FACILITIES MANAGEMENT

OPEN CALL FOR BIDS

FOR

Server Room AC Unit Replacement EN-3023 #EN-178-21

Request for Open Call Number: **TFM-010-25**

Issued: **February 25, 2025**

Submission Deadline: **Thursday, March 27, 2025 @ 3:00PM NDT**

REQUEST FOR OPEN CALL FOR BIDS INFORMATION SHEET

Request for Open Call			
Title:	**Server Room AC Unit Replacement EN-3023 #EN-178-21**		
Open Call #:	**TFM-010-25**	Issue Date:	**February 25, 2025**
Non-Mandatory Site Visit:	**Location: Engineering Building Server Room, EN-3023**		**March 11, 2025 @ 10:00 am NDT**
Questions Deadline:	**Eight (8) days prior to closing time, at 3:00pm (NST).**	Closing Date & Time: Bid Submission Format: Opening Date, Time & Location:	**Thursday March 27, 2025 @ 3:00 pm NDT** **opencalls@mun.ca** **Thursday, March 27, 2025 @ 3:30 pm NDT** **Via Conference line: 1-416-915-6530 (toll free) Access Code: 2774 116 4731 Attendee ID: Please press Pound(#)**
Bids Irrevocable Period after Submission Deadline:			**45 days (See section 1.6)**
Bid Submission: Responses to this solicitation must be submitted by email to opencalls@mun.ca Email subject line must read: BID SUBMISSION: TFM-010-25 ROOM AC UNIT REPLACEMENT EN-3023			

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-010-25 SERVER ROOM AC UNIT REPLACEMENT EN-3023 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*

PROCUREMENT AND CONTRACTING DOCUMENTS GROUP

DIVISION 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS

Open Call for Bids Strategic Procurement Sections

General Conditions and Agreement between Owner and Contractor for the Stipulated Price Contract

SPECIFICATIONS GROUP

General Requirements Subgroup

DIVISION 01 - GENERAL REQUIREMENTS

Facility Construction Subgroup

DIVISION 21 - FIRE SUPPRESSION

DIVISION 22 - PLUMBING

DIVISION 23 - HEATING VENTILATING AND AIR CONDITIONING

DIVISION 25 - INTEGRATED AUTOMATION

DIVISION 26 - ELECTRICAL

END OF SECTION

PART 1 - GENERAL

1.1 A SERIES DRAWINGS – ARCHITECTURAL

.1 A-0.1 Site Access, Locations Plans, & Electrical Panels – Level 1, 3, 4 & Rooftop

1.2 ME SERIES DRAWINGS - MECHANICAL

.1 ME-0.0 General Notes & Symbol Legend

.2 ME-1.0 Server Room Demolition

.3 ME-2.0 New Server Room Cooling Layout

1.3 E SERIES DRAWINGS – ELECTRICAL

.1 E-1.0 Electrical Panel Schedules for Tie-Ins

END OF SECTION

PART 1 – SUBMISSION INSTRUCTIONS

1.1 Bids to be Submitted on Time

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

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

1.2 Bids to be Submitted in Prescribed Format

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

1.3 Amendment of Bids

Bidders may 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.

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

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

Email inquiries and requests for clarification shall be accepted up to eight (**8) days (3:00pm NST)** prior to the closing time. Inquiries and requests for clarification received after this date shall not be addressed. The Strategic Procurement Office will be the only official source of information regarding this Open Call for Bids and information from any other source shall be considered unofficial and may not be correct.

1.4 Amendment of Open Call for Bid Documents

To ensure consistency and quality in the information provided to bidders the Owner shall provide, by way of amendment to this Open Call for Bids, in the form of an addendum, any relevant information with respect to the Open Call inquiries received in writing without revealing the source of those inquiries. Bidders are cautioned that it is their responsibility to ensure that they receive all information relevant to this Open Call. The Owner shall not be

responsible for bidders who fail to inform themselves regarding the scope and nature of the work. The Owner shall publish all amendments on Memorial University's current service providers: MERX: www.merx.com, BIDS: www.bids.ca and PODS: www.pods.net. In addition, all amendments will be published on https://www.mun.ca/finance/strategic_procurement/. Bidders should check on a regular basis for Open Call updates. Bidders are solely responsible for ensuring they are aware of and have complied with all amendments by tender closing time. In the event there is a discrepancy between MERX, BIDS, and PODS and the official website https://www.mun.ca/finance/strategic_procurement/ website, the https://www.mun.ca/finance/strategic_procurement/ is the official website. Bidders are welcome to register their email address through opencalls@mun.ca to receive addendum notifications from Open Calls as a matter of courtesy. This does not relieve any Bidder of their responsibility to ensure all addenda has been received.

1.5 Withdrawal of Bids

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

1.6 Bids Irrevocable after Submission Deadline

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

1.7 Delivery

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

1.8 Signature

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

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

1.9 Closure

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

1.10 Corporations Act

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

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

[End of Part 1]

PART 2 – EVALUATION AND AWARD

2.0 Stages of Evaluation

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

2.1.0 Stage I – Mandatory Submission Requirements

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

2.1.1 Stage II – Mandatory Technical Requirements

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

2.1.2 Stage III – Pricing

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

2.2 No Amendment to Forms

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

2.3 Selection of Lowest Compliant Bidder as Preferred Supplier

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

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

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

2.4 Notice to Bidder and Execution of Agreement

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

2.5 Failure to Enter into Agreement

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

2.6 Payment Terms

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

[End of Part 2]

PART 3 – TERMS AND CONDITIONS OF THE OCB PROCESS

3.1 Open Call Incorporated into Bid

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

3.2 Bidders to Follow Instructions

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

3.3 Bids in English

All bids are to be in English only.

3.4 No Incorporation by Reference

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

3.5 References and Past Performance

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

3.6 Information in Open Call Only an Estimate

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

3.7 Bidders to Bear Their Own Costs

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

3.8 Bid to be Retained by the Owner

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

3.9 Trade Agreements

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

3.10 No Guarantee of Volume of Work or Exclusivity of Contract

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

3.11 Communication After Issuance of Open Call

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

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

3.12 All New Information to Bidders by Way of Addenda

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

3.13 Addenda and Extension of Submission Deadline

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

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

3.14 Notification to Other Bidders

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

3.15 Debriefing

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

3.16 Supplier Complaint Process

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

3.17 Conflict of Interest and Prohibited Conduct

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

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

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

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

3.18 Disqualification for Prohibited Conduct

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

3.19 Bidder Not to Communicate with Media

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

3.20 No Lobbying

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

3.21 Illegal or Unethical Conduct

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

3.22 Past Performance or Past Conduct

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

(a) illegal or unethical conduct as described above;

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

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

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

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

3.23 Confidential Information of the Owner

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

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

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

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

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

3.24 Confidential Information of Bidder

This procurement process is subject to the *Access to Information and Protection of Privacy Act, 2015* (*ATIPPA, 2015*). A bidder must identify any information in its bid 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. Bidders are advised that their bids will, as necessary, be disclosed, on a confidential basis, to advisers retained by the Owner to advise or assist with the Open Call process, including the evaluation of bids.

The Bidder 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*. The Bidder acknowledges that contracting with the Owner is a public process and any information provided through this process and any records the Bidder supplies to the Owner, including the terms and conditions of any Agreement entered into, may be subject to requests under the *ATIPPA, 2015*. In the event of a request to Memorial for third party business information in its custody and control, information can be withheld only if it meets all parts of the 3-part harms test for non-disclosure as stated in section 39 of 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 bidder has any questions about the collection and use of personal information pursuant to this Open Call, questions are to be submitted to the Open Call Contact. Further information relating to subsection 39(1) of the *ATIPPA, 2015* is provided in guidance documents available through the Office of the Information and Privacy Commissioner at https://oipc.nl.ca/guidance/documents.

3.25 Reserved Rights of the Owner

The Owner reserves the right to:

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

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

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

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

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

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

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

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

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

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

(k) reject any or all bids;

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

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

3.26 Limitation of Liability

By submitting a bid, each bidder agrees that:

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

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

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

3.31 Governing Law and Interpretation

These Terms and Conditions of the Open Call Process:

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

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

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

3.32 Facility Compliance Requirement

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

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

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

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

[End of Part 3]

PART 4 – ENVIRONMENTAL HEALTH AND SAFETY REQUIREMENTS

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

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

4.1.0 Regulations, Codes and Standards

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

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

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

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

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

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

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

4.2.0 General Health and Safety Regulations

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

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

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

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

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

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

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

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

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

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

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

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

4.3.0 Contractor Safety Management

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

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

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

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

4.4.0 Contractor Safety Management Element

4.4.1 Purpose

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

4.4.2 Scope

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

4.4.3 Definitions

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

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

4.4.4 Roles and Responsibilities

4.4.4.1 Project Management Team, including Environmental Health & Safety

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

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

4.4.4.2 Contractors

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

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

4.4.5 Procedure

4.4.5.1 Considerations prior to signing of contract

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

4.4.5.2 Requirements

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

Contractors shall also provide the following:

(a) health and safety policy statement;

(b) safety program table of contents; and

(c) site hazard assessment;

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

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

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

(a) safety program and/or manual

(b) applicable documented safe work practices;

(c) inspection reports and schedules;

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

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

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

Memorial reserves the right to:

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

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

4.4.5.3 Schedule of Submissions

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

4.4.6 Post-Contract Evaluation

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

4.5 Access To Site

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

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

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

[End of Part 4]

PART 5– GENERAL CONDITIONS

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

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

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

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

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

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

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

5.8 Corporations Act

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

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

[End of Part 5]

Part 6 – Supplementary Terms and Conditions

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

6.2 Surety

6.2.1 Bid Surety

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

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

6.2.2 Public Work's Surety

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

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

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

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

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

6.3 Site Visit

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

Questions will not be answered at the site visit.

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

6.4 Substitution of Materials

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

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

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

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

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

The decision on substitutions will be final.

6.5 Completion date

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

[End of Part 6]

APPENDIX A – SPECIFICATIONS AND DRAWINGS

SPECIFICATIONS AND DRAWINGS
LOCATED AT THE END OF THIS DOCUMENT

APPENDIX B – SUBMISSION FORM

1. Bidder Information

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

2. Offer

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

3. Rates

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

4. Addenda

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

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

TABLE 1.10: ADDENDA RECEIVED

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

5. No Prohibited Conduct

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

6. Disclosure of Information

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

7. Bid Irrevocable

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

8. Execution of Agreement

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

BIDDER SIGNATURE FORM:

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

(See Part 1 section 1.8 for Electronic Signature acceptance)

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

I have the authority to bind the bidder.

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

APPENDIX C1 – PRICING FORM

1. INSTRUCTIONS ON HOW TO COMPLETE THE PRICING FORM

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

The scope of work for Price A, Price B and Price C is outlined in the contract documents - see specification section 01 11 00 Summary of Works. The Owner reserves the right to delete any or all parts of this tender and award individual and/or combined parts.		
	Contract Bid (HST Excluded)	
Price A: Subtotal		HST EXCLUDED
Price B: Sum of Allowances (Section 01 21 00)	$5000	HST EXCLUDED
Price C: Total: [$(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:

Server Room AC Unit Replacement EN-3023
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 C2 – UNIT RATES

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APPENDIX C2 – UNIT PRICE TABLE

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APPENDIX C3 - FURNITURE BIDDING TABLE

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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
Plumbing	
HVAC	
Controls	
Electrical	
Coring/Drilling	
ADD TRADES AS REQUIRED	

APPENDIX E – PROJECT REFERENCE (ROOFING PROJECTS ONLY)

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DEPARTMENT OF FACILITIES MANAGEMENT

GENERAL CONDITIONS

AND

AGREEMENT BETWEEN OWNER AND CONTRACTOR

FOR

THE STIPULATED PRICE CONTRACT

May 2023

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

INDEX

1.0 GENERAL CONDITIONS

1.1.0 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, Contractor Performance Evaluations, 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.

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.

2.2.0 DOCUMENTS

2.2.1 The Contract Documents shall be signed in triplicate by the Owner and 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 twelve (12) sets of Contract Documents or parts thereof as are reasonably necessary for the performance of the Work.

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. This requirement shall not be deemed to include the executed Contract Documents.

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 expense are the property of the Owner.

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, should they hold 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.

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**.

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.

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) Refuses or fails to supply sufficient, properly skilled workmen 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

d) Fails to make payments due to their Subcontractors, their Suppliers for their workmen; or

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

f) 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:

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

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

c) 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 judicial tribunal as the circumstances require.

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

2.12.0 INDEMNIFICATION

2.12.1 Except as provided in Paragraph 2.10.2, 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 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) Subcontractors shall include, in the breakdown, their 15 percent mark-up (10 percent of the estimated cost for the overhead and 5 percent for profit).

(ii) The Contractor shall include, in the breakdown, the percentages as outlined in (i) for the overhead and profit on their portion of the Work.

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

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.

2.14.3 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.

2.14.4 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.

2.14.5 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.

2.14.6 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.

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

2.14.8 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.

