .1 Flame retardant, black PVC with minimum burst strength 1.3 MPa at 23EC installed in conduit.
 - .2 Fittings: compression or barbed type as required.

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 SUPPORTS

- .1 Install special supports as required and as indicated.

3.3 PNEUMATIC CONTROL SYSTEMS

- .1 General:
 - .1 Install tubing in accessible concealed locations, straight, parallel and close to building structure with required grades for drainage and venting.
 - .2 Install drip legs and drains at low points.
 - .3 Tubing to be free from surface damage.
 - .4 Tubing NOT to pass through or touch unheated ducts or enclosures.

- .5 Do not cover pneumatic tubing with insulation.
- .6 Test tubing, check joints after connection to system.
- .2 Copper tubing:
 - .1 Not to come into contact with dissimilar metal. Use non-metallic stand-offs on air handling systems.
 - .2 Install dielectric couplings where dissimilar metals are connected.
 - .3 Plastic tubing:
 - .1 Inaccessible locations: install plastic tubing in conduit.
 - .2 Inside panels: install in tube trays or racks, or clip individually to back of panel.
 - .3 Multiple tube bundles: install in tube trays, conduit or armoured flexible cable.

3.4 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.

3.5 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.

3.6 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.

3.7 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.

3.8 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.

3.9 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.

3.10 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.

3.11 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.

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- .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.

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- .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.

PART 2 **PRODUCTS (NOT USED)**

PART 3 **EXECUTION**

3.1 **FIELD QUALITY CONTROL**

- .1 Perform one minor inspections during first year of operation. 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.

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- .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 Rectify deficiencies revealed by maintenance inspections and environmental checks.
- .6 Continue system debugging and optimization.

END OF SECTION

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Section 25 10 01- EMCS: Local Area Network (LAN)

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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

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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 Ethernet IP 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 100 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

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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.

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- .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.

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- .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.

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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 Thermistors 10 K ohm, $\pm 0.2^{\circ}$ 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/ohmEC.
 - .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.

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- .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 1/2 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 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.

2.5 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.

2.6 FAN SYSTEM STATIC PRESSURE SENSORS

.1 As per 2.10

2.7 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: $\pm 1\%$ 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 $\frac{1}{2}$ conduit connection. The enclosure shall be an integral part of the unit.
- .7 Pressure ranges: see I/O Summaries.
- .8 LCD Display.

2.8 TURBINE FLOW METERS

.1 Requirements:

- .1 Flow range: as specified in I/O summaries.
- .2 Pressure rating: 1035 kPa (gauge) at 38 °C.
- .3 Temperature rating: 5 to 260 °C.
- .4 Repeatability: plus or minus 0.1 %.
- .5 Accuracy and linearity: plus or minus 0.5 %.
- .6 Flow rangability: at least 10:1.
- .7 Output voltage: 30 to 300 mV peak-to-peak into 10 Kohm load.
- .8 Body material: brass, bronze or cast iron.
- .9 Ends:
 - .1 NPS 2 and under: screwed or flanged
 - .2 NPS 2 1/2 and over: flanged.

2.9 FREQUENCY-TO-DC TRANSMITTERS FOR TURBINE METERS

.1 Requirements:

- .1 Input: greater than 5000 ohm.
 - .1 Range: greater than 100 mV less than 20 V peak-to-peak, 200 through 400 Hz.
- .2 Span adjustment: fully adjustable.
- .3 Zero adjustment: 0 to 10% of output.
- .4 Output: 4 to 20 mA into 500 ohm load.

- .5 Load effect: plus or minus 0.1 % of span zero to maximum load resistance.
- .6 Linearity and repeatability: plus or minus 0.05 % of span.
- .7 Power input: 24 V DC plus or minus 10 %.
- .8 Input, output and power input transformer isolated.
- .9 Enclosure: general purpose CSA 1.

2.10 CURRENT/PNEUMATIC (I/P) TRANSDUCERS

- .1 Requirements:
 - .1 Input range: 4 to 20 mA.
 - .2 Output range: proportional 20-104 kPa.
 - .3 Housing: dustproof or panel mounted.
 - .4 Internal materials: suitable for continuous contact with industrial standard instrument air.
 - .5 Combined non-linearity, repeatability, hysteresis effects: not to exceed plus or minus 2 % of full scale over entire range.
 - .6 Integral zero and span adjustment.
 - .7 Temperature effect: plus or minus 2.0 % full scale/ 50 °C or less.
 - .8 Regulated supply pressure: 206 kPa maximum.
 - .9 Air consumption: 16.5 ml/s maximum.
 - .10 Integral gauge manifold c/w gauge (0-206 kPa).

2.11 SOLENOID CONTROL AIR VALVES

- .1 Coil: 120V AC or 24V DC, as indicated.
- .2 Complete with manual over-ride.
- .3 Shall have the capacity to pass 0.07 l/s air at 104 kPa differential.

2.12 AIR PRESSURE GAUGES

- .1 Diameter: 38 mm minimum.
- .2 Range: zero to two times operating pressure of measured pressure media to nearest standard range.

2.13 ELECTRICAL RELAYS

- .1 Requirements:
 - .1 Double voltage, DPDT, plug-in type with termination base.

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- .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

2.14 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.

2.15 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.

2.16 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.

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- .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.

2.17 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.

2.18 CONTROL AIR COMPRESSOR STATIONS

- .1 Requirements: Provide 2 high pressure, compressors, receiver mounted, base mounted, each complete with belts, guards, intake muffler, replaceable cartridge intake cleaner, starter, pressure switches, alternator.
- .2 Capacity: size to maintain air pressure, meet all control air requirements on 25 % maximum running time.
- .3 Receiver: size to suit running time. Complete with automatic drain, pressure relief valve, pressure gauge ASME code rated for 1400 kPa.
- .4 Vibration isolation: 5 % transmissibility.
- .5 Refrigerated air drier:
 - .1 2 continuous operating type, complete with refrigerant evaporator, mechanical condensate separator, installed with 2 isolating valves. Designed for 1400 kPa maximum operating pressure.

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- .2 Capacity: sized for full capacity of air compressors, to reduce dewpoint to minus 10°C when dehydrating at 700 kPa. Maximum pressure drop 19 kPa at rated capacity.
- .3 Provide 2 filter and PRV assemblies, with isolating valves and filter element, having 99% efficiency in removal of 0.5 micron diameter solid particles and oil aerosols and with indication of degree of saturation. Piping to be such that one dryer is always in circuit and active.

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.

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- .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 I/P TRANSDUCERS

- .1 Install air pressure gauge on outlet.

3.6 PRESSURE GAUGES

- .1 Install on pneumatic systems only.
- .2 Install pressure gauges on pneumatic devices, I/P, pilot positioners, motor operators, switches, relays, valves, damper operators, valve actuators.
- .3 Install pressure gauge on output of controller and auxiliary cabinet pneumatic devices.

3.7 AIR PRESSURE GAUGES

- .1 Install on pneumatic systems only.
- .2 Install on pneumatic devices including I/P's, pilot positioners, motor operators.

3.8 IDENTIFICATION

- .1 Identify field devices properly.
- .2 Refer to Section 25 05 54 - EMCS: Identification.

3.9 AIR FLOW MEASURING STATIONS

- .1 Cap manifold until cleaning of ducts is completed.

3.10 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.

3.11 COMMISSIONING

- .1 Refer to Section 25 08 20 - EMCS: Warranty and Maintenance.

END OF SECTION

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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:

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- .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

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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

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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)

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Examples of specific space conditions:

RM-TNPER 2	Space temperature, North Perimeter, 2 nd 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:

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- .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 3 words.
 - .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.

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- .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.

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- .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.	Point	Descrip	Type	Eng.	Access	Sensor	Assoc	Type	DI/D0	Limits
No	Label			Unit	Level	type	Point	(M,CR)	NO/NC	

MESSAGES								DI/DO		
12	13	14	15	16	17	18	19	20	21	22
Alar	Maint	Set-	Dead	Dev.	NO/NC	Cont's	Dela	Heavy	Auto	Pro
Limit		Point	band	alar	DA/RA	NO/NC	y succ.	Motor	rese	g
		MO/MA	start	m delay					t	

1.4 CONTROL NARRATIVE SEQUENCE OF OPERATIONS

- .1 Cooling Tower(2 such)
 - .1 Update all graphics to include new points and provide piping diagram to match flow arrangement.
 - .2 Cooling tower shall shut down on any high vibration alarm. Chiller and associated pumps shall also shut down.
- .2 Alarms:
 - .1 High Cooling tower water leaving temperature(>40°C)
 - .2 Low flow to chiller(Below 70% of normal flow)
 - .3 High chiller leaving condenser water temperature(>40°C)
 - .4 Low cooling tower basin level

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- .5 High cooling tower basin level
- .6 Cooling tower vibration

1.5 INPUT/OUTPUT POINT SUMMARY TABLE

- .1 Provide input/output table that summarizes the Input/Output (I/O) points for the various systems as outlined within the EMCS specifications and control schematic drawings. The tables shall be all inclusive. The number and location of these devices can be found on the floor plans and/or listed in relevant schedules. All points and field devices required to accomplish the specified sequence of operation shall be provided. Any discrepancies between the specs and drawings shall be reported to the Owner.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

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APRIL 23, 2026

ISSUED FOR TENDER

- LIST OF MECHANICAL DRAWINGS:
- M-1.1 MECHANICAL PENTHOUSE PLAN HVAC MODIFICATIONS
 - M-1.2 MECHANICAL CONTROLS LAYOUT AND LEGEND
 - M-1.3 MECHANICAL SCHEMATIC AND DETAILS
- LIST OF ELECTRICAL DRAWINGS:
- E-0.1 ELECTRICAL LEGEND, SPECIFICATION AND DETAILS
 - E-1.1 LEVEL 6 MECHANICAL PENTHOUSE PLAN - ELECTRICAL