2.14.9 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 workmen 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.

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. 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 named 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 Named 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 policy.

2.21.5 All liability insurance policies 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 nor cancelled until thirty (30) days after written notice of such change or cancellation shall have been given to all Named 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 exceed $100,000 (inclusive of HST)
   - Comprehensive General Liability = $3,000,000.00;
   - Standard Automobile Policy Liability = $3,000,000.00.

b) Where the contract value is less than $100,000 (inclusive of HST)
   - Comprehensive General Liability = $2,000,000.00;
   - Standard Automobile Policy Liability = $2,000,000.00.

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 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.

2.22.2 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.

2.22.3 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.

2.22.4 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."**

2.22.5 All such insurance shall be maintained continuously until ten (10) days after the date the Engineer/Architect issues a certificate of Total 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.

2.22.6 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.

2.22.7 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.

2.22.8 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 two (2) weeks 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 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 MANAGER ANDSUPERINTENDENCE

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

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.

The Project Manager shall have a minimum of ten (10) years' experience on construction projects of similar scale, complexity, type and value.

The project manager shall submit a resume and cover letter.

2.28.3 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.

The superintendent shall have a minimum of ten (10) years' experience on construction projects of similar scale, complexity, type and value.

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, 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.

2.35.4 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.

2.35.5 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.

2.35.6 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.

2.35.7 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.

2.35.8 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

2.37.1 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**

2.37.2 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.

2.37.3 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.

2.37.4 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 written 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

SUPPLEMENTARY GENERAL CONDITIONS

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4.0 SPECIAL CONDITIONS

4.1.0 LAYOUT OF WORK

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

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

4.2.0 JOB SIGN

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

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

4.3.0 TEMPORARY OFFICES AND SHEDS

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

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

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

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

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

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

4.4.0 *TEMPORARY SERVICES*

4.4.1 Light and Power

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

4.4.2 Telephone

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

4.4.3 Toilets

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

4.4.4 Heat

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

When ready for operation, the permanent heating equipment may be used for temporary heating purposes, subject to the conditions of the Mechanical Division of the specifications. Protect all permanent heating equipment used for temporary heating purposes. Provide satisfactory site conditions for the proper operation of this equipment.

4.4.5 Water Supply

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

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

4.5.0 PLANT AND MACHINERY

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

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

4.6.0 PROTECTION OF PUBLIC AND WORKMEN

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

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

4.6.3 The Workers' Compensation Board 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.

Weekly schedule updates shall be provided.

Provide updated construction schedule demoting the original.

4.8.0 *PROGRESS PHOTOGRAPHS*

4.8.1 Submit with monthly progress claim digital progress photographs taken from points designated by the Engineer/Architect. In the lower right-hand corner of the prints show the date and name of the project.

4.9.0 OPERATIONS AND MAINTENANCE DATA

4.9.1 On completion of the project, submit to the Engineer/Architect two (2) copies of Operations and Maintenance Data and one (1) electronic copy as original editable format.

a) Bind data in vinyl hard covered, 3-ring, loose-leaf binder for 215 x 280 mm size paper.

b) Enclose title sheet, labelled "Operation and Maintenance Data", project number, project name, date and list of contents.

c) Organize contents into applicable sections of work to parallel project specifications breakdown. Mark each section by labelled tabs protected with celluloid covers fastened to hard paper dividing sheets.

d) Provide electronic document in CD or DVD as original editable file format or, at the direction of the Owner, pdf format.

4.9.2 Include the following information plus data specified in Division 15 and 16:

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, phone and fax 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.

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

4.9.4 The final certificate will not be issued until the data books have been received and approved by the Engineer/Architect.

4.10.0 COORDINATION OF WORK

4.10.1 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.

4.11.0 TRAFFIC MAINTENANCE

4.11.1 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.

4.12.0 FIRE PROTECTION

4.12.1 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.

4.13.0 JOB MEETINGS

4.13.1 Where the value of the contract exceeds $100,000 (HST included) job meetings shall occur at definitely prescribed times (minimum once 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.

4.13.2 Where the value of the contract is less than $100,000 (HST included) job meetings shall occur at the discretion of the University Project Coordinator but shall not occur fewer than once per month.

4.14.0 AS-BUILT DRAWINGS

4.14.1 The Engineer/Architect will issue to the Contractor three (3) sets of prints of architectural, mechanical and electrical 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).

4.14.2 As-built drawings shall be white prints and shall indicate all changes in Architectural, Mechanical and Electrical work, including any changes in location of piping, ducts, panels, etc.

4.14.3 Provide electronic as-builts in CD or DVD as original editable file format or, at the direction of the Owner, pdf format.

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

4.15.0 COMPLETION TIME

4.15.1 The project shall be ready for the use and occupancy by the Owner within the time stated in the Open Call and Acceptance Form.

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

4.16.0 CLOSE DOWN OF WORK

4.16.1 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.

4.17.0 BROKEN GLASS

4.17.1 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.

4.18.0 HOARDING

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

4.19.0 COMMISSIONING

4.19.1 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.

4.20.0 FINAL CLEAN-UP

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

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

4.20.3 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.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Types of items described in this Section:

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

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

1.3 WORK COVERED BY CONTRACT DOCUMENTS

A. Project Identification: EN-178-21 Server Room EN3023
1. Project Location: Faculty of Engineering and Applied Science, Memorial University, St. John’s, NL

B. Owner: Memorial University of Newfoundland
   1. Owner's Representative: Department of Facilities Management, Tel. 709-864-8725

C. The Work consists of the following:
   1. The installation of three split systems to cool server room EN3023, 3 evaporators to be installed in the ceiling and 3 rooftop condensers connected to the evaporators, and meet cooling requirements for the new equipment that is being installed in there. The rooftop condensers are to be installed on wall mounted brackets, which are to be provided and installed by the contractor.

1.4 TYPE OF CONTRACT

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

1.5 WORK PHASES

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

1.6 WORK UNDER OTHER CONTRACTS

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

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

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

D. Future Work: Owner has awarded / will award separate contract(s) for the following additional work to be performed at site after Substantial Completion. Completion of that work will depend on successful completion of preparatory work under this Contract.
   1. No future work planned.

1.7 PRODUCTS ORDERED IN ADVANCE

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

B. List of Products Ordered in Advance:
   1. None.

1.8 OWNER-FURNISHED PRODUCTS

A. Owner will furnish products indicated. The Work includes providing support systems to receive Owner's equipment and making plumbing, mechanical, and electrical connections.

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

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

1.9 USE OF PREMISES

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

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

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

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

1.10 OWNER'S OCCUPANCY REQUIREMENTS

A. Full Owner Occupancy: Owner will occupy site and existing building during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits, unless otherwise indicated.

1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
2. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.

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

C. Owner Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed areas of building, before Substantial Completion, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and partial occupancy shall not constitute acceptance of the total Work.
1. Obtain a Certificate of Occupancy from authorities having jurisdiction before Owner occupancy.
2. Before partial Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of building.
3. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of building.

1.11 WORK RESTRICTIONS

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

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

C. No smoking is permitted on MUN Campus.

1.12 INTERPRETATION OF DOCUMENTS

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

5. Specifications take precedence over all other drawings;

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

1.13 SPECIFICATION FORMATS AND CONVENTIONS

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

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

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

1.14 PROJECT MANAGEMENT AND COORDINATION

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

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

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

1.15 Requests For Interpretation (RFIs)

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

1.16 CONSTRUCTION PROGRESS DOCUMENTATION

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

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

1.17 PHOTOGRAPHIC DOCUMENTATION

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

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

C. E-mail or otherwise submit photos to Owner`s representative on monthly basis to coincide with the each Application for Payment.

1.18 SUBSTITUTION PROCEDURES

A. Substitution Requests: Submit PDF copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
   1. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
      a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
      b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
      c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable specification section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
      d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
      e. Samples, where applicable or requested.
      f. Certificates and qualification data, where applicable or requested.
      g. List of similar installations for completed projects with project names and addresses and names and addresses of Owner's Representatives and owners.
      h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
      i. Research reports evidencing compliance with building code in effect for Project.
      j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
      k. Cost information, including a proposal of change, if any, in the Contract Sum.
      l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
      m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
   2. Owner's Representative's Action: If necessary, Owner's Representative will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Owner's Representative will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
      a. Forms of Acceptance: Change Order, Construction Change Directive, or Owner's Representative's Supplemental Instructions for minor changes in the Work.
      b. Use product specified if Owner's Representative does not issue a decision on use of a proposed substitution within time allocated.

B. Substitutions for Cause: Submit requests for substitution immediately upon discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.

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

C. Substitutions for Convenience: Owner's Representative will consider requests for substitution if received within 60 days after the Notice of Award. Requests received after that time may be considered or rejected at discretion of Owner's Representative.
   1. Conditions: Owner's Representative will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Owner's Representative will return requests without action, except to record noncompliance with these requirements:
      a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume.
      b. Requested substitution does not require extensive revisions to the Contract Documents.
      c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
      d. Substitution request is fully documented and properly submitted.
      e. Requested substitution will not adversely affect Contractor's construction schedule.
      f. Requested substitution has received necessary approvals of authorities having jurisdiction.
      g. Requested substitution is compatible with other portions of the Work.
      h. Requested substitution has been coordinated with other portions of the Work.
      i. Requested substitution provides specified warranty.

1.19 SUBMITTAL PROCEDURES

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

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

C. Submittal Procedures
   1. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
      a. Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

2. Submit three paper copies of each submittal, unless otherwise indicated. The Owner`s Representative will return no copies on any submittals but instead will e-mail a web link to a web site which will host PDFs of the reviewed documents.
3. Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Owner`s Representative's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
    a. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Owner`s Representative will advise Contractor when a submittal being processed must be delayed for coordination.
    b. Resubmittal Review: Allow 15 days for review of each resubmittal.
    c. Sequential Review: Where sequential review of submittals by Owner`s Representative's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.
4. Owner`s Representative will review each submittal, make marks to indicate corrections or modifications required, and return it. Owner`s Representative will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action, as follows:
    a. REVIEWED – NO COMMENTS
    b. REVIEWED WITH COMMENTS. REVISE & RESUBMIT PRIOR TO START OF WROK.
    c. REVIEVED WITH COMMENTS. PROCEED WITH WORK SUBJECT TO IMPLEMENTATION OF NOTED COMMENTS, REVISE AND RESUBMIT.
    d. NOT ACCEPTED.

1.20 ENVIRONMENTAL PROCEDURES

A. Definitions
1. Hazardous Material: Product, substance, or organism that is used for its original purpose; and that is either dangerous goods or a material that may cause adverse impact to the environment or adversely affect health of persons, animals, or plant life when released into the environment.

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

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

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

E. Protect any trees and plants on site and adjacent properties that are in immediate area of construction.
1. 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.
2. Restrict tree removal to areas indicated or designated by Owner`s Representative.

F. Minimize stripping of topsoil and vegetation.

1.21 WILDLIFE PROTECTION

A. Should nests of migratory birds (Seagulls) be encountered during work, immediately notify Owner’s Representative for directives to be followed.
1. Do not disturb nest site and neighbouring vegetation until nesting is completed.
2. Minimize work immediately adjacent to such areas until nesting is completed.
3. Protect these areas by following recommendations of Canadian Wildlife Service.

1.22 QUALITY REQUIREMENTS

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

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

1.23 REGULATORY REQUIREMENTS

A. 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.

B. Meet or exceed requirements of:
1. Contract documents.
2. Specified standards, codes, and referenced documents.

1.24 TEMPORARY FACILITIES AND CONTROLS

A. Temporary Utility Installation
1. General: Install temporary service or connect to existing service.
a. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
2. Sanitary Facilities: If the Owner has existing toilet facilities these may be used as long as these facilities are kept cleaned and maintained in a condition acceptable to the Owner. Otherwise provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

3. Water Service: If the Owner has existing water service it may be used as long as it does not impact on the Owner`s need. Otherwise install water service and distribution piping in sizes and pressures adequate for construction.
4. Sewers and Drainage: Provide temporary utilities as required to remove effluent lawfully.
5. Heating: Provide temporary heating as required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
6. Ventilation and Humidity Control: Provide temporary ventilation as required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
7. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
    a. Install electric power service overhead, unless otherwise indicated.
    b. If the Owner has an existing power source, the contractor may access it for temporary power provided it does not impact the Owner`s needs.
8. Lighting: Provide temporary lighting with local switching as required to provide adequate illumination for construction operations, observations, inspections, and traffic conditions.
9. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
10. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weather tight enclosure for building exterior.
11. Tree and Plant Protection: Install temporary fencing as required to protect trees and plants intended to remain. Install protection outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.
12. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner as required to prevent people and animals from easily entering site except by entrance gates.

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

1.25 TEMPORARY BARRIERS AND ENCLOSURES

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

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

C. Dust Tight Screens
1. Provide dust tight screens or insulated partitions to localize dust generating activities, and for protection of workers, finished areas of Work and public.

D. Protection Of Building Finishes
1. Provide protection for finished and partially finished building finishes and equipment during performance of work.

2. Provide necessary screens, covers, and hoardings.
3. Be responsible for damage incurred due to lack of or improper protection.

1.26 PRODUCT REQUIREMENTS

A. Manufacturer's Instructions
1. Unless otherwise indicated in specifications, install or erect products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with products. Obtain written instructions directly from manufacturers.
2. Notify Owner`s Representative in writing, of conflicts between specifications and manufacturer's instructions, so that Owner`s Representative may establish course of action.

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

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

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

1.27 EXECUTION

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

B. Construction Layout
1. Where work involves construction outside of an existing footprint, engage a land surveyor to lay out the Work using accepted surveying practices.
2. On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified location certificate showing dimensions, locations, angles, and elevations of construction and site work.

C. Installation

1. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
    a. Make vertical work plumb and make horizontal work level.
    b. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
    c. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
    d. Maintain minimum headroom clearance of 2440 mm in occupied spaces and in unoccupied spaces.
2. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
3. Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
    a. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Owner`s Representative.

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

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

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

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

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

1.28 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

A. Waste Reduction
1. Reduce construction waste during installation work. Undertake practices which will minimize waste and optimize full use of new materials on site, such as:
    a. Use of a central cutting area to allow for easy access to off-cuts;
    b. Use of off-cuts for blocking and bridging elsewhere.

c. Use of effective and strategically placed facilities on site for storage and staging of left-over or partially cut materials (such as gypsum board, plywood, ceiling tiles, insulation etc...) to allow for easy incorporation into

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

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

1.29 CLOSEOUT PROCEDURES

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

3. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

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

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

1.30 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

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

1.31 WARRANTIES

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

B. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.

1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 215-by-280-mm paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title *WARRANTIES*, Project name, and name of Contractor.

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

1.32 OPERATION AND MAINTENANCE DATA

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

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

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

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

1.33 PROJECT RECORD DOCUMENTS

A. Record Drawings
1. Maintain one set of blue- or black-line white prints of the Contract Drawings and Shop Drawings.
2. Mark Record Prints to show the actual installation where installation varies from that shown originally.
3. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
a. Accurately record information in an understandable drawing technique.
b. Record data as soon as possible after obtaining it. Record and check the mark-up before enclosing concealed installations.
4. Content: Types of items requiring marking include, but are not limited to, the following:
a. Dimensional changes to Drawings.
b. Revisions to details shown on Drawings.
c. Depths of foundations below first floor.
d. Locations and depths of underground utilities.
e. Revisions to routing of piping and conduits.
f. Revisions to electrical circuitry.
g. Actual equipment locations.
h. Duct size and routing.

i. Locations of concealed internal utilities.
j. Changes made by Change Order or Change Directive.
k. Changes made following Owner`s Representative's written orders.
l. Details not on the original Contract Drawings.
m. Field records for variable and concealed conditions.
n. Record information on the Work that is shown only schematically.

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

1.34 DEMOSTRATION AND TRAINING

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

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

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

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

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

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

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

1.3 SELECTION AND PURCHASE

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

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

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

1.4 SUBMITTALS

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

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

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

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

1.5 COORDINATION

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

1.6 QUANTITY ALLOWANCES

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

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

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

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

1.7 CONTINGENCY ALLOWANCES

.1 Use the contingency allowance only as directed by Owner's Representative for Owner's purposes and only by Change Orders that indicate amounts to be charged to the allowance.

.2 Contractor's overhead, profit, and related costs for products and equipment ordered by Owner under the contingency allowance are included in the allowance and are not part of the Contract Sum. These costs include delivery, installation, insurance, equipment rental, and similar costs.

.3 Change Orders authorizing use of funds from the contingency allowance will include Contractor's related costs and reasonable overhead and profit margins.

.4 At Project closeout, credit unused amounts remaining in the contingency allowance to Owner by Change Order.

.5 The cash allowance shall not include HST.

1.8 TESTING AND INSPECTING ALLOWANCES

.1 Testing and inspecting allowances include the cost of engaging testing agencies, actual tests and inspections, and reporting results.

.2 The allowance does not include incidental labour required to assist the testing agency or costs for retesting if previous tests and inspections result in failure. The cost for incidental labour to assist the testing agency shall be included in the Contract Sum.

.3 At Project closeout, credit unused amounts remaining in the testing and inspecting allowance to Owner by Change Order.

1.9 ADJUSTMENT OF ALLOWANCES

.1 Allowance Adjustment: To adjust allowance amounts, prepare a Change Order proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable. If

applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.

.1 Include installation costs in purchase amount only where indicated as part of the allowance.

.2 If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other margins claimed.

.3 Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.

.2 Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or Contractor's handling, labour, installation, overhead, and profit.

.1 Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in the Contract Documents.

.2 No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

.1 Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 SCHEDULE OF ALLOWANCES

.1 Control Integration Allowance:

.1 No Control Integration Allowances apply to this work.

.2 Lump-Sum Allowance:

.1 No Lump Sum Allowances apply to this Work.

.3 Unit-Cost Allowance:

.1 No Unit Cost Allowances apply to this Work.

.4 Contingency Allowance:

.1 Include a contingency allowance of $5,000 for use according to Owner's instructions.

.5 Testing and Inspection Allowance:

.1 No testing and Inspection Allowance apply to this Work.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

.1 Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

.2 Related Sections:
.1 Division 01 Section *Payment Procedures* for submitting Applications for Payment and the schedule of values.
.2 Division 01 Section *Construction Progress Documentation* for submitting schedules and reports, including Contractor's construction schedule.
.3 Division 01 Section *Operation and Maintenance Data* for submitting operation and maintenance manuals.
.4 Division 01 Section *Project Record Documents* for submitting record Drawings, record Specifications, and record Product Data.
.5 Division 01 Section *Demonstration and Training* for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.3 DEFINITIONS

.1 Action Submittals: Written and graphic information and physical samples that require Owner's Representative's responsive action. Action submittals are those submittals indicated in individual Specification Sections as action submittals.

.2 Informational Submittals: Written and graphic information and physical samples that do not require Owner's Representative's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as informational submittals.

.3 File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.

.4 Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.4 ACTION SUBMITTALS

.1 Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or modifications to submittals noted by the Owner's Representative and additional time for handling and reviewing submittals required by those corrections.
.1 Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.

.2 Initial Submittal: Submit concurrently with start-up construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.

.3 Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.

.1 Submit revised submittal schedule to reflect changes in current status and timing for submittals.

.4 Format: Arrange the following information in a tabular format:

.1 Scheduled date for first submittal.

.2 Specification Section number and title.

.3 Submittal category: Action, informational.

.4 Name of subcontractor.

.5 Description of the Work covered.

.6 Scheduled date for Owner's Representative's final release or approval.

.7 Scheduled dates for purchasing.

.8 Scheduled dates for installation.

.9 Activity or event number.

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

.1 Owner's Representative's Digital Data Files: Electronic copies of CAD Drawings of the Contract Drawings will be provided by Owner's Representative for Contractor's use in preparing submittals.

.1 Owner's Representative will furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawings.

.1 Owner's Representative makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.

.2 Digital Drawing Software Program: The Contract Drawings are available in Autodesk AutoCAD 2014 format.

.3 Only the following plot files will by furnished for each appropriate discipline:

.1 Floor plans.

.2 Reflected ceiling plans.

.2 Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

.1 Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.

.2 Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.

.3 Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.

.3 Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Owner's Representative's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

.1 Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Owner's Representative will advise Contractor when a submittal being processed must be delayed for coordination.

.2 Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.

.3 Resubmittal Review: Allow 15 days for review of each resubmittal.

.4 Sequential Review: Where sequential review of submittals by Owner's Representative's consultants, Owner, or other parties is required, allow 21 days for initial review of each submittal.

.4 Identification and Information: Place a permanent label or title block on each paper copy submittal item for identification.
- .1 Indicate name of firm or entity that prepared each submittal on label or title block.
- .2 Include the following information for processing and recording action taken:
  - .1 Project name.
  - .2 Date.
  - .3 Name of Owner's Representative.
  - .4 Name of Contractor.
  - .5 Name of subcontractor.
  - .6 Name of supplier.
  - .7 Name of manufacturer.
  - .8 Submittal number or other unique identifier, including revision identifier.
    - .1 Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 06 10 00.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 06 10 00.01.A).
  - .9 Number and title of appropriate Specification Section.
  - .10 Drawing number and detail references, as appropriate.
  - .11 Location(s) where product is to be installed, as appropriate.
  - .12 Other necessary identification.

.5 Options: Identify options requiring selection by the Owner's Representative.

.6 Deviations: Identify deviations from the Contract Documents on submittals.

.7 Additional Paper Copies: Unless additional copies are required for final submittal, and unless Owner's Representative observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.

.8 Transmittal: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Owner's Representative will discard submittals received from sources other than Contractor.
- .1 Transmittal Form: Provide locations on form for the following information:
  - .1 Project name.
  - .2 Date.
  - .3 Category and type of submittal.
  - .4 Submittal purpose and description.
  - .5 Specification Section number and title.
  - .6 Indication of full or partial submittal.
  - .7 Remarks.
  - .8 Signature of transmitter.
- .2 On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Owner's Representative on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

.9 Resubmittals: Make resubmittal in same form and number of copies as initial submittal.
- .1 Note date and content of previous submittal.
- .2 Note date and content of revision in label or title block and clearly indicate extent of revision.
- .3 Resubmit submittals until they are marked with approval notation from Owner's Representative's action stamp.

.10 Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

.11 Use for Construction: Use only final submittals that are marked with approval notation from Owner's Representative's action stamp.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

.1 General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
- .1 Submittals in General; Submit three paper copies of each submittal, unless otherwise indicated. Owner's Representative will return no copies but will instead post a scanned version of the document in PDF to the project web Site and notify the Contractor of same via e-mail notice.
- .2 Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Division 01 Section *Closeout Procedures*.
- .3 Test and Inspection Reports Submittals: Comply with requirements specified in Division 01 Section *Quality Requirements*.

.2 Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
- .1 If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
- .2 Mark each copy of each submittal to show which products and options are applicable.
- .3 Include the following information, as applicable:
  - .1 Manufacturer's catalog cuts.
  - .2 Manufacturer's product specifications.
  - .3 Standard color charts.
  - .4 Statement of compliance with specified referenced standards.
  - .5 Testing by recognized testing agency.
  - .6 Application of testing agency labels and seals.
  - .7 Notation of coordination requirements.
  - .8 Availability and delivery time information.
- .4 For equipment, include the following in addition to the above, as applicable:
  - .1 Wiring diagrams showing factory-installed wiring.
  - .2 Printed performance curves.
  - .3 Operational range diagrams.
  - .4 Clearances required to other construction, if not indicated on accompanying Shop Drawings.
- .5 Submit Product Data before or concurrent with Samples.

.3 Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
- .1 Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
  - .1 Identification of products.
  - .2 Schedules.
  - .3 Compliance with specified standards.
  - .4 Notation of coordination requirements.
  - .5 Notation of dimensions established by field measurement.

.6 Relationship and attachment to adjoining construction clearly indicated.
.7 Seal and signature of professional engineer if specified.

.2 Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings whenever possible on sheets not larger than 11 x17"

.4 Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

.1 Transmit Samples that contain multiple, related components such as accessories together in one submittal package.

.2 Identification: Attach label on unexposed side of Samples that includes the following:

.1 Generic description of Sample.
.2 Product name and name of manufacturer.
.3 Sample source.
.4 Number and title of applicable Specification Section.

.3 Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

.1 Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
.2 Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

.4 Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

.1 Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Owner's Representative will return submittal with options selected.

.5 Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

.1 Number of Samples: Submit two sets of Samples. Owner's Representative will retain two Sample sets; remainder will be returned a PDF scan of the sample.

.1 Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
.2 If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least two sets of paired units that show approximate limits of variations.

.5 Contractor's Construction Schedule: Comply with requirements specified in Division 01 Section *Construction Progress Documentation*.

.6 Application for Payment: Comply with requirements specified in Division 01 Section *Payment Procedures*.

.7 Schedule of Values: Comply with requirements specified in Division 01 Section *Payment Procedures*.

.8 Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

.1 Name, address, and telephone number of entity performing subcontract or supplying products.
.2 Number and title of related Specification Section(s) covered by subcontract.
.3 Drawing number and detail references, as appropriate, covered by subcontract.

.9 Sustainability Submittals: Comply with requirements specified in Division 01 Section *Sustainable Design Requirements*.

.10 Coordination Drawings: Comply with requirements specified in Division 01 Section *Project Management and Coordination*.

.11 Schedule of Tests and Inspections: Comply with requirements specified in Division 01 Section *Quality Requirements*.

.12 Maintenance Data: Comply with requirements specified in Division 01 Section *Operation and Maintenance Data*.

2.2 DELEGATED-DESIGN SERVICES

.1 Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
.1 If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Owner's Representative.
.2 Provide submittals and certificates sealed with by a professional identified by the Section who is licensed to practice in the project's jurisdiction; signifying compliance with the performance and design criteria in the Contract Documents. Indicate list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

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

.2 Project Closeout and Maintenance/Material Submittals: Refer to requirements in Division 01 Section *Closeout Procedures*.