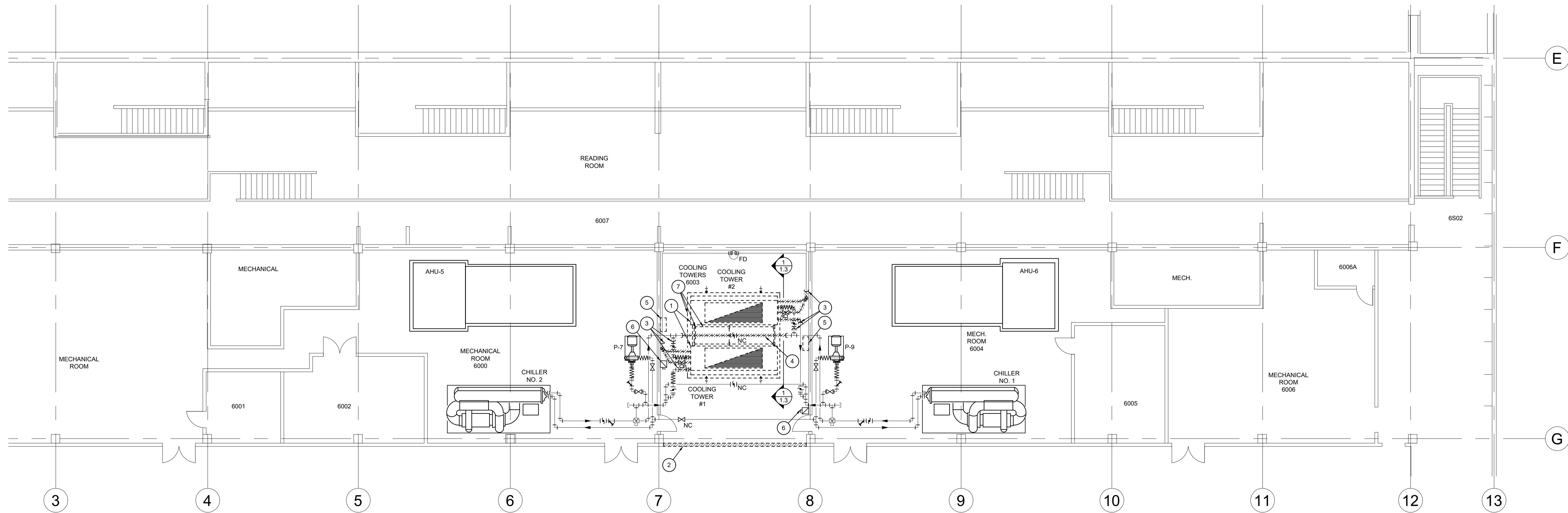
ISSUED FOR TENDER

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.*

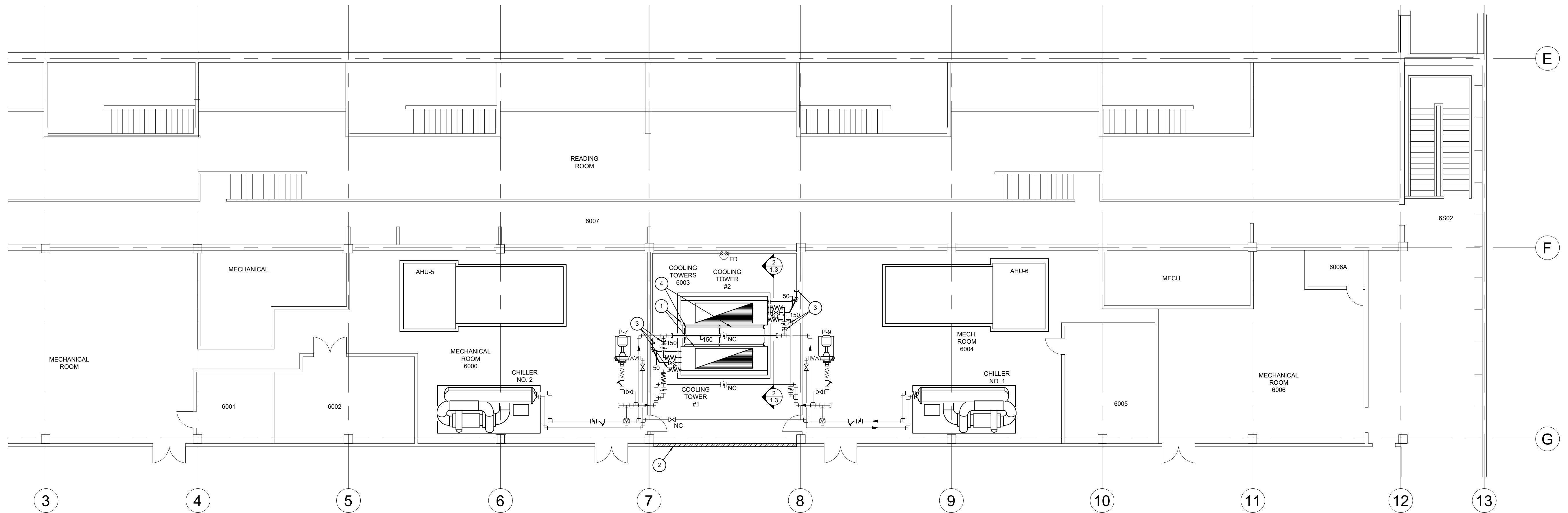
- Dedication plaque, Arts & Administration Building, St. John's Campus





LEVEL 6 (PENTHOUSE) FLOOR PLAN - DEMOLITION

SCALE : 1:100
0m 1m 2m 3m 4m 5m 6m 7m 8m 9m 10m



LEVEL 6 (PENTHOUSE) FLOOR PLAN - NEW LAYOUT

SCALE : 1:100
0m 1m 2m 3m 4m 5m 6m 7m 8m 9m 10m

GENERAL NOTES:

- CONTRACTOR TO CONFIRM EXACT SYSTEM LAYOUT ON SITE BEFORE COMMENCING ANY DEMOLITION. ALL EXISTING SYSTEMS OUTSIDE THIS AREA OF WORK SHALL REMAIN FULLY OPERATIONAL. PROVIDE TEMPORARY PIPING AS NEEDED TO MAINTAIN SYSTEMS OPERATIONS AND COORDINATE WITH OWNER.
- CONTRACTOR TO COORDINATE ALL DEMOLITION WORK WITH OWNER. SHUT DOWN TIME TO BE COORDINATED WITH OWNER AND TO BE KEPT TO A MINIMUM.
- CONTRACTOR TO PROVIDE ALL REQUIRED TEMPORARY RIGGING TO INSTALL COOLING TOWER SECTIONS IN PLACE.
- EXISTING BUILDING TO REMAIN OPERATIONAL DURING CONSTRUCTION. COORDINATE ANY REQUIRED MECHANICAL SYSTEM SHUT-DOWN WITH OWNER REPRESENTATIVE 48HRS PRIOR TO START OF WORK.
- REPORT ANY DISCREPANCIES TO ENGINEER PRIOR TO PROCEEDING.

DRAWING NOTES (DEMOLITION):

- EXISTING COOLING TOWERS 1 AND 2 TO BE REMOVED. ALL PIPING CONNECTIONS/UNIONS TO BE REMOVED. CAP PIPING FOR CONNECTION TO NEW UNITS.
- EXISTING FRESH AIR INTAKE SCREEN TO BE REMOVED TO FACILITATE REMOVAL OF DEMOLISHED EQUIPMENT AND INSTALLATION OF NEW COOLING TOWERS.
- EXISTING CONNECTING PIPING AND ASSOCIATED VALVES AND DEVICES TO BE REMOVED. CAP PIPING AT APPROXIMATE LOCATIONS FOR RECONNECTION IN NEW LAYOUT.
- EXISTING SECTION OF PIPING TO BE REMOVED TO FACILITATE REMOVAL OF EXISTING COOLING TOWERS AND REINSTALLED FOR INCLUSION IN NEW LAYOUT.
- EXISTING LEVEL CONTROLLER TO BE REMOVED.
- EXISTING COOLING TOWER DISCONNECT SWITCH TO REMAIN.
- EXISTING WELDED STEEL COOLING TOWERS MAINTENANCE SUPPORT PLATFORM, FRAME AND LADDER BETWEEN UNITS TO BE REMOVED AND RETAINED FOR REINSTALLATION.

GENERAL NOTES:

- CONTRACTOR TO CONFIRM EXACT SYSTEM LAYOUT ON SITE BEFORE COMMENCING ANY DEMOLITION. ALL EXISTING SYSTEMS OUTSIDE THIS AREA OF WORK SHALL REMAIN FULLY OPERATIONAL. PROVIDE TEMPORARY PIPING AS NEEDED TO MAINTAIN SYSTEMS OPERATIONS AND COORDINATE WITH OWNER.
- CONTRACTOR TO COORDINATE ALL DEMOLITION WORK WITH OWNER. SHUT DOWN TIME TO BE COORDINATED WITH OWNER AND TO BE KEPT TO A MINIMUM.
- CONTRACTOR TO PROVIDE ALL REQUIRED TEMPORARY RIGGING TO INSTALL COOLING TOWER SECTIONS IN PLACE.
- EXISTING BUILDING TO REMAIN OPERATIONAL DURING CONSTRUCTION. COORDINATE ANY REQUIRED MECHANICAL SYSTEM SHUT-DOWN WITH OWNER REPRESENTATIVE 48HRS PRIOR TO START OF WORK.
- REPORT ANY DISCREPANCIES TO ENGINEER PRIOR TO PROCEEDING.
- PAIN ALL EXISTING AND NEW PIPING IN COOLING TOWER SPACE. COLOR TO MATCH EXISTING.

DRAWING NOTES (NEW LAYOUT):

- NEW COOLING TOWERS 1 AND 2. RECONNECT ALL PIPING CONNECTIONS/UNIONS. PROVIDE ALL FITTINGS AND ADAPTERS AS REQUIRED.
- EXISTING FRESH AIR INTAKE SCREEN TO BE REINSTALLED AFTER NEW COOLING TOWERS ARE POSITIONED.
- CONNECT NEW CONNECTING BRANCH PIPING TO EXISTING CAPPED CONNECTIONS. PROVIDE ALL VALVES AND DEVICES INDICATED. SEE DEMOLITION LAYOUT AND SCHEMATIC.
- REINSTALL REMOVED SUPPORT PLATFORM, FRAME AND LADDER. CLEAN, REMOVE RUST, AND PAINT.

No.	REVISION	DATE (YYMMDD)
0	ISSUED FOR TENDER	2026.04.23

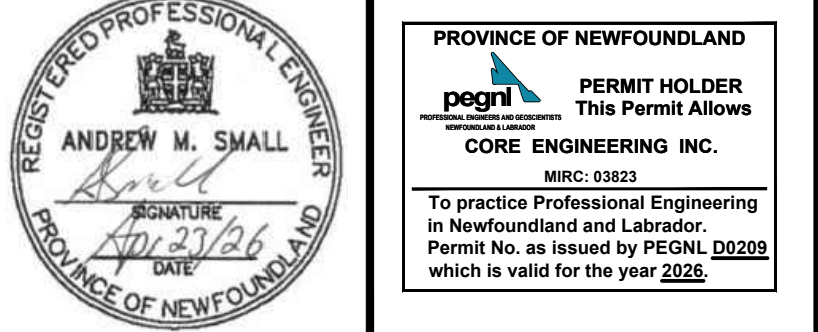
GENERAL NOTES

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- THE CONTRACTOR IS TO VERIFY ALL DIMENSIONS AND SITE CONDITIONS PRIOR TO SUBMISSION OF TENDERS.
- 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.