.3 Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 OWNER'S REPRESENTATIVE'S ACTION

.1 General: Owner's Representative will not review submittals that do not bear Contractor's approval stamp and will return them without action.

.2 Action Submittals: Owner's Representative will review each submittal, make marks to indicate corrections or modifications required, and return it. Owner's Representative will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.

.3 Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Types of items described in this Section:

1. Health and safety requirements for projects located in Newfoundland and Labrador.

1.3 REFERENCES

A. Code and standards referenced in this section refer to the latest edition thereof.

B. Canadian Standards Association (CSA)

1. CSA S269.1 Falsework for Construction Purposes.
2. CAN/CSA-Z259.1 Safety Belts and Lanyards.
3. CAN/CSA-Z259.10 Full body Harnesses.
4. CAN/CSA-Z259.11 Shock Absorbers for Personal Fall Arrest Systems.
5. CAN/CSA-Z259.2, Fall Arresting Devices, Personnel Lowering Devices and Lifelines.
6. FCC No. 301 Standard for Construction Operations.
7. CSA Z275.2 Occupational Safety Code for Diving Operations.
8. CSA Z275.4 Competency Standard for Divers Operations.

C. FCC No. 302 Standard for Welding and Cutting.

D. Transportation of Dangerous Goods Act Regulations.

E. Newfoundland Occupational Health and Safety Act, Amended

F. Consolidated Newfoundland and Regulations 1149 WMIS Regulations Under the Occupational Health and Safety Act

G. Consolidated Newfoundland and Regulations 1165 Occupational Health and Safety Regulations under the Occupational Health and Safety Act.

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

I. National Building Code of Canada.

1.4 SUBMITTALS

A. At least 10 (ten) working days prior to commencing any site work: submit to Owner's Representative copies of:

1. A complete Site Specific Hazard Assessment and Safety Program Table of Contents.
2. **Including requirments as outlined by the Department of Envrionmental Health & Safety, See APPENDIX A.**

B. Acceptance of the Project Health and Safety Hazard Assessment and Management Plan and other submitted documents by the Owner's Representative shall only be viewed as acknowledgement that the contractor has submitted the required documentation under this specification section.

C. Owner's Representative makes no representation and provides no warranty for the accuracy, completeness and legislative compliance of the Project Health and Safety Hazard Management Plan and other submitted documents by this acceptance.

D. Responsibility for errors and omissions in the Project Health and Safety Hazard Assessment and Management Plan and other submitted documents is not relieved by acceptance by Owner's Representative.

1.5 OCCUPATIONAL HEALTH AND SAFETY (PROJECT HEALTH AND SAFETY HAZARD ASSESSMENT AND MANAGEMENT PLANS)

A. Conduct operations in accordance with latest edition of the Newfoundland Occupational Health and Safety (OH&S) Act and Regulations.

B. Prepare a detailed Project Health and Safety Hazard Assessment and Management Plan for the Owner. Assessment shall identify, evaluate and control job specific hazards and the necessary control measures to be implemented for managing hazards.

C. Provide a copy of the Project Health and Safety Hazard Assessment and Management Plan upon request to Occupational Health and Safety Branch, Department of Labour, Province of Newfoundland and Labrador and the Owner.

D. The written Health and Safety Hazard Assessment and Management Plan shall incorporate the following:

1. A site-specific health and safety plan, refer to clause 1.6 Site-Specific Health and Safety Hazard Assessment and Management Plan of this section for requirements.
2. An organizational structure which shall establish the specific chain of command and specify the overall responsibilities of contractor's employees at the work site.
3. A comprehensive work plan which shall:

    a. define work tasks and objectives of site activities/operations and the logistics and resources required to reach these tasks and objectives
    b. establish personnel requirements for implementing the plan, and
    c. establish site specific training and notification requirements and schedules.

4. A personal protected equipment (PPE) Program which shall detail PPE:

    a. Selection criteria based on site hazards.
    b. Use, maintenance, inspection and storage requirements and procedures.

c. Decontamination and disposal procedures.
d. Inspection procedures prior to during and after use, and other appropriate medical considerations.
e. Limitations during temperature extremes, heat stress and other appropriate medical consideration.

5. An emergency response procedure, refer to Clause 1.7 Supervision and Emergency Response Procedure of this section for requirements.
6. A hazard communication program for informing workers, visitors and individuals outside of the work area as required.
7. A diving program which shall contain standard operating procedures to be followed in the diving operation.
8. A health and safety training program.
9. General safety rules.

E. Periodically review and modify as required each component of the Project Health and Safety Hazard Assessment and Management Plan when a new hazard is identified during completion of work and when an error or omission is identified in any part of the Project Health and Safety Hazard Assessment and Management Plan.

F. Implement all requirements of the Project Health and Safety Hazard Assessment and Management Plan.

1. Ensure that every person entering the project site is informed of requirements under the Project Health and Safety Hazard Assessment and Management Plan.
2. Take all necessary measures to immediately implement any engineering controls, administrative contacts, personal protective equipment required or termination of work procedures to ensure compliance with the Project Health and Safety Hazard Assessment and Management Plan.

1.6 SITE SPECIFIC HEALTH AND SAFETY PLAN

A. Prepare a detailed site Specific Project Health and Safety Plan which shall:

1. Contain certain hazard assessment results.
2. Identify engineering and administrative demonstrative controls (work-practices and procedures) to be implemented for managing identified and potential hazards, and comply with applicable federal and provincial legislation and more stringent requirements that have been specified in these specifications.

B. Review for completeness the hazard assessment results immediately prior to commencing work, when a new hazard is identified during completion of work and when an error or omission is identified.

1. Be solely responsible for investigating, evaluation and managing any report of actual or potential hazards.
2. Retain copies of all completed hazard assessments at the project site and make available to the Owner's Representative immediately upon request.

1.7 SUPERVISION AND EMERGENCY RESCUE PROCEDURE

A. Carry out work under the direct supervision of competent persons responsible for safety by ensuring the work complies with the appropriate section of OH&S Act and Regulations

B. Assign a sufficient number of supervisory personnel to the work site.

C. Provide a suitable means of communications for workers required to work alone.

D. Develop an emergency rescue plan for the job site and ensure that supervisors and workers are trained in the emergency rescue plan.

E. The emergency response plan shall address, as a minimum:

1. Pre-emergency planning.
2. Personnel roles, lines of authority and communication.
3. Emergency recognition and prevention.
4. Safe distances and places of refuge.
5. Site security and control
6. Evacuation routes and procedures
7. Decontamination procedures which are not covered by the site specific safety and health plan.
8. Emergency medical treatment and first aid.
9. Emergency alarm, notification and response procedures including procedures for reporting incidents to local, provincial and federal government departments.
10. PPE and emergency equipment.
11. Procedures for handling emergency incidents.
12. Site specific emergency response training requirements and schedules.
13. For diving operation, include procedures for:

    a. Managing deteriorating environmental conditions.
    b. Managing unexpected weather or sea-state condition.
    c. Evacuation of diver(s) under pressures greater that atmospheric pressure.
    d. In-water emergency transfers.
    e. Managing failing of equipment below the surface that impairs the ability of a diver to complete a dive.
    f. Managing failure of any major component of diving plant or equipment.
    g. Emergency signalling between divers involved in the diving program and between the diver(s) and the attendants using umbilical, tethers or other suitable methods.
    h. Mobilizing stand-by divers.
    i. Mobilizing crafts, stand-by boats and any other devices to be used for rescue.
    j. Contacting evacuation, rescue, treatment facilities and medical services that will be used in the diving program.
    k. Operation of emergency power and lighting facilities.

F. The emergency response procedures shall be rehearsed regularly as part of the overall training program.

G. Provide adequate first aid facilities for the jobsite and ensure that a minimum number of workers are trained in first aid in accordance with the First Aid Regulations.

1.8 CONTRACTORS SAFETY OFFICER

A. The contractor's Safety Officer will be solely responsible for the implementation and monitoring of the Project Health and Safety Hazard Assessment and Management Plan, and will have the authority to implement health and safety changes as directed by the Owner's Representative. The Safety Officer shall have as a minimum:

1. Completed training in hazardous occurrence management and response/protocols.
2. Completed training in the use, maintenance of fall protection systems.
3. Completed training in the design and construction of scaffolding.
4. Completed training in confined space entry protocols and techniques.
5. Completed training in First Aid.

6. Have working knowledge of occupational safety and health regulations.
7. Be responsible for completing Contractor's Health and Safety Training Sessions and ensuring that personnel not successfully completing required training are not permitted to enter site to perform Work.
8. Be responsible for implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan.
9. Be on site during execution of Work and report directly to and be under direction of site supervisor.

1.9 HEALTH AND SAFETY COMMITTEE

A. Establish an Occupational Health and Safety Committee where ten or more workers are employed on the job site as per the OH&S Act and Regulations.Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.

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

1.10 RESPONSIBILITY

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

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

1.11 UNFORESEEN HAZARDS

A. Should any unforeseen or peculiar safety-related factor, hazard, or condition become evident during performance of Work, follow procedures in place for Employee's Right to Refuse Work in accordance with Acts and Regulations of Province having jurisdiction. Advise Owner’s Representative verbally and in writing.

1.12 INSTRUCTION AND TRAINING

A. Workers shall not participate in or supervise any activity on the work site until they have been trained to a level required by this job function and responsibility. Training shall as a minimum thoroughly cover the following:

1. Federal and Provincial Health and Safety Legislation requirements including roles and responsibilities of workers and person(s) responsible for implementing, monitoring and enforcing health and safety requirements.
2. Safety and health hazards associated with working on a contaminated site including recognition of symptoms and signs which might indicate over exposure to hazards.
3. Limitations, use, maintenance and disinfection-decontamination of personal protective equipment associated with completing work.
4. Limitations, use, maintenance and care of engineering controls and equipment.

5. Limitations and use of emergency notifications and response equipment including emergency response protocol.
6. Work practices and procedures to minimize the risk of an accident and hazardous occurrence from exposure to a hazard.

B. Provide and maintain training of workers, as required, by Federal and Provincial legislation.

C. Provide copies of all safety training certificates, upon request, to Owner's Representative for review, and to be maintained on the worker when they enter the work site.

D. Authorized visitors shall not access the work site until they have been:

1. Notified of the names of persons responsible for implementing, monitoring and enforcing the Health and Safety Hazard Assessment and Management Plan.
2. Briefed on safety and health hazards present on the site.
3. Instructed in the proper use and limitations of personal protective equipment.
4. Briefed as the emergency response protocol including notification and evacuation process.
5. Informed of practices and procedures to minimize risks from hazards and applicable to activities performed by visitors.

1.13 CONSTRUCTION SAFETY MEASURES

A. Observe construction safety measures of National Building Code, latest edition, Provincial Government, OH&S Act and Regulations, Workplace Health and Safety and Compensation Commission and Municipal Authority provided that in any case of conflict or discrepancy more stringent requirements shall apply.

B. Administer the project in a manner that will ensure, at all times, full compliance with Federal and Provincial Acts, regulations and applicable safety codes and the site Health and Safety Hazard Assessment and Management Plan.

C. Provide Owner's Representative with copies of all orders, directions and any other documentation, issued by the Provincial Department of Government Services, Occupational Health and Safety branch immediately after receipt.

1.14 POSTING OF DOCUMENTS

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

1.15 HEALTH AND SAFETY MONITORING

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

B. The contractor shall be responsible for any and all costs associated with delays as a result of contractor's failure to comply with the requirements outlined in this section.

1.16 CORRECTION OF NON-COMPLIANCE

A. Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Owner's Representative.

B. Provide Owner's Representative with written report of action taken to correct non-compliance of health and safety issues identified.

C. Owner's Representative may stop work if non-compliance of health and safety regulations is not corrected.

1.17 WHMIS

A. Ensure that all controlled products are in accordance with the Workplace Hazardous Materials Information System (WHMIS) Regulations and Chemical Substances of the OH&S Act and Regulations regarding use, handling, labelling, storage, and disposal of hazardous materials.

B. Deliver copies of relevant (Material) Safety Data Sheets (SDS) to job site and the Owner's Representative. The SDS must be acceptable to Labour Canada and Health and Welfare Canada for all controlled products that will be used in the performance of this work.

C. Train workers required to use or work in close proximity to controlled products as per OH&S Act and Regulations.

D. Label controlled products at jobsite as per OH&S and Regulations.

E. Provide appropriate emergency facilities as specified in the SDS where workers might be exposed to contact with chemicals, e.g. eye-wash facilities, emergency shower.

1. Workers to be trained in use of such emergency equipment.

F. Contractor shall provide appropriate personal protective equipment as specified in the SDS where workers are required to use controlled products.

1. Properly fit workers for personal protective equipment
2. Train workers in care, use and maintenance of personal protective equipment.

G. No controlled products are to be brought on-site without prior approved SDS.

H. The SDS are to remain on site at all times.

1.18 OVERLOADING

A. Ensure no part of work or associated equipment is subjected to loading that will endanger its safety or will cause permanent deformation.

1.19 FALSEWORK

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

1.20 SCAFFOLDING

A. Design, erect and maintain scaffolding in accordance with CSA S269.2 and Sections 91-97 of the OH&S Act and Regulations.

B. Ensure that fall-restraint or fall-arrest devices are used by all workers working at elevations greater than 3.05 metres above grade or floor level in accordance with CSA Z259.

1.21 PERSONAL PROTECTIVE EQUIPMENT

A. Ensure workers on the jobsite use personal protective equipment appropriate to the hazards identified in the Hazard Assessment and Management Plan and those workers are trained in the proper care, use, and maintenance of such equipment.

B. PPE selections shall be based on an evaluation of the performance characteristics of the PPE relative to the requirements and limitations of the site, task-specific conditions, duration and hazards and potential hazards identified on site.

C. Provide workers and visitors to the site with proper respiratory protection equipment.

1. No work shall be performed in an area where an airborne contaminant exceeds one half (½) the IDLH concentration.
2. Respiratory protection shall be provided in accordance with the requirements of the Occupational Health and Safety Branch, Department of Labour of the Province of Newfoundland and Labrador and these specifications.
3. Establish, implement and maintain a respirator inspection and maintenance program.
4. Copies of all respirator owners' maintenance manuals shall be kept at all times at the contractor's site office.

D. Provide and maintain a supply of dermal protection equipment to allow visitors and all workers proper dermal protection.

1. Dermal protection shall be sufficient to act as a protective barrier between the skin and an airborne contaminant or hazardous material. Dermal protection shall also be provided for all physical hazards.
2. Dermal protection equipment shall not be used after exceeding 75% of the break through time. The break through time shall be based on the contaminant which requires the least amount of time to break through the protective equipment
3. Copies of all dermal protection user specifications, owners and maintenance manuals shall be kept at all times at the contractor's site office.
4. Establish, implement and maintain air inspection program to ensure proper dermal protection in accordance with CSA, NIOSH, U.S. EPA and manufacturer's requirements.

E. Provide all workers and up to two (2) visitors to the site with proper hearing protection. Workers and visitors shall not be exposed to noise levels greater than 85 dB (A) over an eight hour shift without proper hearing protection.

F. Provide all workers and up to two (2) visitors to the site with CSA approved eye protection sufficient to act as a protective barrier between the eye and airborne contaminants, hazardous materials and physical hazard.

G. Provide workers and up to two (2) visitors to the site with CSA approved hard hats.

1.22 EXCAVATION SAFETY

A. Protect excavations more than 1.25 metres deep against cave-ins or wall collapse by side wall sloping to the appropriate angle of repose, an engineered shoring/sheathing system or an approved trench box.

1. Provide a ladder which can extend from the bottom of the excavation to at least 0.91 metres above the top of the excavation.

B. Ensure that all excavations less than 1.25 metres deep are effectively protected when hazardous ground movement may be expected.

C. Design trench boxes, certified by a registered Professional Engineer, and fabricated by a reputable manufacturer. Provide the manufacturer's Depth Certificate Statement permanently affixed. Use trench boxes in strict accordance with manufacturer's instructions and depth certification data.

D. For excavations deeper than six (6) metres, provide a certificate from a registered Professional Engineer stating that the protection methods proposed have been properly designed in accordance with accepted engineering practice. The engineer's certificate shall verify that the trench boxes, if used, are properly designed and constructed to suit the depth and soil conditions.

1. Ensure that the superintendent and every crew chief, foreperson and lead hand engaged in trenching operations or working in trenches have in his/her possession a copy of the Department of Labour's "Trench Excavation Safety Guide".

1.23 CONFINED SPACE WORK

A. Comply with requirements of Canada Occupational Safety and Health Regulations, Part XI and Consolidated Regulations Newfoundland and Labrador (CRNL) OH&S 1165/96.

B. Provide approved air monitoring equipment where workers are working in confined spaces and ensure any test equipment to be used is calibrated, in good working order and used by trained persons.

C. Develop a confined space entry program specific to the nature of work performed and in accordance with OH&S Act and Regulations and ensure supervisors and workers are trained in the confined space entry program.

1. Ensure that personal protective equipment and emergency rescue equipment appropriate to the nature of the work being performed is provided and used.

D. Provide and maintain training of workers, as required by the Federal and Provincial Legislation.

E. Provide Owner's Representative with a copy of an "Entry Permit" for each entry into the confined space to ensure compliance with Federal and Provincial Legislation.

1.24 HAZARDOUS MATERIALS

A. Should material resembling hazardous materials (asbestos/mould) be encountered during the execution of work and notify Owner's Representative. Do not proceed until written instructions have been received from Owner's Representative.

B. Unless otherwise noted, for hazardous materials abatement and repair, employ the services of a recognized Environmental Consultant to provide all air monitoring and testing services for regulatory requirements.

1.25 HEAVY EQUIPMENT

A. Ensure mobile equipment used on jobsite is of the type specified in OH&S Act and Regulations fitted with a Roll Over Protective (ROP) Structure.

B. Provide certificate of training in Power Line Hazards for operators of heavy equipment.

C. Obtain written clearance from the power utility where equipment is used in close proximity to (within 5.5 metres) overhead or underground power lines.

D. Equip cranes with:

1. A mechanism which will effectively prevent the hook assembly from running into the top boom pulley.
2. A legible load chart.
3. A maintenance log book.

1.26 WORK STOPPAGE

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

PART 2 - PRODUCTS (NOT APPLICABLE)

EXECUTION (NOT APPLICABLE)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DEFINITIONS

.1 General: Basic Contract definitions are included in the Conditions of the Contract.

.2 *Approved*: When used to convey Owner's Representative's action on Contractor's submittals, applications, and requests, *approved* is limited to Owner's Representative's duties and responsibilities as stated in the Conditions of the Contract.

.3 *Directed*: A command or instruction by Owner's Representative. Other terms including *requested*, *authorized*, *selected*, *required*, and *permitted* have the same meaning as *directed*.

.4 *Indicated*: Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including *shown*, *noted*, *scheduled*, and *specified* have the same meaning as *indicated*.

.5 *Regulations*: Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

.6 *Furnish*: Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

.7 *Install*: Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

.8 *Provide*: Furnish and install, complete and ready for the intended use.

.9 *Project Site*: Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.3 INDUSTRY STANDARDS

.1 Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

.2 Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

.3 Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

.1 Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.4 ABBREVIATIONS AND ACRONYMS

.1 Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

.1 AA - Aluminium Association, 900 19th Street N.W., Washington, D.C., U.S.A. 20006 URL http://www.aluminum.org

.2 AASHTO - American Association of State Highway and Transportation Officials, 444 N Capitol Street N.W., Suite 249, Washington, D.C., U.S.A. 20001 URL http://www.aashto.org

.3 ACEC Association of Consulting Engineers of Canada,130 Albert Street, Ottawa, ON. K1P 5G4 URL http://www.acec.ca .

.4 AHA - American Hardboard Association, 1210W Northwest Hwy., Palatine, Illinois, U.S.A. 60067 URL : http://www.areat.com

.5 AITC - American Institute of Timber Construction, 7012 S. Revere Parkway, Suite 140, Englewood, Colorado, U.S.A. 80112 URL http://www.aitc-glulam.org

.6 AMCA - Air Movement and Control Association Inc., 30 West University Drive, Arlington Heights, Illinois, U.S.A. 60004-1893 URL http://www.amca.org

.7 ANSI - American National Standards Institute, 11 West 42nd Street, New York, New York, U.S.A. 10036 URL http://www.ansi.org

.8 APA - The Engineered Wood Association, P.O. Box 11700, Tacoma, Washington, U.S.A. 98411-0700 URL http://www.apawood.org

.9 API - American Petroleum Institute,1220 L St. Northwest, Washington, D.C., U.S.A. 20005-4070 URL http://www.api.org

.10 ARI - Air Conditioning and Refrigeration Institute, 4301 North Fairfax Drive, Suite 425, Arlington, Virginia, U.S.A. 22203 URL http://www.ari.org

.11 ASHRAE - American Society of Heating, Refrigeration and Air-Conditioning Engineers, 1791 Tullie Circle NE, Atlanta, Georgia, U.S.A. 30329 URL http://www.ashrae.org

.12 ASME - American Society of Mechanical Engineers, United Engineering Centre, Three Park Avenue, New York, New York, U.S.A. 10016-5990 URL http://www.asme.org

.13 ASPT Association for Asphalt Paving Technologists, 400 Selby Avenue, Suite 1, St. Paul, MN 55102 U.S.A. URL http://www.asphalt.org

.14 ASTM - American Society for Testing and Materials, 100 Barr Harbor Drive West, Conshohocken, Pennsylvania 19428-2959 URL http://www.astm.org

.15 AWCI - Association of the Wall and Ceiling Industries International, 803 West Broad Street, Suite 600, Falls Church, UA, U.S.A. 22046 URL http://www.awci.org

.16 AWMAC - Architectural Woodwork Manufacturers Association of Canada, 516 4 Street West, High River, Alberta T1V 1B6 URL http://www.awmac.com

.17 AWPA - American Wire Producer's Association, 6232 Roudsby, Alexandria, VA U.S.A. 22315-5285 URL http://www.awpa.org

.18 AWPA - American Wood Preservers' Association, P.O. Box 5690, Grandbury Texas, U.S.A. 76049-0690 URL http://www.awap.com

.19 AWS - American Welding Society, 550 N.W. LeJeune Road, Miami, Florida U.S.A. 33126 URL http://www.amweld.org

.20 AWWA - American Water Works Association, 6666 W. Quincy Avenue, Denver, Colorado, U.S.A. 80235 URL http://www.awwa.org

.21 CCA Canadian Construction Association,75 Albert St., Suite 400 Ottawa, Ontario, K1P 5E7 URL http://www.cca-acc.com

.22 CCDC Canadian Construction Documents Committee, Refer to ACEC, CCA, CSC or RAIC

.23 CITC Canadian Institute of Timber Construction, 200 Cooper Street, Ottawa, Ontario K2P 0G1

.24 CFFM - Canadian Forces Fire Marshal, 101 Colonel By Drive, 8NT MGen George R. Pearkes Bldg., Ottawa, Ontario K1A 0K2

.25 CGA - Canadian Gas Association, 20 Eglinton Avenue West, Suite 1305, Toronto, Ontario M4R 1K8 URL http://www.cga.ca

.26 CGSB - Canadian General Standards Board, Place du Portage, Phase III, 6B1, 11 Laurier Street, Hull, Quebec K1A 1G6 URL http://w3.pwgsc.gc.ca/cgsb

.27 CISC - Canadian Institute of Steel Construction, 201 Consumers Road, Suite 300, Willowdale, Ontario M2J 4G8 URL http://www.buildingweb.com/CISC

.28 CLA - Canadian Lumbermen's Association, 27 Goulburn Avenue, Ottawa, Ontario, K1N 8C7 URL http://www.cla.ca.ca

.29 CNLA - Canadian Nursery Landscape Association, RR #4, Stn. Main, 7856 Fifth Street, Milton, Ontario. L9T 2X8 URL http://www.canadanursery.com

.30 CRCA - Canadian Roofing Contractors Association, 155 Queen Street, Suite 130C, Ottawa, Ontario K1P 6L1 URL http://www.roofingcanada.com

.31 CSA - Canadian Standards Association International, 178 Rexdale Blvd., Toronto, Ontario M9W 1R3 URL http://www.csa-international.org

.32 CSC - Construction Specifications Canada, 100 Lombard Street, Suite 200, Toronto, Ontario M5C 1M3 URL http://www.csc-dcc.ca

.33 CSDFMA - Canadian Steel Door and Frame Manufacturing Association One Yonge Street, Suite 1400, Toronto, Ontario M5E 1J9

.34 CSPI - Corrugated Steel Pipe Institute, 201 Consumers Road, Suite 306, Willowdale, Ontario M2J 4G8

.35 CSSBI - Canadian Sheet Steel Building Institute, 652 Bishop St. N., Unit 2A, Cambridge, Ontario N3H 4V6 URL http://www.cssbi.ca

.36 CUFCA Canadian Urethane Foam Contractor's Association

.37 CWC - Canadian Wood Council, 1400 Blair Place, Suite 210, Ottawa, Ontario K1J 9B8 URL http://www.cwc.ca

.38 EC - Environment Canada, Conservation and Protection, Ottawa, Ontario KIA 0H3 URL http://www.ec.gc.ca

.39 EEMAC - Electrical and Electronic Manufacturers' Association of Canada, 5800 Explorer Drive, Suite 200, Mississauga, Ontario L4W 5K9 URL http://www.electrofed.ca

.40 EIMA EIFS Industry Manufacturer's Association, 3000 Corporate Center Drive, Suite 270, Morrow, Georgia U.S.A. 30260 URL http://www.eifsfacts.com