CONSULTANT:



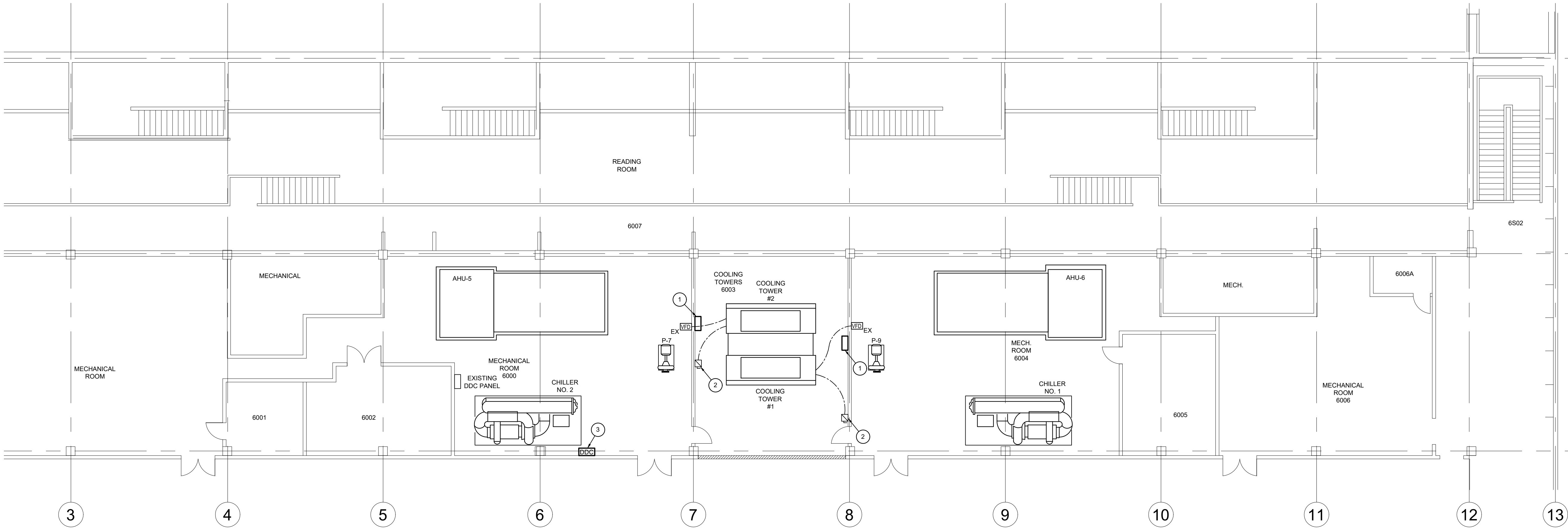
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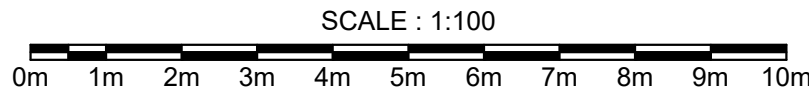
PROJECT NAME:
**MUN
QEII LIBRARY
COOLING TOWER REPLACEMENT**

DRAWING TITLE:
**Mechanical
Penthouse Plan
HVAC Modifications**

DESIGNED: A.S	DRAWN: D.B
REVIEWED: A.S	APPROVED: A.S
SCALE: AS NOTED	DATE: 26.03.26
MUN PROJECT No. L-503-25	DRAWING No. M-1.1



LEVEL 6 (PENTHOUSE) FLOOR PLAN - NEW CONTROLS LAYOUT



- GENERAL NOTES:**
- ALL CONNECTIONS TO THERMOSTATS OR OTHER DEVICES IS SYMBOLIC ONLY. REFER TO CONTROLS SCHEMATICS.
 - COORDINATE THE NUMBER OF & EXACT LOCATION OF UNIT HEATERS & BASEBOARDS WITH THE ELECTRICAL TRADE. PROVIDE ADDITIONAL THERMOSTATS & WIRING, AS REQUIRED.
 - CONFIRM LOCATION OF ALL STARTERS, AND THERMOSTATS WITH OWNER PRIOR TO ROUGH IN TO AVOID CONFLICT WITH ANY EQUIPMENT, SHELVING, STORAGE, ETC.

- DRAWING NOTES:**
- NEW LEVEL CONTROLLER. COORDINATE EXACT LOCATION ON SITE.
 - EXISTING DISCONNECT SWITCH.
 - NEW DDC PANEL. COORDINATE EXACT LOCATION ON SITE.

MECHANICAL LEGEND

- PLUMBING / PIPING**
- DENOTES EXISTING PIPING TO BE REMOVED
 - CTS --- COOLING TOWER WATER SUPPLY PIPING
 - CTR --- COOLING TOWER WATER RETURN PIPING
 - CWS --- CHILLED WATER SUPPLY PIPING
 - CWR --- CHILLED WATER RETURN PIPING
 - FD FLOOR DRAIN (EXISTING)
- FITTINGS/VALVES**
- 3-WAY VALVE
 - BUTTERFLY VALVE
 - VALVE (NORMALLY CLOSED)
 - GATE VALVE
 - CHECK VALVE
 - ELBOW UP AND DOWN
 - 90° TEE AND 45° BEND OR LATERAL
 - UNION SCREWED OR FLANGED
 - "Y" - STRAINER
 - BALL VALVE
 - FLEXIBLE CONNECTION
 - THERMOSTAT

No.	REVISION	DATE (YY/MM/DD)
0	ISSUED FOR TENDER	2026.04.23

GENERAL NOTES

1.

DO NOT SCALE FROM DRAWINGS.

2.

THE CONTRACTOR IS TO VERIFY ALL DIMENSIONS AND SITE CONDITIONS PRIOR TO SUBMISSION OF TENDERS.

3.

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:

CONSULTANT:

COREENGINEERING INC.

A MEMBER OF

BPA

STAMP:

REGISTERED PROFESSIONAL ENGINEER

ANDREW M. SMALL

SIGNATURE

2026.04.23

DATE

PROVINCE OF NEWFOUNDLAND

PERMIT:

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 PEONL: D2020

which is valid for the year 2026

MEMORIALUNIVERSITY

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:

MUN

QEII LIBRARY

COOLING TOWER REPLACEMENT

DRAWING TITLE:

Mechanical

Controls Layout and Legend

DESIGNED:

A.S

DRAWN:

D.B

REVIEWED:

A.S

APPROVED:

A.S

SCALE:

AS NOTED

DATE:

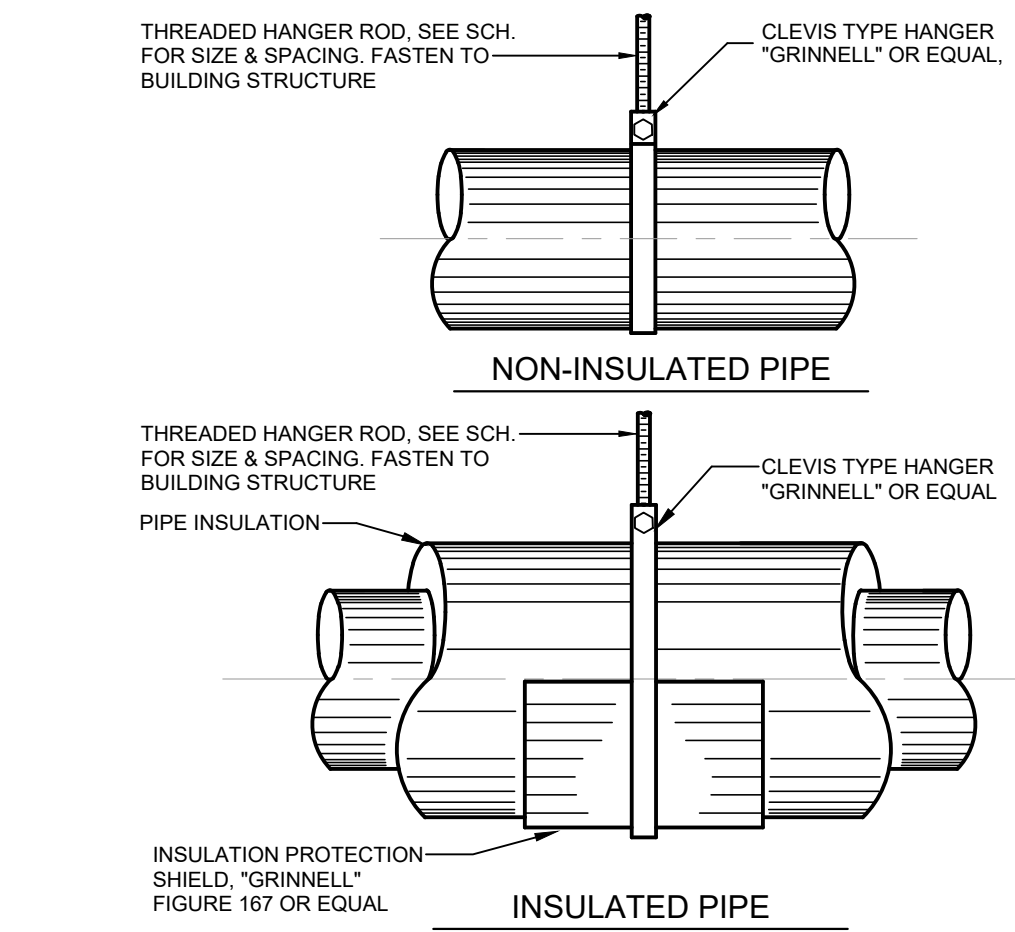
26.03.26

MUN PROJECT No.

L-503-25

DRAWING No.

M-1.2



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 SCH.											
PIPE SIZE (mm)	25	32	40	50	65	75	100	125	150	200	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	7.0

NOTE: FOR TRAPEZE HANGER, TAKE SPACING FOR SMALLEST DIAMETER PIPE

TYP. PIPE HANGER DETAIL

SCALE: N.T.S.

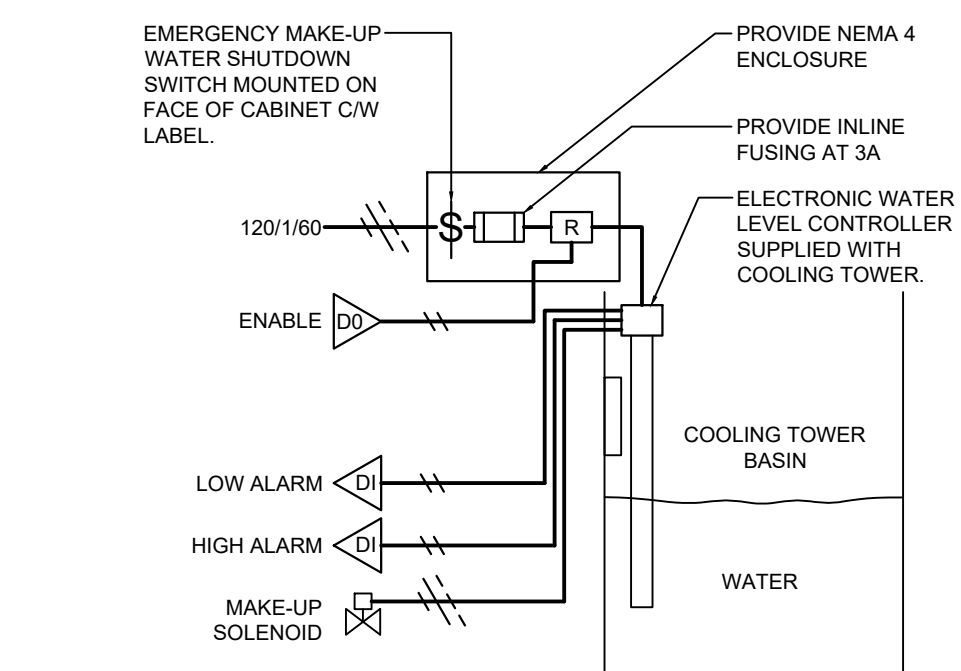
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1.2