.41 FCC - Fire Commissioner of Canada, Place du Portage, Phase II, 165 rue Hotel de Ville, Hull Quebec K1A 0J2 URL http://www.hrdc-drhc.gc.ca

.42 IEEE - Institute of Electrical and Electronics Engineers, 345 East 47th Street, New York, New York U.S.A. 10017 URL http://www.ieee.org

.43 MPI - The Master Painters Institute, 4090 Graveley Street, Burnaby, BC V5C 3T6 URL http://www.paintinfo.com

.44 MSS - Manufacturers Standardization Society of the Valve and Fittings Industry, 127 Park Street, N.E., Vienna, Virginia U.S.A.22180

.45 NAAMM - National Association of Architectural Metal Manufacturers, 8 South Michigan Avenue, Suite 1000, Chicago, Illinois U.S.A. 60603 URL http://www.naamm.org

.46 NABA - National Air Barrier Association, 400-283 Bannatyne Avenue, Winnipeg, Manitoba R3B 3B2

.47 NEMA - National Electrical Manufacturers Association,1300 N. 17th Street, Suite 1847, Rosslyn, Virginia 22209 URL http://www.nema.org

.48 NFPA - National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101Quincy, Massachusetts, U.S.A. 02269-9101 URL http://www.nfpa.org

.49 NFSA - National Fire Sprinkler Association, 40 Jon Barrett Road, P.O. Box 1000, Patterson, New York, U.S.A. 12563 URL http://www.nfsa.org

.50 NHLA - National Hardwood Lumber Association, P.O. Box 34518, Memphis, Tennessee, U.S.A 38184-0518 URL http://www.natlhardwood.org

.51 NLGA - National Lumber Grades Authority, 406 First Capital Place, New Westminster, B.C. V3M 6G2

.52 NRC - National Research Council, Montreal Road, Ottawa, Ontario K1A 0S2 URL http://www.nrc.gc.ca
.53 NSPE National Society of Professional Engineers, 1420 King Street, Alexandria, VA U.S.A. 22314-2794 URL http://www.nspe.org
.54 PCI - Prestressed Concrete Institute, 209 W. Jackson Blvd., Suite 500, Chicago, Illinois, U.S.A. 60606 URL http://www.pci.org
.55 PEI - Porcelain Enamel Institute, P.O. Box 158541, 4004 Hillsboro Pike, Suite 224-B Nashville, TN, U.S.A. 37215 URL http://www.porecelainenamel.com
.56 QPL - Qualification Program List, c/o Canadian General Standards Board, Place du Portage, Phase III, 6B1, 11 Laurier Street, Hull, Quebec K1A 1G6 URL http://www.pwgsc.gc.ca/cgsb
.57 RAIC Royal Architectural Institute of Canada, 55 Murray Street, Suite 330, Ottawa, Ontario, K1N 5M3 URL http://www.raic.org
.58 SCC - Standards Council of Canada, 200 Albert Street, Suite 2000, Ottawa, Ontario K1P 6N7 URL http://www.scc.ca
.59 SSPC - The Society for Protective Coatings, 40 24th Street, Pittsburgh, Pennsylvania 15222-4656 URL http://www.sspc.org
.60 TPI - Truss Plate Institute, 583 D'Onofrio Drive, Suite 200, Madison, WI, U.S.A. 53719 URL http://www.tpinst.org
.61 TTMAC - Terrazzo, Tile and Marble Association of Canada, 30 Capston Gate, Unit 5 Concord, Ontario L4K 3E8 URL http://www.ttmac.com
.62 UL - Underwriters' Laboratories, 333 Pfingsten Road, Northbrook, Illinois, U.S.A. 60062 URL http://www.ul.com
.63 ULC - Underwriters' Laboratories of Canada, 7 Crouse Road, Toronto, Ontario M1R 3A9 URL http://www.ulc.ca

.2 Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.
.1 NBCC – National Building Code of Canada
.2 NFCC – National Fire Code of Canada
.3 NFPA 101 - National Fire protection Association Life Safety Code

.3 Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.
.1 PWGSC – Public Works and Government Services Canada
.2 DND – Department of National Defence.

.4 Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.
.1 -

.5 Provincial Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.
.1 -

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

.1 Types of items described in this Section:
  .1 Administrative and procedural requirements for contract closeout, including, but not limited to, the following:
    .1 Substantial Completion procedures.
    .2 Final completion procedures.
    .3 Warranties.
    .4 Final cleaning.

.2 Types of items you will not find described in this Section:
  .1 Submitting final completion construction photographic documentation.
  .2 Progress cleaning of project site.
  .3 Operation and maintenance manual requirements.
  .4 Submitting record drawings, record specifications, and record product data.
  .5 Requirements for instructing owner's personnel.
  .6 Divisions 02 through 49 sections for specific closeout and special cleaning requirements for the work in those Sections.

1.3 SUBSTANTIAL COMPLETION

.1 Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete with request.
  .1 Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
  .2 Advise Owner of pending insurance changeover requirements.
  .3 Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
  .4 Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
  .5 Prepare and submit Project Record Documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
  .6 Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
  .7 Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
  .8 Complete startup testing of systems.
  .9 Submit test/adjust/balance records.
  .10 Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
  .11 Advise Owner of changeover in heat and other utilities.
  .12 Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
  .13 Complete final cleaning requirements, including touchup painting.
  .14 Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

.15 Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.

.2 Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Owner's Representative will either proceed with inspection or notify Contractor of unfulfilled requirements. Owner's Representative will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Owner's Representative, that must be completed or corrected before certificate will be issued.
- .1 Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
- .2 Results of completed inspection will form the basis of requirements for final completion.

1.4 FINAL COMPLETION

.1 Preliminary Procedures: Before requesting final inspection for determining final completion, complete the following:
- .1 Submit a final Application for Payment according to Division 01 Section *Payment Procedures*.
- .2 Submit certified copy of Owner's Representative's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Owner's Representative. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.

.2 Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Owner's Representative will either proceed with inspection or notify Contractor of unfulfilled requirements. Owner's Representative will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
- .1 Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

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

1.6 WARRANTIES

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

.2 Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.

.1 Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 215-by-280-mm paper.

.2 Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.

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

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

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

.1 Use cleaning products that meet Green Seal GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 FINAL CLEANING

.1 General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

.2 Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

.1 Complete the following cleaning operations, as applicable to the project, before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:

.1 Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.

.2 Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.

.3 Rake grounds that are neither planted nor paved to a smooth, even-textured surface.

.4 Remove tools, construction equipment, machinery, and surplus material from Project site.

.5 Remove snow and ice to provide safe access to building.

.6 Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.

.7 Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.

.8 Sweep concrete floors broom clean in unoccupied spaces.

.9 Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.

.10 Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.

.11 Remove labels that are not permanent.

.12 Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
  .1 Do not paint over *ULC* and other required labels and identification, including mechanical and electrical nameplates.

.13 Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.

.14 Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.

.15 Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.

.16 Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.

.17 Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter upon inspection.
  .1 Clean HVAC system in compliance with NADCA Standard 1992-01. Provide written report upon completion of cleaning upon request.

.18 Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

.19 Leave Project clean and ready for occupancy.

.20 If final cleaning is not to a standard acceptable to the owner, the owner, with prior notice to the contractor, may opt to have owners cleaning staff perform final cleaning at a cost to the contractor. Full owner burden rates will apply.

.3 Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid Project of rodents, insects, and other pests if pest problems are suspected by the Owner's Representative. Prepare a report.

.4 Construction Waste Disposal: Comply with waste disposal requirements in Division 01 Section *Construction Waste Management and Disposal*.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

.2 OPR and BoD documentation are included by reference for information only.

1.2 SUMMARY

.1 Types of items described in this Section:
  .1 General requirements that apply to implementation of commissioning without regard to specific systems, assemblies, or components.

.2 Types of items you will not find described in this Section:
  .1 Commissioning process activities for building exterior enclosure, roof, and foundation systems, assemblies, equipment, and components.
  .2 Commissioning process activities for building interiors construction, stairways, and finish systems and assemblies.
  .3 Commissioning process activities for conveying systems, assemblies, equipment, and components.
  .4 Commissioning process activities for fire-suppression systems, assemblies, equipment, and components.
  .5 Commissioning process activities for plumbing systems, assemblies, equipment, and components.
  .6 Commissioning process activities for HVAC systems, assemblies, equipment, and components.
  .7 Commissioning process activities for integrated automation systems, assemblies, equipment, and components.
  .8 Commissioning process activities for electrical systems, assemblies, equipment, and components.
  .9 Commissioning process activities for communications systems, assemblies, equipment, and components.
  .10 Commissioning process activities for electronic safety and security systems, assemblies, equipment, and components.

1.3 DEFINITIONS

.1 BoD: Basis of Design. A document that records concepts, calculations, decisions, and product selections used to meet the OPR and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.

.2 Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.

.3 CxA: Commissioning Authority.

.4 OPR: Owner's Project Requirements. A document that details the functional requirements of a project and the expectations of how it will be used and operated. These include Project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information.

.5 Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean *as-built* systems, subsystems, equipment, and components.

1.4 COMMISSIONING TEAM

.1 Members Appointed by Contractor(s): Individuals, each having the authority to act on behalf of the entity he or she represents, explicitly organized to implement the commissioning process through coordinated action. The commissioning team shall consist of, but not be limited to, representatives of Contractor, including Project superintendent and subcontractors, installers, suppliers, and specialists deemed appropriate by the CxA.

.2 Members Appointed by Owner:
- .1 CxA: The designated person, company, or entity that plans, schedules, and coordinates the commissioning team to implement the commissioning process. Owner will engage the CxA under a separate contract.
- .2 Representatives of the facility user and operation and maintenance personnel.
- .3 Owner's Representative and engineering design professionals.

1.5 OWNER'S RESPONSIBILITIES

.1 Provide the OPR documentation to the CxA and Contractor for information and use.

.2 Assign operation and maintenance personnel and schedule them to participate in commissioning team activities.

.3 Provide the BoD documentation, prepared by Owner's Representative and approved by Owner, to the CxA and Contractor for use in developing the commissioning plan, systems manual, and operation and maintenance training plan.

1.6 CONTRACTOR'S RESPONSIBILITIES

.1 Contractor shall assign representatives with expertise and authority to act on its behalf and shall schedule them to participate in and perform commissioning process activities including, but not limited to, the following:
- .1 Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend corrective action.
- .2 Cooperate with the CxA for resolution of issues recorded in the Issues Log.
- .3 Attend commissioning team meetings held on a variable basis.
- .4 Integrate and coordinate commissioning process activities with construction schedule.
- .5 Review and accept construction checklists provided by the CxA.
- .6 Complete paper construction checklists as Work is completed and provide to the Commissioning Authority on a weekly basis.
- .7 Review and accept commissioning process test procedures provided by the Commissioning Authority.
- .8 Complete commissioning process test procedures.

1.7 CxA'S RESPONSIBILITIES

.1 Organize and lead the commissioning team.

.2 Provide commissioning plan.

.3 Convene commissioning team meetings.

.4 Provide Project-specific construction checklists and commissioning process test procedures.

.5 Verify the execution of commissioning process activities using random sampling. The sampling rate may vary from 1 to 100 percent. Verification will include, but is not limited to, equipment submittals, construction checklists, training, operating and maintenance data, tests, and test reports to verify compliance with the OPR. When a random sample does not meet the requirement, the CxA will report the failure in the Issues Log.

.6 Prepare and maintain the Issues Log.

.7 Prepare and maintain completed construction checklist log.

.8 Witness systems, assemblies, equipment, and component startup.

.9 Compile test data, inspection reports, and certificates; include them in the systems manual and commissioning process report.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

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's Representative.

.3 Shop drawings to show:

- .1 Mounting arrangements.
- .2 Operating and maintenance clearances.

.4 Shop drawings and product data accompanied by:

- .1 Detailed drawings of bases, supports, and anchor bolts.
- .2 Acoustical sound power data, where applicable.
- .3 Points of operation on performance curves.
- .4 Manufacturer to certify current model production.
- .5 Certification of compliance to applicable codes.

.5 In addition to transmittal letter referred to in Section 01 33 00 - Submittal Procedures: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.

.6 Closeout Submittals:

- .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
- .2 Operation and maintenance manual approved by, and final copies deposited with, Owner's Representative before final inspection.
- .3 Operation data to include:
  - .1 Control schematics for systems including environmental controls.
  - .2 Description of systems and their controls.
  - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
  - .4 Operation instruction for systems and component.
  - .5 Description of actions to be taken in event of equipment failure.
  - .6 Valves schedule and flow diagram.
  - .7 Colour coding chart.

.4 Maintenance data to include:

.1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.

.2 Data to include schedules of tasks, frequency, tools required and task time.

.5 Performance data to include:

.1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.

.2 Equipment performance verification test results.

.3 Special performance data as specified.

.4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

.6 Approvals:

.1 Submit 2 copies of draft Operation and Maintenance Manual to Owner’s Representative for approval. Submission of individual data will not be accepted unless directed by Engineer / Architect.

.2 Make changes as required and re-submit as directed by Owner’s Representative.

.7 Additional data:

.1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.