CONTROL LEGEND

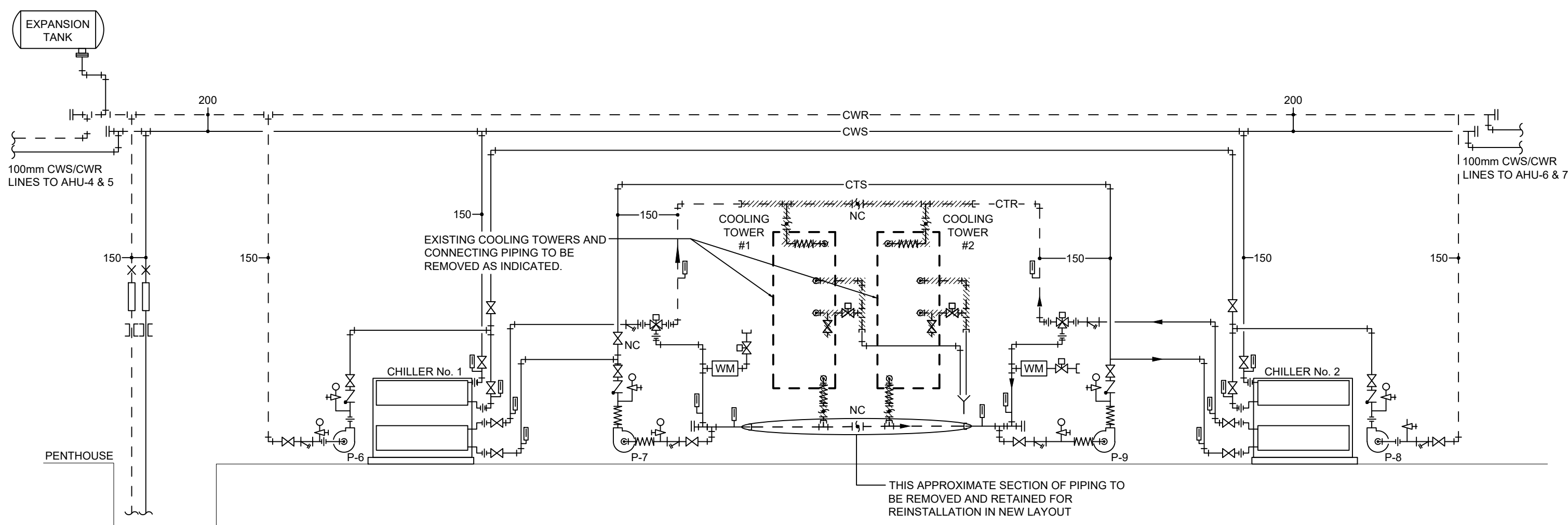
TS	TEMPERATURE SENSOR DUCT MOUNTED/PIPE MOUNTED. PROVIDE IMMERSION WELL FOR PIPE MOUNTED APPLICATION. PROVIDE CORRECT LENGTH ELEMENT FOR AVERAGING (AVG) APPLICATION.
VFD	EXISTING VARIABLE FREQUENCY DRIVE
DDC	NEW DDC PANEL
EX	EXISTING DISCONNECT SWITCH
DISC	NON-FUSED DISC. SWITCH BY ELECTRICAL TRADE UNLESS OTHERWISE NOTED.
EX	EXISTING MAGNETIC STARTER
FM	ANALOG PADDLE TYPE FLOW METER WITH STAINLESS STEEL WETTED PARTS, RATED PRESSURE, +/- 1% ACCURACY OVER RANGE, 0-30L/S RANGE, PULSE OUTPUT, 24VAC POWER SUPPLY, EQUAL TO "BADGER" SDI SERIES
WM	EXISTING WATER FLOW METER C/W PULSE OUTPUT TO DDC
VS	VIBRATION SWITCH SUPPLIED WITH COOLING TOWER
SH	SHIELDED WIRE - PROVIDE SHIELDED WIRE WHERE SHOWN AND WHERE NECESSARY
W	INDICATES # OF WIRES - CONTRACTOR TO VERIFY AND INCLUDE ADEQUATE WIRING IN PRICING TO SUIT DEVICE/APPLICATION
R	RELAY SIZED TO SUIT LOAD, 24 VAC COIL, 120V CONTACTS.
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:
- ALL CONTROL DEVICES AND ASSOCIATED LOW VOLTAGE WIRING SHALL BE SUPPLIED AND INSTALLED BY THE MECHANICAL TRADE UNLESS OTHERWISE NOTED.
 - MAIN DDC CONTROLLER TO BE MOUNTED IN NEMA1 ENCLOSURE OF SIZE TO SUIT.
 - PROVIDE LAMECOD LABELS FOR ALL EQUIPMENT.
 - ALL EXISTING CONTROL SYSTEM IS HONEYWELL EBI CONTROLS. PROVIDE ALL SOFTWARE & HARDWARE AS REQUIRED TO CONNECT TO EXISTING CONTROLS. UPGRADE ALL GRAPHICS TO INCLUDE NEW CONTROLS.



MAKE-UP WATER CONTROL DETAIL (2 SUCH)

SCALE: N.T.S.

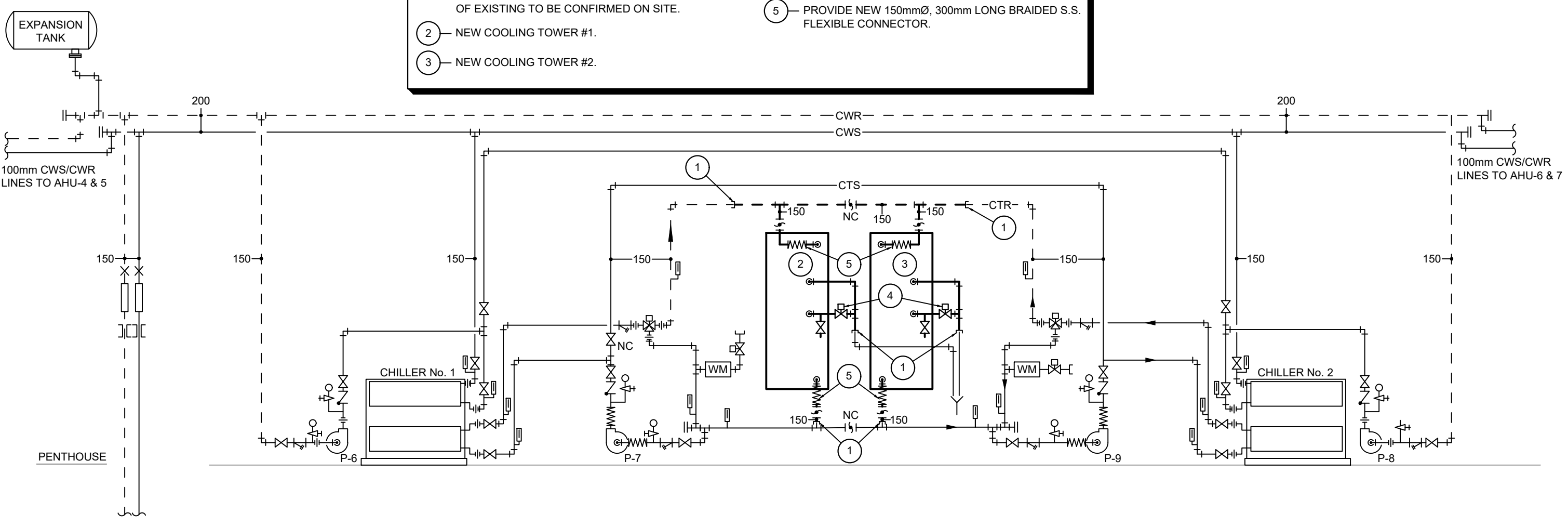


CHILLED / CONDENSING WATER SCHEMATIC - DEMOLITION

SCALE: N.T.S.

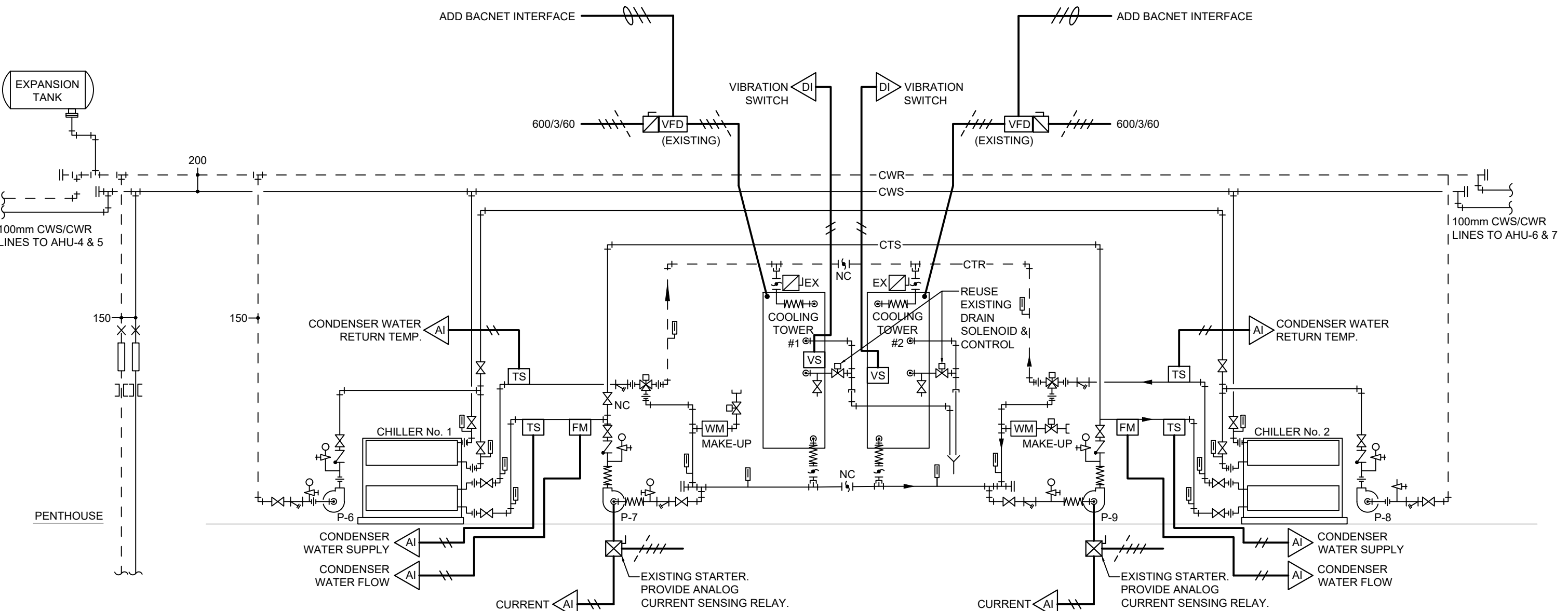
DRAWING NOTES:

- CONNECT NEW PIPING TO EXISTING AT THIS APPROXIMATE LOCATION. EXACT LOCATION AND SIZES OF EXISTING TO BE CONFIRMED ON SITE.
- NEW COOLING TOWER #1.
- NEW COOLING TOWER #2.
- NEW DRAIN SOLENOID.
- PROVIDE NEW 150mmØ, 300mm LONG BRAIDED S.S. FLEXIBLE CONNECTOR.



CHILLED / CONDENSING WATER SCHEMATIC - NEW LAYOUT

SCALE: N.T.S.



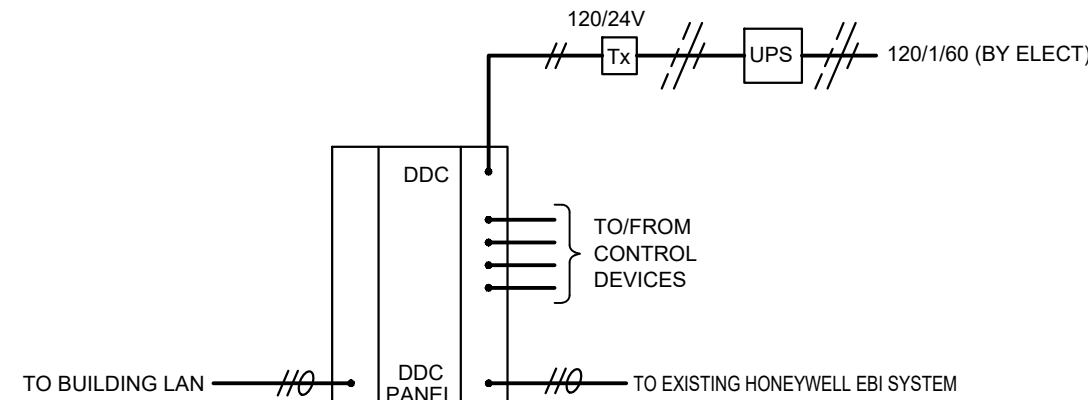
CHILLED / CONDENSING WATER SCHEMATIC - NEW WORK - CONTROLS

SCALE: N.T.S.

- NOTES:
- PROVIDE CONTROL TRANSFORMERS, RELAYS AS REQ'D FOR ALL CONTROL DEVICES.
 - LOCATE PANELS, TRANSFORMERS, RELAYS, ETC IN NEMA1 ENCLOSURES.
 - ALL COMMUNICATION NETWORKS SHALL BE SEPARATED BY SPEED AND COMMUNICATION PROTOCOLS. PROVIDE SWITCHES, GATEWAYS, AND CONTROLLERS TO CONNECT.

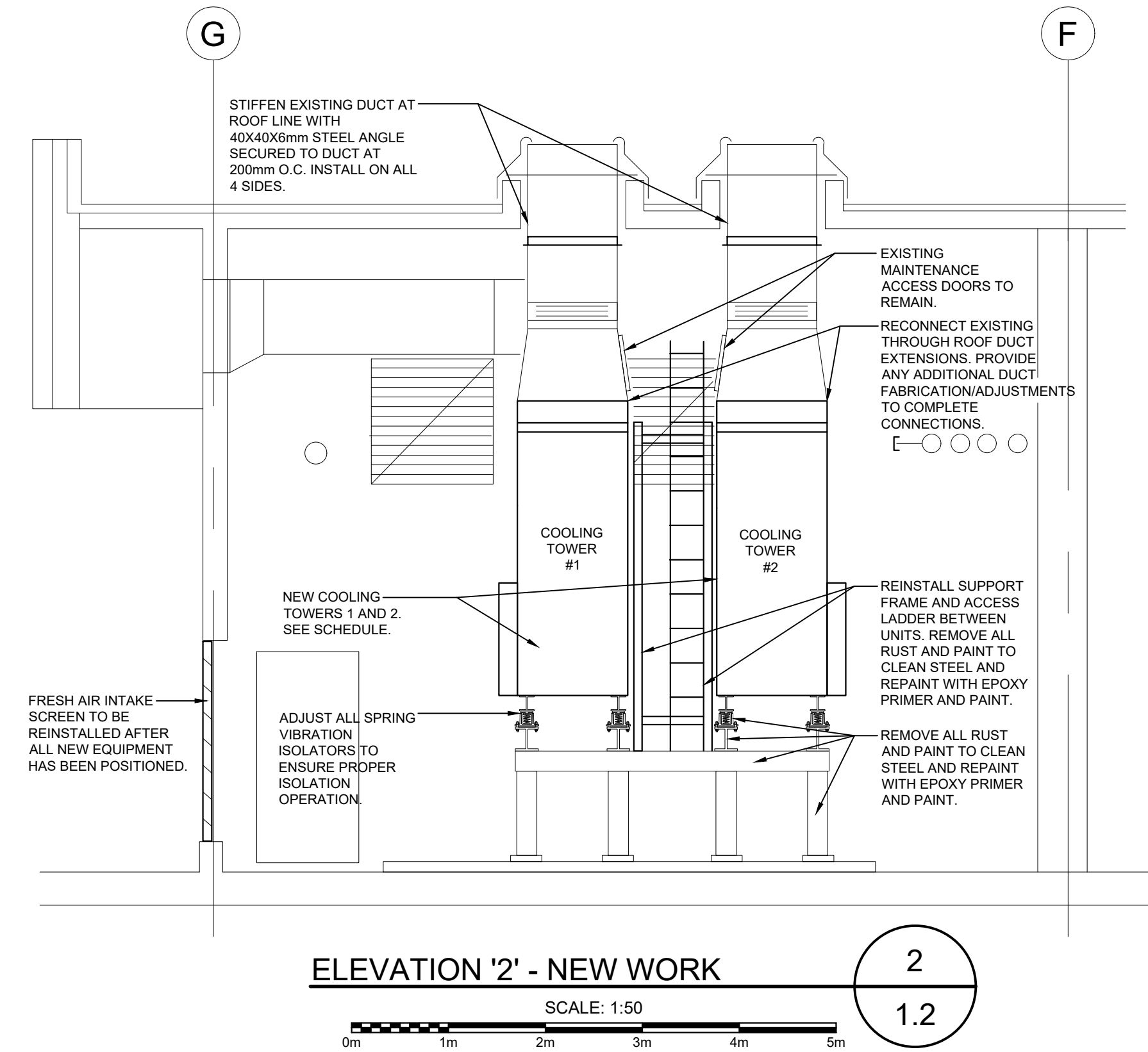
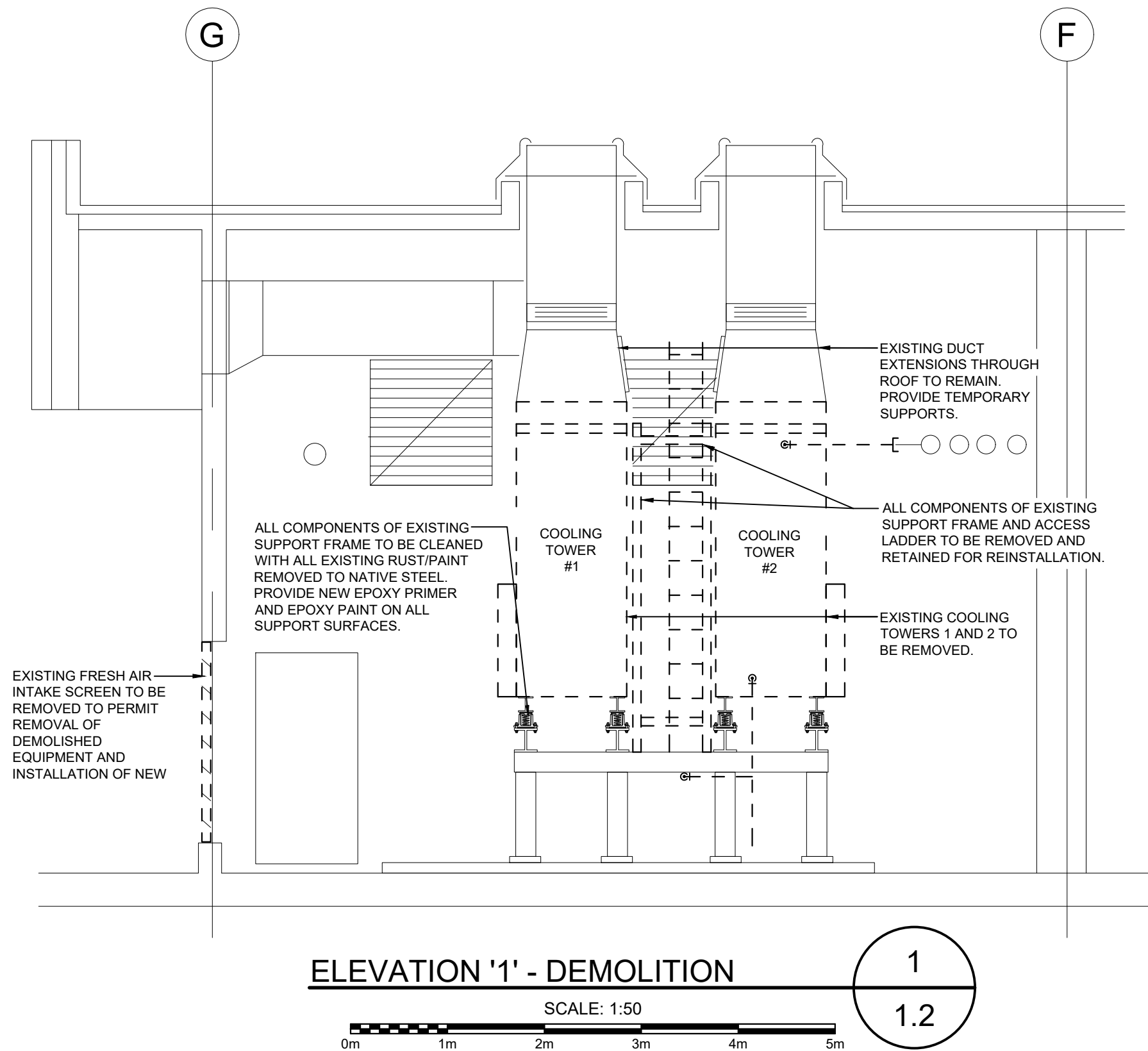
DDC SYSTEM ARCHITECTURE

SCALE: N.T.S.



COOLING TOWER													
SYMBOL	MANUFACTURER	MODEL	TYPE	NET COOLING CAPACITY (kW)	ENT. FLUID TEMP (°C)	LVG. FLUID TEMP (°C)	FLUID	FLUID FLOW (L/s)	FLUID PD (kPa)	WET BULB TEMP (°C)	AIRFLOW (L/s)	UNIT WEIGHT (kg)	REMARKS
CT-1 / CT-2	BALTIMORE AIR COIL	VTO-116	OPEN	700	34.7	28.1	WATER	25.2	21	21	-	1400	

NOTES: 1. CW 304 STAINLESS BASIN, G236 POLYMER COATED GALVANIZED CASING, ELECTRONIC WATER LEVEL CONTROL, OVERSIZED RECTANGULAR ACCESS DOORS, BAS CONNECTED VIBRATION SWITCH
2. FLUID FRICTION IS SPRAY NOZZLE ONLY
3. CONTRACTOR TO CONFIRM ALL DIMENSIONS/CONNECTIONS AND SUPPORT REQUIREMENTS MATCH EXISTING COOLING TOWER (CONTRACTOR TO ADJUST STEEL FRAME TO ACCOMMODATE AS NEEDED)



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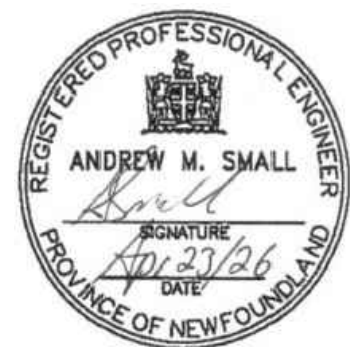
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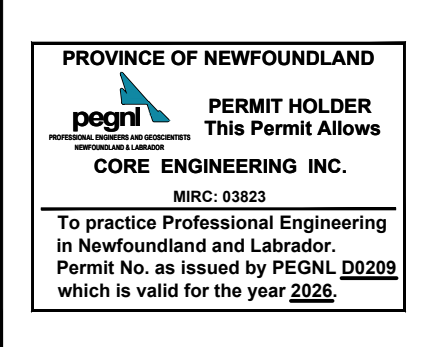
CONSULTANT:



STAMP:



PERMIT:



Department of Facilities Management

This University was named 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:

**MUN
QEII LIBRARY
COOLING TOWER REPLACEMENT**

DRAWING TITLE:

**Mechanical
Schematic and Details**

DESIGNED: A.S.	DRAWN: D.B.
REVIEWED: A.S.	APPROVED: A.S.
SCALE: AS NOTED	DATE: 26.03.26
MUN PROJECT No. L-503-25	DRAWING No. M-1.3

R0

ELECTRICAL SPECIFICATION

1.0 GENERAL:

- 1.1 COMPLETE ELECTRICAL INSTALLATION SHALL CONFORM TO THE CANADIAN ELECTRICAL CODE C22.1-24 AND LOCAL BYLAWS CURRENTLY IN FORCE IN THE PROVINCE AND MUNICIPALITY.
- 1.2 ALL WORK SHALL BE PERFORMED BY PERSONNEL HAVING QUALIFICATIONS AS REQUIRED BY AN AUTHORITY HAVING JURISDICTION WHO ARE COMPETENT IN THEIR TRADE.
- 1.3 BEFORE SUBMITTING A PROPOSAL FOR THE WORK COVERED BY THE SPECIFICATIONS, EACH BIDDER SHALL VISIT AND INSPECT THE SITE OF THE PROPOSED WORK IN ORDER THAT THEY MAY BE THOROUGHLY FAMILIAR WITH THE SITE AND LOCAL CONDITIONS, WITH THE CHARACTER AND DETAIL OF THE BUILDING CONSTRUCTION AND WITH ALL MATTERS WHICH CAN, IN ANY WAY, AFFECT THE WORK COVERED BY THE SPECIFICATIONS. NO CLAIM WILL BE ENTERAINED FOR ANY LABOR, MATERIALS OR OTHER EXTRAS THAT MAY BE REQUIRED FOR THE PROPER EXECUTION AND COMPLETION OF THE CONTRACT WHICH COULD HAVE BEEN DETERMINED BY SITE EXAMINATION.
- 1.4 PAYMENT FOR PERMITS AND DEPOSITS FOR THE WORK SHALL BE INCLUDED IN THE TENDER PRICE.
- 1.5 USE ONLY NEW CSA APPROVED MATERIALS EXCEPT HERE SPECIFICALLY NOTED.
- 1.6 THE CONTRACTOR SHALL GUARANTEE ALL NEW MATERIALS AND WORKMANSHIP FOR A PERIOD OF ONE (1) YEAR FROM DATE OF COMPLETION OF THE WORK AND FINAL ACCEPTANCE BY THE OWNER.
- 1.7 SHOP DRAWINGS SHOWING THE DESIGN AND CONSTRUCTION OF ALL APPARATUS SHALL BE PROVIDED. ELECTRONIC COPIES OF DRAWINGS SHALL BE SUBMITTED FOR EXAMINATION. ALL SHOP DRAWINGS TO INCLUDE ELECTRICAL SUBCONTRACTORS REVIEW STAMP, NAME OF PROJECT AND SIGNATURE INDICATING ITEM HAS BEEN REVIEWED BY ELECTRICAL SUBCONTRACTOR PRIOR TO SUBMISSION. IF CORRECTIONS ARE REQUIRED, COPIES WILL BE RETURNED WITH CORRECTIONS NOTED. INCLUDE SHOP DRAWINGS FOR THE FOLLOWING:
- 1.1 ELECTRICAL DISTRIBUTION EQUIPMENT
- 1.8 PROVIDE "AS-BUILT" DRAWINGS TO INDICATE ACTUAL CIRCUIT NUMBERS TO ALL ELECTRICAL EQUIPMENT SHOWN ON THE DRAWINGS AND ALL EXISTING REMAINING EQUIPMENT.
- 1.9 THIS CONTRACTOR SHALL PROVIDE PROPER PROTECTION FOR ALL EQUIPMENT, FIXTURES, MATERIALS, ETC. DURING THE CONSTRUCTION PERIOD. UPON COMPLETION OF THE WORK ALL PROTECTIVE MATERIALS, DIRT, RUBBISH AND DEBRIS DUE TO THE WORK SHALL BE REMOVED FROM THE SITE.
- 1.10 CONTRACTOR SHALL SUPPLY AND INSTALL ALL MATERIALS EXCEPT AS OTHERWISE SPECIFIED.
- 1.11 IDENTIFY ELECTRICAL EQUIPMENT WITH LAMACOID NAMEPLATES 3mm THICK PLASTIC ENGRAVING SHEET, BLACK FACE, WHITE CORE, MECHANICALLY ATTACHED WITH SELF TAPPING SCREWS. WORDING ON NAMEPLATES AND LABELS TO BE APPROVED BY ENGINEER BEFORE MANUFACTURE.
- 1.12 CSA AND MANUFACTURERS LABELS MUST BE VISIBLE AND LEGIBLE AFTER EQUIPMENT IS INSTALLED.

2.0 COORDINATION:

- 2.1 COORDINATE WORK WITH WORK OF OTHER DIVISIONS TO AVOID CONFLICT.
- 2.2 LOCATE DISTRIBUTION SYSTEMS, EQUIPMENT AND MATERIALS TO PROVIDE MINIMUM INTERFERENCE AND MAXIMUM USABLE SPACE.
- 2.3 WHERE INTERFERENCE OCCURS, OWNER MUST APPROVE RELOCATION OF EQUIPMENT AND MATERIALS REGARDLESS OF INSTALLATION ORDERS.
- 2.4 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 COORDINATION BY THIS DIVISION. THE COST OF THIS RELOCATION SHALL BE THE RESPONSIBILITY OF THIS DIVISION. THE OWNER SHALL DECIDE THE EXTENT OF THE RELOCATION REQUIRED.

3.0 SAFETY:

- 3.1 NO WORK SHALL BE CARRIED OUT ON ANY LIVE EQUIPMENT. DISCONNECT POWER COMPLETELY TO ALL EQUIPMENT BEFORE PROCEEDING WITH WORK ON THAT EQUIPMENT. UTILIZE LOCK-OUTS & TAG-OUTS ON ALL EQUIPMENT WHICH IS BEING WORKED ON.

4.0 FIRE RATING PENETRATIONS:

- 4.1 MAINTAIN FIRE RATING AROUND CONDUITS PASSING THROUGH WALLS AND CEILINGS.
- 4.2 USE 3M BRAND, OR EQUAL, FIRE BARRIER PRODUCTS AT EACH PENETRATION.
- 4.3 STANDARD OF ACCEPTANCE FOR FIRE BARRIER PRODUCTS SHALL BE 3M #CP25 FIRE BARRIER CAULK, #303 PUTTY, #FS195 WRAP AND #CS195 SHEET.

5.0 WIRING METHODS:

- 5.1 FOR GENERAL PURPOSE WIRING USE RW90 COPPER CONDUCTORS IN EMT CONDUIT.
- 5.2 UTILIZE CONCRETE OR MASONRY BOXES AS APPROPRIATE.
- 5.3 USE TYPE TW INSULATED GREEN GROUND/BOND CONDUCTOR IN ALL CONDUITS FOR CIRCUITS OPERATING AT OVER 30 VOLTS.
- 5.4 THE ELECTRICAL WIRING SYSTEM AND VARIOUS ELECTRICAL EQUIPMENT TO BE GROUNDING IN ACCORDANCE WITH THE CANADIAN ELECTRICAL CODE C22.1-24. PROVIDE GROUND WIRE IN ALL CONDUITS.
- 5.5 EXCEPT AS NOTED RUN ALL CONDUIT PARALLEL AND PERPENDICULAR TO BUILDING LINES. SUPPORT ALL CONDUIT USING APPROVED STRAPS AND HANGARS. TIE WIRE IS NOT ACCEPTABLE FOR SUPPORTING CONDUIT.
- 5.6 WIRE AND CABLES TO BE RUN CONCEALED AT ALL TIMES, UNLESS OTHERWISE STATED.
- 5.7 MINIMUM WIRE SIZE: #12 AWG. MINIMUM CONDUIT SIZE: 21mm.
- 5.8 PERFORM SPLICES ON #8 AWG AND SMALLER WIRES USING 3M-SCOTCHLOC OR IDEAL-WIRENUT CONNECTORS.
- 5.9 LUGS, TERMINALS AND SCREWS USED FOR TERMINATION OF WIRING TO BE SUITABLE FOR EITHER COPPER OR ALUMINUM CONDUCTORS.

6.0 OUTLET BOXES:

- 6.1 BOXES ARE TO BE FLUSH MOUNTED.
- 6.2 WHERE DEVICES ARE SHOWN GROUPED, MOUNT BOXES WITH MAXIMUM 50mm SPACING. PROVIDE ADDITIONAL BLOCKING AS REQUIRED.
- 6.3 DO NOT INSTALL OUTLETS BACK TO BACK IN WALL. ALLOW MINIMUM 150mm HORIZONTAL CLEARANCE BETWEEN BOXES.

7.0 DISCONNECT SWITCHES:

- 7.1 HEAVY DUTY DISCONNECT SWITCHES ABLE TO BE PADLOCKED INTO ON OR OFF POSITION WITH 3 LOCKS, LEVER HANDLE.
- 7.2 ENCLOSURE: NEMA 1 FOR INTERIOR, NEMA 3R FOR EXTERIOR.
- 7.3 FUSIBLE OR NON-FUSIBLE AS INDICATED.
- 7.4 IDENTIFICATION AS PER 1.1.1.
- 7.5 MECHANICALLY INTERLOCKED DOOR.

8.0 WORK IN EXISTING AREAS:

- 8.1 THE CONTRACTOR SHALL DISCONNECT AND REMOVE ALL ELECTRICAL COMMUNICATIONS AND FIRE ALARM DEVICES NOT BEING REUSED, AND TURN OVER TO OWNER'S REPRESENTATIVE ON SITE.
- 8.2 IN AREAS WHERE EXISTING DEVICES ARE BEING REMOVED, THE CONTRACTOR SHALL ENSURE THAT A SAFE AND WORKING SYSTEM IS MAINTAINED TO ALL REMAINING DEVICES.
- 8.3 REUSE EXISTING CIRCUITS WHERE POSSIBLE AND PROVIDE NEW AS REQUIRED. WHERE NEW LOADS ARE ADDED TO EXISTING CIRCUITS CONTRACTOR IS TO VERIFY EXISTING CIRCUIT CAPACITY AND REDISTRIBUTE LOADS WHERE LOAD IS >80% OR BREAKER RATING.
- 8.4 THE ELECTRICAL CONTRACTOR SHALL CLEAN AND REFURBISH ALL EXISTING DEVICES THAT ARE TO REMAIN AND/OR BE RELOCATED. EXTEND CONDUIT AND WIRE TO SUIT.
- 8.5 IF ANY CIRCUITS ARE DAMAGED OR INTERRUPTED DURING CONSTRUCTION, CIRCUITS SHALL BE EXTENDED AND RECONNECTED AS REQUIRED TO MAINTAIN EXISTING DEVICES AND EQUIPMENT IN SERVICE.
- 8.6 RELOCATE ALL EXISTING JUNCTION BOXES, CONDUITS, DEVICES, ETC. AS REQUIRED TO ACCOMMODATE DEMOLITION OF EXISTING AND CONSTRUCTION OF NEW WALL & CEILING ASSEMBLIES.