.8 Site records:

.1 Owner’s Representative will provide 1 set of reproducible mechanical drawings or AutoCAD files. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.

.2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.

.3 Use different colour for each service.

.4 Make available for reference purposes and inspection.

.9 As-built drawings:

.1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.

.2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).

.3 Submit to Owner’s Representative for approval and make corrections as directed.

.4 Perform testing, adjusting and balancing for HVAC using as-built drawings.

.5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.

.10 Submit copies of as-built drawings for inclusion in final TAB report.

1.3 QUALITY ASSURANCE

.1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.

.2 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 head gasket set for each heat exchanger.
.4 One glass for each gauge glass.
.5 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.

.2 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Section 01 78 00 - Closeout Submittals.

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

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Waste Management and Disposal:

.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 PRODUCTS

2.1 MATERIALS

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

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 Submit tests as specified in other sections of this specification.

.2 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

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

3.4 DEMONSTRATION

.1 Owner’s Representative will use equipment and systems for test purposes prior to acceptance. Contractor to supply labour, material, and instruments required for testing.

.2 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

.3 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.

.4 Instruction duration time requirements as specified in appropriate sections.

.5 Owner’s Representative may record these demonstrations on video tape for future reference.

3.5 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 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's Representative.

.3 Shop drawings to show:

- .1 Mounting arrangements.
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.4 Shop drawings and product data accompanied by:

- .1 Detailed drawings of bases, supports, and anchor bolts.
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- .4 Manufacturer to certify current model production.
- .5 Certification of compliance to applicable codes.

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  - .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.
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.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.

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.1 Submit 2 copies of draft Operation and Maintenance Manual to Owner’s Representative for approval. Submission of individual data will not be accepted unless directed by Owner’s Representative.

.2 Make changes as required and re-submit as directed by Owner’s Representative.

.7 Additional data:

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.8 Site records:

.1 Owner’s Representative will provide 1 set of reproducible mechanical drawings or AutoCAD files. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.

.2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.

.3 Use different colour for each service.

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.9 As-built drawings:

.1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.

.2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).

.3 Submit to Owner’s Representative for approval and make corrections as directed.

.4 Perform testing, adjusting and balancing for HVAC using as-built drawings.

.5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.

.10 Submit copies of as-built drawings for inclusion in final TAB report.

1.3 QUALITY ASSURANCE

.1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.

.2 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.

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.1 Owner’s Representative will use equipment and systems for test purposes prior to acceptance. Contractor to supply labour, material, and instruments required for testing.

.2 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

.3 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.

.4 Instruction duration time requirements as specified in appropriate sections.

.5 Owner’s Representative may record these demonstrations on video tape for future reference.

3.5 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 DESCRIPTION OF WORK

.1 Provide labour, materials, services and equipment necessary to complete the work of this section. Work includes, but is not limited to the following:
  .1 Supply and install new thermal insulation for piping and piping accessories as required for installation of new split system evaporators and rooftop condensers, with all associated piping.

1.2 REFERENCES

.1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE).
  .1 ASHRAE Standard 90.1, Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings (Including all Addenda).

.2 American Society for Testing and Materials (ASTM)
  .1 ASTM B209M, Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate Metric.
  .2 ASTM C335, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
  .3 ASTM C411, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
  .4 ASTM C449/C449M, Standard Specification for Mineral Fibre-Hydraulic-Setting Thermal Insulating and Finishing Cement.
  .5 ASTM C533 Standard specification for Calium Silicate Insulation Block and Pipe.
  .6 ASTM C547 Standard Specification for Mineral Fibre Pipe Insulation.
  .7 ASTM C795, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
  .8 ASTM C921, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
  .9 ASTM D1784, Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.

.3 Canadian General Standards Board (CGSB)
  .1 CGSB 51-GP-52Ma, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
  .2 CAN/CGSB-51.53, Poly (Vinyl Chloride) Jacketting Sheet, for Insulated Pipes, Vessels and Round Ducts.

.4 Department of Justice Canada (Jus)
  .1 Canadian Environmental Assessment Act (CEAA), c. 37.
  .2 Canadian Environmental Protection Act, (CEPA), c. 33.
  .3 Transportation of Dangerous Goods Act (TDGA), c. 34.

.5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  .1 Material Safety Data Sheets.

.6 Manufacturer's Trade Associations
  .1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards.

.7 Underwriters' Laboratories of Canada (ULC)
  .1 CAN/ULC-S102, Surface Burning Characteristics of Building Materials and Assemblies.

.8 National Energy Code for Buildings (NECB

1.3 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

1.4 SUBMITTALS

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

.2 Product Data:
.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
.1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) 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

1.5 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.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, handle, store and protect materials in accordance with 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.

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 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.

.5 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 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's Representative.
- .3 Minimum service temperatures: -20°C.
- .4 Maximum service temperature: 65°C.
- .5 Moisture vapour transmission: 0.02 perm.
- .6 Thickness: 0.55 mm.
- .7 Fastenings:
  - .1 Use solvent weld adhesive compatible with insulation to seal laps and joints.
  - .2 Tacks.
  - .3 Pressure sensitive vinyl tape of matching colour.

.8 Special requirements:
.1 Indoor: flame spread rating 25, smoke developed rating 50
.2 Outdoor: UV rated material at least 0.5 mm thick.

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

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

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

2.7 WEATHERPROOF CAULIKING FOR JACKETS INSTALLED OUTDOORS

.1 Caulking to: Section 07 92 00 - Joint Sealants

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 Surfaces to be clean, dry, free from foreign material.

3.3 INSTALLATION

.1 Install in accordance with TIAC National Standards.

.2 Apply materials in accordance with manufacturers instructions and this specification.

.3 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm.

.4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
.1 Install hangers, supports outside vapour retarder jacket.

.5 Supports, Hangers:

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

3.4 INSULATION OF ELASTOMERIC INSULATON

.1 Insulation to remain dry. Overlaps to manufacturers instructions. Ensure tight joints.

.2 Provide vapour retarder as recommended by manufacturer.

3.5 PIPING INSULATION SCHEDULES

.1 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

.2 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.

.3 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***
RWL and RWP		A-3	25	25	25	25	25	25
Roof Drain Body		C-2	25	25	25	25	25	25

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

3.6 CLEANING

.1 Clean adjacent surfaces immediately and leave Work neat and clean.

.2 Remove excess and droppings, using recommended cleaners as work progresses.

.3 Upon completion remove surplus materials, rubbish, tools and equipment.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

.1 Section includes:

.1 The installation of drainage waste and vent piping – cast iron and copper.

1.2 RELATED SECTIONS

.1 Section 01 35 29.06 - Health and Safety Requirements.

.2 Section 01 74 21 - Construction/Demolition Waste Management and Disposal

.3 Section 23 05 05 - Installation of Pipework.

1.3 REFERENCES

.1 American Iron and Steel Institute (AISI)

.1 AISI 304, Stainless Steel.

.2 American Society for Testing and Materials (ASTM)

.1 ASTM B32, Specification for Solder Metal.
.2 ASTM B306, Specification for Copper Drainage Tube (DWV).
.3 ASTM C564, Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

.3 Canadian Standards Association (CSA International)

.1 CAN/CSA-B70, Cast Iron Soil Pipe, Fittings and Means of Joining.
.2 CAN/CSA- B125.3, Plumbing Fittings.

1.4 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.

1.5 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.

1.6 SUBMITTALS:

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

.2 Product Data:

.1 Provide manufacturer's printed product literature and datasheets for adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.

PART 2 PRODUCTS

2.1 COPPER TUBE AND FITTINGS

.1 Above ground sanitary, storm and vent Type DWV to: ASTM B306.

.1 Fittings.

.1 Cast brass: to CAN/CSA-B125.

.2 Wrought copper: to CAN/CSA-B125.

.2 Solder: tin-lead, 50:50, type 50A or tin-antimomy only 95:5, type TA to ASTM B32.

2.2 CAST IRON PIPING AND FITTINGS

.1 Buried sanitary, storm and vent minimum NPS2, to: CAN/CSA-B70, with one layer of protective coating of butimous.

.1 Joints.

.1 Mechanical joints.

.1 Neoprene or butyl rubber compression gaskets: to ASTM C564 or CAN/CSA-B70.

.2 Stainless steel clamps.

.2 Hub and spigot.

.1 Neoprene gasket : to CSA B70.

.2 Cold caulking compounds.

.2 Above ground sanitary, storm and vent: to CAN/CSA-B70.

.1 Joints.

.1 Mechanical joints.

.1 Neoprene or butyl rubber compression gaskets with stainless steel clamps.

2.3 STAINLESS STEEL PIPE AND FITTINGS

.1 Above ground and buried sanitary, storm and vent, NPS 2 to NPS 10, stainless steel, type AISI 304.

.1 Mechanical Joints:

.1 Push-fit socket joint with EPDM sealing ring.

PART 3 EXECUTION

3.1 INSTALLATION

.1 In accordance with Section 23 05 05 – Installation of Pipework and by certified journeyperson.

.2 Install in accordance with Canadian Plumbing Code and local authority having jurisdiction.

3.2 TESTING

.1 Pressure test buried systems before backfilling.

.2 Hydraulically test to verify grades and freedom from obstructions.

3.3 PERFORMANCE VERIFICATION

.1 Cleanouts:

- .1 Ensure accessible and that access doors are correctly located.
- .2 Open, cover with linseed oil and re-seal.
- .3 Verify that cleanout rods can probe as far as the next cleanout, at least.

.2 Test to ensure traps are fully and permanently primed.

.3 Storm water drainage:

- .1 Verify domes are secure.
- .2 Ensure weirs are correctly sized and installed correctly.
- .3 Verify provisions for movement of roof system.

.4 Ensure that fixtures are properly anchored, connected to system and effectively vented.

.5 Affix applicable label (storm, sanitary, vent, pump discharge, etc.) c/w directional arrows every floor or 4.5 m (whichever is less).

.6 Provide copies of test reports for Commissioning Manuals.

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's Representative.

.3 Shop drawings to show:

- .1 Mounting arrangements.
- .2 Operating and maintenance clearances.

.4 Shop drawings and product data accompanied by:

- .1 Detailed drawings of bases, supports, and anchor bolts.
- .2 Acoustical sound power data, where applicable.
- .3 Points of operation on performance curves.
- .4 Manufacturer to certify current model production.
- .5 Certification of compliance to applicable codes.

.5 In addition to transmittal letter referred to in Section 01 33 00 - Submittal Procedures: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.

.6 Closeout Submittals:

- .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
- .2 Operation and maintenance manual approved by, and final copies deposited with, Owner's Representative before final inspection.
- .3 Operation data to include:
  - .1 Control schematics for systems including environmental controls.
  - .2 Description of systems and their controls.
  - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
  - .4 Operation instruction for systems and component.
  - .5 Description of actions to be taken in event of equipment failure.
  - .6 Valves schedule and flow diagram.
  - .7 Colour coding chart.

.4 Maintenance data to include:

.1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.

.2 Data to include schedules of tasks, frequency, tools required and task time.

.5 Performance data to include:

.1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.

.2 Equipment performance verification test results.

.3 Special performance data as specified.

.4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

.6 Approvals:

.1 Submit 2 copies of draft Operation and Maintenance Manual to Owner’s Representative for approval. Submission of individual data will not be accepted unless directed by Owner’s Representative.

.2 Make changes as required and re-submit as directed by Owner’s Representative.

.7 Additional data:

.1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.

.8 Site records:

.1 Owner’s Representative will provide 1 set of reproducible mechanical drawings or AutoCAD files. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.

.2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.

.3 Use different colour for each service.

.4 Make available for reference purposes and inspection.

.9 As-built drawings:

.1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.

.2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).

.3 Submit to Owner’s Representative for approval and make corrections as directed.

.4 Perform testing, adjusting and balancing for HVAC using as-built drawings.

.5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.

.10 Submit copies of as-built drawings for inclusion in final TAB report.

1.3 QUALITY ASSURANCE

.1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.

.2 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 head gasket set for each heat exchanger.
.4 One glass for each gauge glass.
.5 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.

.2 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Section 01 78 00 - Closeout Submittals.

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

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Waste Management and Disposal:

.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 PRODUCTS

2.1 MATERIALS

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

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. 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:

.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’s Representative will use equipment and systems for test purposes prior to acceptance. Contractor to supply labour, material, and instruments required for testing.

.2 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

.3 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.

.4 Instruction duration time requirements as specified in appropriate sections.

.5 Owner’s Representative may record these demonstrations on video tape for future reference.

3.5 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 RELATED SECTIONS

.1 Section 01 74 11 – 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's Representative.

1.3 QUALITY ASSURANCE

.1 Installers to be certified to journeyperson.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 CONNECTIONS TO EQUIPMENT

.1 In accordance with manufacturer's instructions unless otherwise indicated.

.2 Use valves and either unions or flanges for isolation and ease of maintenance and assembly.

.1 Unions are not required in installations using grooved mechanical couplings (The couplings shall serve as unions).