9.0 EXECUTION:

- 9.1 INSTALL MATERIALS IN STRICT ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS.
- 9.2 PROVIDE INSPECTION CERTIFICATE UPON COMPLETION OF THIS WORK.
- 9.3 FIELD QUALITY CONTROL:
1. CONDUCT THE FOLLOWING TESTS:
- 1.1 POWER DISTRIBUTION SYSTEM INCLUDING PHASING, VOLTAGE GROUNDING AND LOAD BALANCE.
- 1.2 CIRCUITS ORIGINATING FROM BRANCH DISTRIBUTION PANELS.
- 1.3 MOTORS AND ASSOCIATED CONTROLS EQUIPMENT. INCLUDE SEQUENCED OPERATION OF SYSTEMS WHERE APPLICABLE.
2. FURNISH MANUFACTURERS CERTIFICATE OR LETTER CONFIRMING THAT THE INSTALLATION, AS IT PERTAINS TO EACH SYSTEM, HAS BEEN INSTALLED TO MANUFACTURERS INSTRUCTIONS.
3. INSTALLATION RESISTANCE TESTING:
- 3.1 MEGGER CIRCUITS, FEEDERS AND EQUIPMENT UP TO 350V WITH 500V INSTRUMENT, UP TO 600V WITH 1000V INSTRUMENT.
- 3.2 CHECK RESISTANCE TO GROUND BEFORE TESTING.
- 3.3 CARRY OUT CHECK IN PRESENCE OF ENGINEER.
- 3.4 PROVIDE INSTRUMENTS, METERS, EQUIPMENT AND PERSONAL REQUIRED TO CONDUCT TESTS.
- 3.5 SUBMIT TEST RESULTS FOR ENGINEER'S REVIEW.

10.0 STANDARD OF ACCEPTANCE:

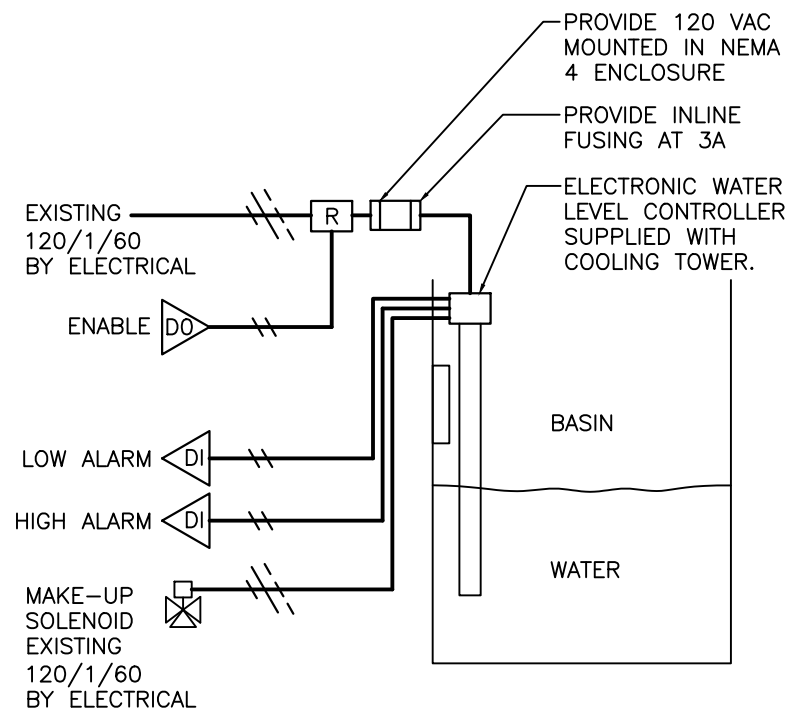
- 10.1 THE ITEMS NAMED MEET IN ALL RESPECT PERFORMANCE, QUALITY AND WORKMANSHIP AND ARE ACCEPTABLE TO THE OWNER WITHOUT QUALIFICATIONS.
- 10.2 EQUIPMENT PROPOSED SHALL MEET THE SAME STANDARDS OF PERFORMANCE, QUALITY AND WORKMANSHIP.
- 11.0 DEMOLITION:
- 11.1 PERFORM ALL REQUIRED DEMOLITION. DO NOT LEAVE POWERED WIRING EXPOSED IN DEMOLISHED AREAS.
- 11.2 REUSE EXISTING FIRE ALARM & SECURITY SYSTEM DEVICES WHERE INDICATED.
- 11.3 VISIT SITE TO DETERMINE FULL EXTENT OF DEMOLITION WORK.
- 11.4 REMOVE ALL ELECTRICAL EQUIPMENT DEEMED OBSOLETE BY RENOVATION.
- 11.5 COORDINATE EXACT REQUIREMENTS OF PHASING WITH GENERAL CONTRACTOR.
- 11.6 OWNER TO HAVE FIRST RIGHT OF REFUSAL FOR ALL EQUIPMENT BEING REMOVED. ALL OTHER OBSOLETE ELECTRICAL EQUIPMENT TO BE REMOVED FROM SITE BY DIVISION 16.
- 11.7 CONNECT NEW LIGHTING, RECEPTACLES AND HEATING TO EXISTING CIRCUITS WHERE POSSIBLE.
- 11.8 PROVIDE NEW TYPE WRITTEN DIRECTORIES FOR ALL EXISTING PANEL BOARDS INDICATING ALL NEW & EXISTING CIRCUITS.
- 11.9 REMOVE WIRING ASSOCIATED WITH OBSOLETE ELECTRICAL EQUIPMENT BACK TO SOURCE.

NOTES:

1. ALL EMCS CONTROL WIRING 50 VOLTS AND UNDER TO BE SUPPLIED AND INSTALLED BY MECHANICAL. REFER TO ELEC. SPECIFICATIONS FOR WIRING METHODS.
2. UNLESS OTHERWISE NOTED ALL CONTROLS DEVICES TO BE SUPPLIED BY MECHANICAL.
3. ALL LINE VOLTAGE WIRING AND CONDUITS BY ELECTRICAL.

ELECTRICAL LEGEND

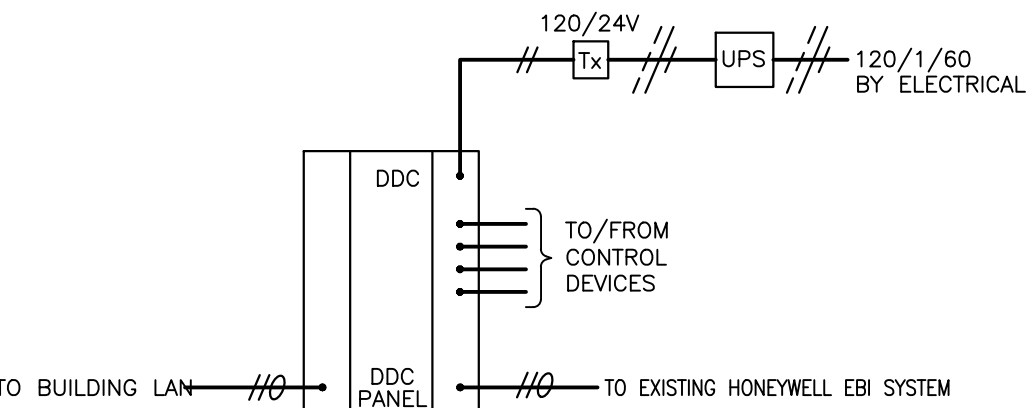
- ⦿ ELECTRICAL CONNECTION TO EQUIPMENT.
- ⌘ DISCONNECT SWITCH SUPPLIED AND INSTALLED BY ELECTRICAL.
- ELECTRICAL PANEL BOARD
- VFD VARIABLE FREQUENCY DRIVE
- MOTOR CONTROL CENTRE (MCC)
- JB - JUNCTION BOX.
- ER - INDICATES EXISTING TO BE REMOVED
- EX - INDICATES EXISTING TO REMAIN
- RL - INDICATES EXISTING TO BE RELOCATED
- NL - INDICATES NEW LOCATION



- NOTES:
1. RECONNECT AS EXISTING. EXTEND EXISTING CONDUIT AND WIRE AS REQUIRED.

MAKE-UP WATER CONTROL DETAIL

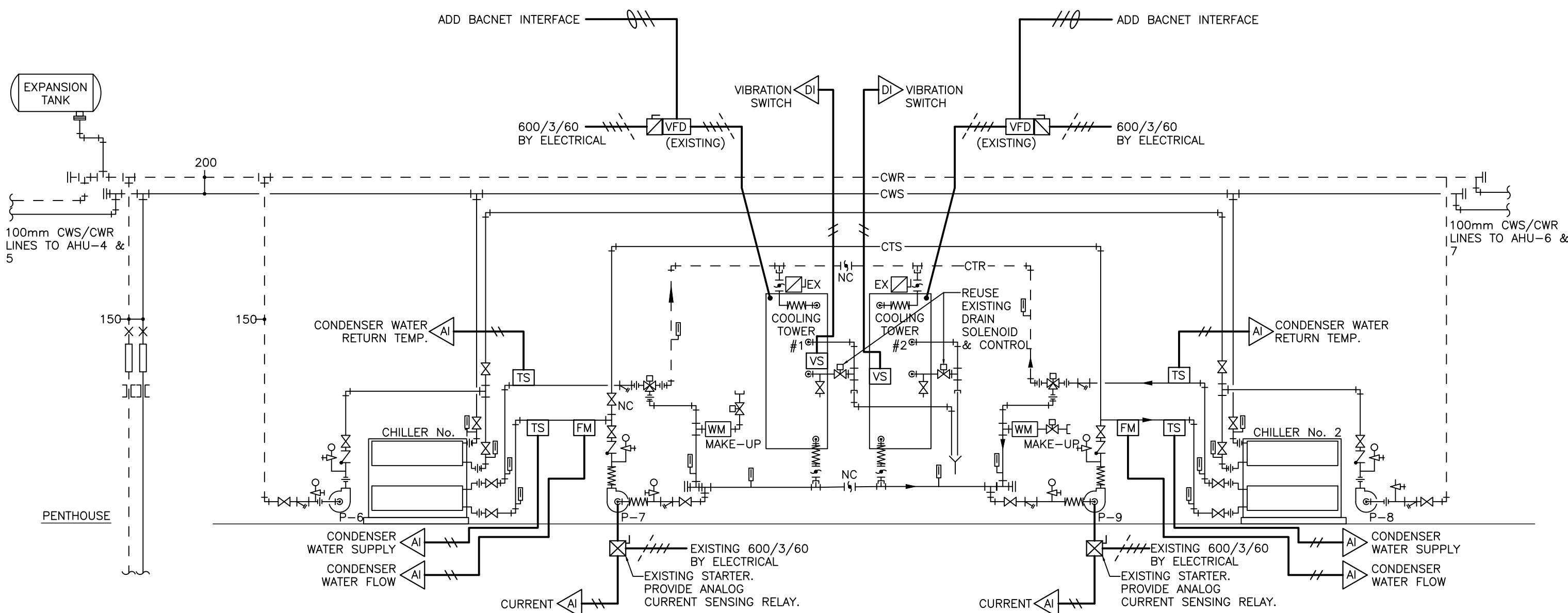
SCALE : N.T.S.



- NOTES:
1. PROVIDE CONTROL TRANSFORMERS, RELAYS AS REQ'D FOR ALL CONTROL DEVICES.
2. LOCATE PANELS, TRANSFORMERS, RELAYS, ETC IN EMT ENCLOSURES.
3. ALL COMMUNICATION NETWORKS SHALL BE SEPARATED BY SPEED AND COMMUNICATION PROTOCOLS. PROVIDE SWITCHES, GATEWAYS, AND CONTROLLERS TO CONNECT.

DDC SYSTEM ARCHITECTURE

SCALE: N.T.S.



CHILLED / CONDENSING WATER - CONTROL SCHEMATICS

SCALE: N.T.S.

CONTROL LEGEND

- TS TEMPERATURE SENSOR DUCT MOUNTED/PIPE MOUNTED. PROVIDE IMMERSION WELL FOR PIPE MOUNTED APPLICATION. PROVIDE CORRECT LENGTH ELEMENT FOR AVERAGING (AVG) APPLICATION.
- VFD EX EXISTING VARIABLE FREQUENCY DRIVE
- DDC NEW DDC PANEL
- ⌘ EX EXISTING DISCONNECT SWITCH
- ⌘ EX NON-FUSED DISC. SWITCH BY ELECTRICAL TRADE UNLESS OTHERWISE NOTED.
- ⌘ EX EXISTING MAGNETIC STARTER
- FM ANALOG PADDLE TYPE FLOW METER WITH STAINLESS STEEL WETTED PARTS, RATED PRESSURE, +/- 1% ACCURACY OVER RANGE, 0-30L/S RANGE, PULSE OUTPUT, 24VAC POWER SUPPLY. EQUAL TO "BADGER" SDI SERIES
- WM EXISTING WATER FLOW METER C/W PULSE OUTPUT TO DDC
- R RELAY.
- VS VIBRATION SWITCH SUPPLIED WITH COOLING TOWER.
- EP ELECTRIC / PNEUMATIC RELAY WITH 0-10 VDC INPUT AND MODULATING PNEUMATIC OUTPUT.
- ≡≡≡ EXISTING PNEUMATIC TUBING.
- ≡≡≡ SHIELDED WIRE - PROVIDE SHIELDED WIRE WHERE SHOWN AND WHERE NECESSARY
- ≡≡≡ INDICATES # OF WIRES - CONTRACTOR TO VERIFY AND INCLUDE ADEQUATE WIRING IN PRICING TO SUIT DEVICE/APPLICATION
- DI 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. ALL CONTROL DEVICES AND ASSOCIATED LOW VOLTAGE WIRING SHALL BE SUPPLIED AND INSTALLED BY THE MECHANICAL TRADE UNLESS OTHERWISE NOTED.
2. MAIN DDC CONTROLLER TO BE MOUNTED IN NEMA1 ENCLOSURE OF SIZE TO SUIT.
3. PROVIDE LAMACOID LABELS FOR ALL EQUIPMENT.
4. ALL EXISTING CONTROL SYSTEM IS HONEYWELL EBI CONTROLS. PROVIDE ALL SOFTWARE & HARDWARE AS REQUIRED TO CONNECT TO EXISTING CONTROLS. UPGRADE ALL GRAPHICS TO INCLUDE NEW CONTROLS.

No.	REVISION	DATE (YYMMDD)
0	ISSUED FOR TENDER	2026.04.23

GENERAL NOTES

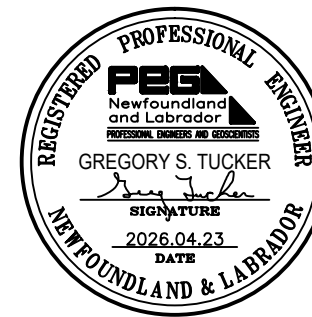
1. DO NOT SCALE FROM DRAWINGS.
2. THE CONTRACTOR IS TO VERIFY ALL DIMENSIONS AND SITE CONDITIONS PRIOR TO SUBMISSION OF TENDERS.
3. ALL DEFICIENCIES FOUND IN THIS DRAWING IS TO BE BROUGHT TO THE ATTENTION OF THE FACILITIES ENGINEERING AND DEVELOPMENT OFFICE OF THE DEPARTMENT OF FACILITIES MANAGEMENT, MEMORIAL UNIVERSITY OF NEWFOUNDLAND, PRIOR TO THE SUBMISSION OF THE TENDERS.

PERMITS REQUIRED FOR ELECTRICAL WORK AT MEMORIAL UNIVERSITY OF NEWFOUNDLAND SHALL BE OBTAINED FROM SERVICE NL EFFECTIVE FEBRUARY 1, 2020 AND MADE AVAILABLE TO MUN REPRESENTATIVES UPON REQUEST. SEE STIPULATED PRICE CONTRACT GENERAL CONDITIONS SECTION 2.18.0 LAWS, NOTICES, PERMITS AND FEES.

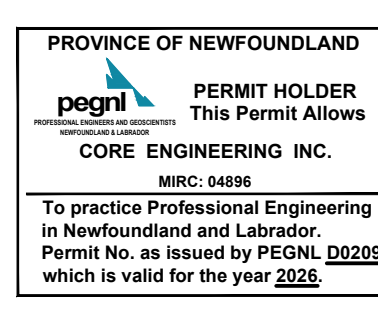
CONSULTANT:



STAMP:



PERMIT:



Department of Facilities Management
This University was named 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:

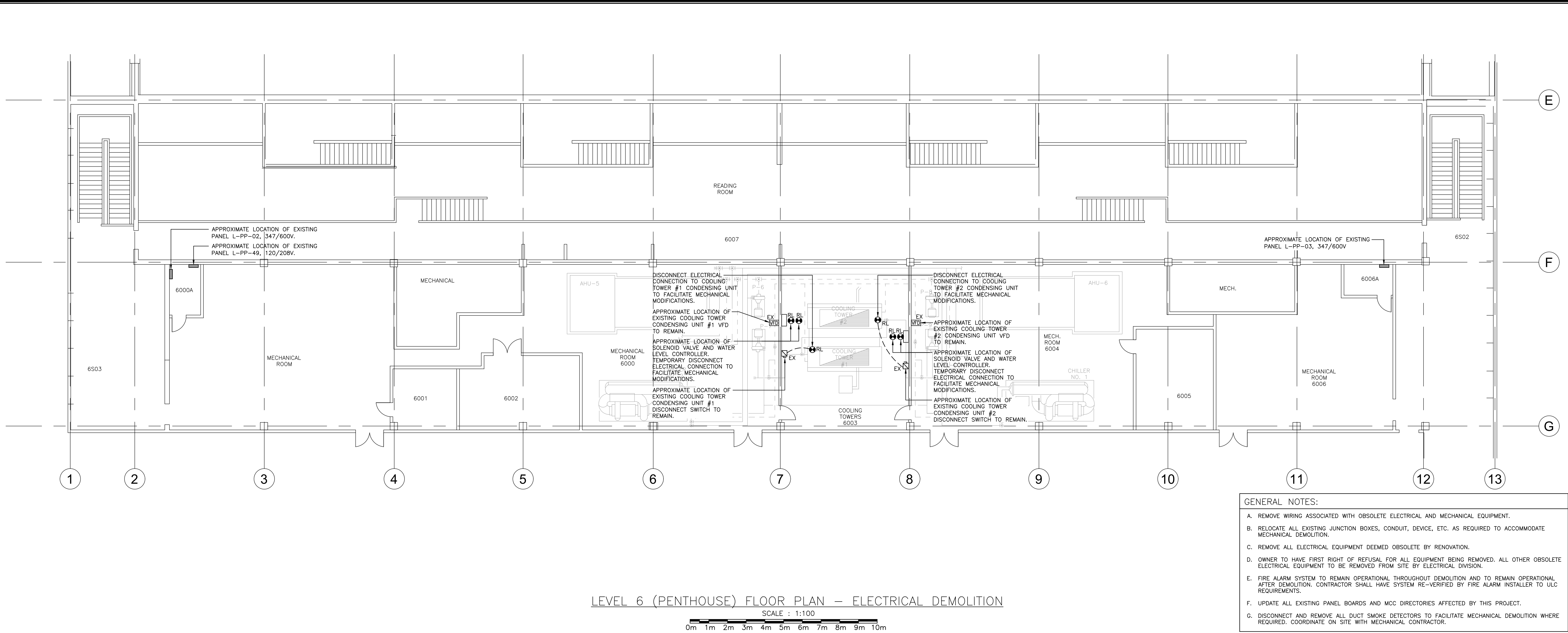
**MUN
QEII LIBRARY
COOLING TOWER REPLACEMENT**

DRAWING TITLE:

**ELECTRICAL LEGEND,
SPECIFICATION AND DETAILS**

DESIGNED: BH	DRAWN: BH
REVIEWED: GT	APPROVED: GT
SCALE: AS NOTED	DATE: 2026.03.25
MUN PROJECT No: L-503-25	DRAWING No: E-0.1

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No.	REVISION	DATE (YYMMDD)
0	ISSUED FOR TENDER	2026.04.23

GENERAL NOTES

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PERMITS REQUIRED FOR ELECTRICAL WORK AT MEMORIAL UNIVERSITY OF NEWFOUNDLAND SHALL BE OBTAINED FROM SERVICE NL EFFECTIVE FEBRUARY 1, 2020 AND MADE AVAILABLE TO MUN REPRESENTATIVES UPON REQUEST. SEE STIPULATED PRICE CONTRACT GENERAL CONDITIONS SECTION 2.18 & LAWS, NOTICES, PERMITS AND FEES.

GENERAL NOTES:

- REMOVE WIRING ASSOCIATED WITH OBSOLETE ELECTRICAL AND MECHANICAL EQUIPMENT.
- RELOCATE ALL EXISTING JUNCTION BOXES, CONDUIT, DEVICE, ETC. AS REQUIRED TO ACCOMMODATE MECHANICAL DEMOLITION.
- REMOVE ALL ELECTRICAL EQUIPMENT DEEMED OBSOLETE BY RENOVATION.
- OWNER TO HAVE FIRST RIGHT OF REFUSAL FOR ALL EQUIPMENT BEING REMOVED. ALL OTHER OBSOLETE ELECTRICAL EQUIPMENT TO BE REMOVED FROM SITE BY ELECTRICAL DIVISION.
- FIRE ALARM SYSTEM TO REMAIN OPERATIONAL THROUGHOUT DEMOLITION AND TO REMAIN OPERATIONAL AFTER DEMOLITION. CONTRACTOR SHALL HAVE SYSTEM RE-VERIFIED BY FIRE ALARM INSTALLER TO ULC REQUIREMENTS.
- UPDATE ALL EXISTING PANEL BOARDS AND MCC DIRECTORIES AFFECTED BY THIS PROJECT.
- DISCONNECT AND REMOVE ALL DUCT SMOKE DETECTORS TO FACILITATE MECHANICAL DEMOLITION WHERE REQUIRED. COORDINATE ON SITE WITH MECHANICAL CONTRACTOR.

CONSULTANT:

CORE ENGINEERING INC.

A MEMBER OF

BPA

STAMP:

PROFESSIONAL ENGINEER
NEWFOUNDLAND & LABRADOR
GREGORY S. TUCKER
2026-04-23
DATE

PERMIT:

PROVINCE OF NEWFOUNDLAND
PERMIT HOLDER
This Permit Allows
CORE ENGINEERING INC.
MREC: 04895
To practice Professional Engineering in Newfoundland and Labrador.
Permit No. as issued by PEQNL D0209 which is valid for the year 2026

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.
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PROJECT NAME:
MUN QEII LIBRARY COOLING TOWER REPLACEMENT

DRAWING TITLE:
LEVEL 6 MECHANICAL PENTHOUSE PLAN - ELECTRICAL

DESIGNED: BH	DRAWN: BH
REVIEWED: GT	APPROVED: GT
SCALE: AS NOTED	DATE: 2026.03.25
MUN PROJECT No: L-503-25	DRAWING No: E-1.1