.3 Use double swing joints when equipment mounted on vibration isolation and when piping subject to movement.

.4 The flexible type grooved joint couplings may be used in lieu of a flexible connector at equipment connections for vibration attenuation and stress relief. Couplings shall be placed in close proximity to the source of the vibration, as per manufacturer's recommendations.

3.2 CLEARANCES

.1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer.

.2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer or as indicated (whichever is greater) without interrupting operation of other system, equipment, components.

3.3 DRAINS

.1 Install piping with grade in direction of flow except as indicated.

.2 Install drain valve at low points in piping systems, at equipment and at section isolating valves.

.3 Pipe each drain valve discharge separately to above floor drain. Discharge to be visible.

.4 Drain valves: NPS 3/4 gate or globe valves unless indicated otherwise, with hose end male thread, cap and chain.

3.4 AIR VENTS

.1 Install automatic air vents at high points in piping systems.

.2 Install isolating valve at each automatic air valve.

.3 Install drain piping to approved location and terminate where discharge is visible.

3.5 DIELECTRIC WATERWAY FITTINGS AND COUPLINGS

.1 General: Compatible with system, to suit pressure rating of system.

.2 Locations: Where dissimilar metals are joined.

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

.1 Waterway fittings shall be complete with thermoplastic liner.

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

.1 Waterway fittings shall be complete with thermoplastic liner.

3.6 PIPEWORK INSTALLATION

.1 Installation by certified journeyperson.

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

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

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

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

.4 Protect openings against entry of foreign material.

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

.6 Assemble piping using fittings manufactured to ANSI standards.

.7 Saddle type branch fittings may be used on mains if branch line is no larger than half the size of main.

.1 Hole saw (or drill) and ream main to maintain full inside diameter of branch line prior to welding saddle.

.8 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.

.9 Install concealed pipework to minimize furring space, maximize headroom, conserve space.

.10 Slope piping, except where indicated, in direction of flow for positive drainage and venting.

.11 Install, except where indicated, to permit separate thermal insulation of each pipe.

.12 Group piping wherever possible and as indicated.

.13 Ream pipes, remove scale and other foreign material before assembly.

.14 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.

.15 Provide for thermal expansion as indicated.

.16 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.

.17 Check Valves:

.1 Install silent check valves on discharge of pumps and in vertical pipes with downward flow and elsewhere as indicated.

.2 Install swing check valves in horizontal lines on discharge of pumps and elsewhere as indicated.

3.7 SLEEVES

.1 General: Install where pipes pass through masonry, concrete structures, fire rated assemblies, and elsewhere as indicated.

.2 Material: Schedule 40 black steel pipe.

.3 Construction: Foundation walls and where sleeves extend above finished floors to have annular fins continuously welded on at mid-point.

.4 Sizes: 6 mm minimum clearance between sleeve and uninsulated pipe or between sleeve and insulation.

.5 Installation:

.1 Concrete, masonry walls, concrete floors on grade: Terminate flush with finished surface.

.2 Other floors: Terminate 25 mm above finished floor.

.3 Before installation, paint exposed exterior surfaces with heavy application of zinc-rich paint.

.6 Sealing:

.1 Foundation walls and below grade floors: Fire retardant, waterproof non-hardening mastic.

.2 Elsewhere: Provide space for firestopping. Maintain fire rating integrity.

.3 Sleeves installed for future use: Fill with lime plaster or other easily removable filler.

.4 Ensure no contact between copper pipe or tube and sleeve.

3.8 ESCUTCHEONS

.1 Install on pipes passing through walls, partitions, floors, and ceilings in finished areas.

.2 Construction: One piece type with set screws. Chrome or nickel plated brass or type 302 stainless steel.

.3 Sizes: Outside diameter to cover opening or sleeve. Inside diameter to fit around pipe or outside of insulation if so provided.

3.9 PREPARATION FOR FIRESTOPPING

.1 Material and installation within annular space between pipes, ducts, insulation and adjacent fire separation to Section 07 84 00 - Firestopping.

.2 Uninsulated unheated pipes not subject to movement: No special preparation.

.3 Uninsulated heated pipes subject to movement: Wrap with non-combustible smooth material to permit pipe movement without damaging firestopping material or installation, or install per manufacturer's recommendation as specified within the associated approval.

.4 Insulated pipes and ducts: Ensure integrity of insulation and vapour barriers.

3.10 FLUSHING OUT OF PIPING SYSTEMS

.1 In accordance with Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.

.2 Before start-up, clean interior of piping systems in accordance with requirements of Section 01 74 11 - 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's Representative, 48 hours minimum prior to performance of pressure tests.

.2 Pipework: Test as specified in relevant sections of other sections or Divisions.

.3 Maintain specified test pressure without loss for 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's Representative. Work to be carried out in off hours after 5 p.m., weekends or holidays.

.6 Pay costs for repairs or replacement, retesting, and making good. Owner's Representative to determine whether repair or replacement is appropriate.

.7 Insulate or conceal work only after approval and certification of tests by Owner's Representative.

3.12 EXISTING SYSTEMS

.1 Connect into existing piping systems at times approved by Owner's Representative. Work to be carried out off hours after 5 p.m., weekends or holidays.

.2 Request written approval ten (10) working days minimum, prior to commencement of work.

.3 Be responsible for damage to existing plant by this work.

.4 Ensure daily clean-up of existing areas.

END OF SECTION

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 Materials Safety Data Sheets (MSDS).

.5 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)

.1 MSS SP-58, Pipe Hangers and Supports - Materials, Design and Manufacture.
.2 ANSI/MSS SP-69, Pipe Hangers and Supports - Selection and Application.
.3 MSS SP-89, Pipe Hangers and Supports - Fabrication and Installation Practices.

.6 Underwriter's Laboratories of Canada (ULC)

1.4 SYSTEM DESCRIPTION

.1 Design Requirements

.1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.

.2 Base maximum load ratings on allowable stresses prescribed by MSS SP58 or ASME B31.1.

.3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.

.4 Design hangers and supports to support systems under all conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.

.5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment to be in accordance with MSS SP58.

.2 Performance Requirements

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

1.5 SUBMITTALS

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

.2 Shop drawings: submit drawings stamped and signed for approval by Owner's Representative.

.3 Submit shop drawings and product data for following items:

.1 Bases, hangers and supports.

.2 Connections to equipment and structure.

.3 Structural assemblies.

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

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

.1 Owner's Representative will make available 1 copy of systems supplier's installation instructions.

.5 Closeout Submittals:

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

1.6 QUALITY ASSURANCE

.1 Health and Safety:

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

1.7 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.

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

.2 Waste Management and Disposal:

.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 PRODUCTS

2.1 GENERAL

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

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

2.2 PIPE HANGERS

.1 Finishes:

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

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

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

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

.1 Cold piping NPS 2 maximum: malleable iron C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip.

.1 Rod: 9 mm UL listed, 13 mm FM approved.

.2 Cold piping NPS 2 1/2 or greater, hot piping: Malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, UL listed, FM approved where required to MSS-SP58 and MSS-SP69.

.3 Upper attachment structural: Suspension from upper flange of I-Beam.

.1 Cold piping NPS 2 maximum: Ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, UL listed FM approved where required to MSS SP69.

.2 Cold piping NPS 2 1/2 or greater, all hot piping: Malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nut UL listed, FM approved where required.

.4 Upper attachment to concrete.

.1 Ceiling: Carbon steel welded eye rod, clevis plate, clevis pin and cotters with weldless forged steel eye nut. Ensure eye 6 mm minimum greater than rod diameter.

.2 Concrete inserts: wedge shaped body with knockout protector plate UL listed FM approved where required to MSS SP-69.

.5 Shop and field-fabricated assemblies.

.1 Trapeze hanger assemblies: MSS SP-89.

.2 Steel brackets: MSS SP-89.

.3 Sway braces for seismic restraint systems: to MSS SP-89.

.6 Hanger rods: threaded rod material to MSS SP-58.

.1 Ensure that hanger rods are subject to tensile loading only.

.2 Provide linkages where lateral or axial movement of pipework is anticipated.

.3 Do not use 22 mm or 28 mm rod.

.7 Pipe attachments: material to MSS SP-58.

.1 Attachments for steel piping: carbon steel galvanized.

.2 Attachments for copper piping: copper plated black steel.

.3 Use insulation saddles for hot pipework.

.4 Oversize pipe hangers and supports for insulated pipes.

.8 Adjustable clevis: material to MSS SP-69, UL listed FM approved, where required clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.

.1 Ensure "U" has hole in bottom for rivetting to insulation shields.

.9 Yoke style pipe roll: carbon steel yoke, rod and nuts with cast iron roll, to MSS SP-69.

.10 U-bolts: carbon steel to MSS SP-69 with 2 nuts at each end to ASTM A563.

.1 Finishes for steel pipework: galvanized.

.2 Finishes for copper, glass, brass or aluminum pipework: black with formed portion plastic coated or epoxy coated.

.11 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP-69.

2.3 RISER CLAMPS

.1 Steel or cast iron pipe: galvanized black carbon steel to MSS SP-58, type 42, UL listed FM approved where required.

.2 Copper pipe: carbon steel copper plated to MSS SP-58, type 42.

.3 Bolts: to ASTM A307.

.4 Nuts: to ASTM A563.

2.4 INSULATION PROTECTION SHIELDS

.1 Insulated cold piping:

.1 64 kg/m^3 density insulation plus insulation protection shield to: MSS SP-69, galvanized sheet carbon steel. Length designed for maximum 3 m span.

.2 Insulated hot piping:

.1 Curved plate 300 mm long, with edges turned up, welded-in centre plate for pipe sizes NPS 12 and over, carbon steel to comply with MSS SP-69.

2.5 CONSTANT SUPPORT SPRING HANGERS

.1 Springs: alloy steel to ASTM A125, shot peened, magnetic particle inspected, with +/-5% spring rate tolerance, tested for free height, spring rate, loaded height and provided with Certified Mill Test Report(CMTR).

.2 Load adjustability: 10 % minimum adjustability each side of calibrated load. Adjustment without special tools. Adjustments not to affect travel capabilities.

.3 Provide upper and lower factory set travel stops.

.4 Provide load adjustment scale for field adjustments.

.5 Total travel to be actual travel + 20%. Difference between total travel and actual travel 25 mm minimum.

.6 Individually calibrated scales on each side of support calibrated prior to shipment, complete with calibration record.

2.6 VARIABLE SUPPORT SPRING HANGERS

.1 Vertical movement: 13 mm minimum, 50 mm maximum, use single spring pre-compressed variable spring hangers.

.2 Vertical movement greater than 50 mm: use double spring pre-compressed variable spring hanger with 2 springs in series in single casing.

.3 Variable spring hanger to be complete with factory calibrated travel stops. Provide certificate of calibration for each hanger.

.4 Steel alloy springs: to ASTM A125, shot peened, magnetic particle inspected, with +/-5 % spring rate tolerance, tested for free height, spring rate, loaded height and provided with CMTR.

2.7 EQUIPMENT SUPPORTS

.1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel meeting requirements of Section 05 12 23 - Structural Steel for Buildings. Submit calculations with shop drawings.

2.8 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

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

2.9 PLATFORMS AND CATWALKS

.1 To Section 05 50 00 - Metal Fabrication.

2.10 HOUSE-KEEPING PADS

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

.2 Concrete: to Section 03 30 00 - Cast-in-place Concrete by Division 3.

2.11 OTHER EQUIPMENT SUPPORTS

.1 From structural grade steel meeting requirements of Section 05 12 23 - Structural Steel for Buildings.

.2 Submit structural calculations with shop drawings.

PART 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install in accordance with:

.1 Manufacturer's instructions and recommendations.

.2 Vibration Control Devices:

.1 Install on piping systems at pumps, boilers, chillers, cooling towers, elsewhere as indicated.

.3 Clamps on riser piping:

.1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.

.2 Bolt-tightening torques to be to industry standards.

.3 Steel pipes: Install below coupling or shear lugs welded to pipe.

.4 Cast iron pipes: Install below joint.

.4 Clevis plates:

.1 Attach to concrete with 4 minimum concrete inserts, one at each corner.

.5 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.

.6 Use approved constant support type hangers where:

.1 vertical movement of pipework is 13 mm or more,

.2 transfer of load to adjacent hangers or connected equipment is not permitted.

.7 Use variable support spring hangers where:

.1 transfer of load to adjacent piping or to connected equipment is not critical.

.2 variation in supporting effect does not exceed 25 % of total load.

3.3 HANGER SPACING

.1 Plumbing piping: most stringent requirements of Canadian Plumbing Code

.2 Fire protection: to applicable fire code.

.3 Gas and fuel oil piping: up to NPS 1/2: every 1.8 m.

.4 Copper piping: up to NPS 1/2: every 1.5 m.

.5 Hydronic, steam, condensate, rigid, and flexible joint roll groove pipe: in accordance with table below, but not less than one hanger at joints.

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

.6 Within 300 mm of each elbow.

.7 Pipework greater than NPS 12: to MSS SP69.

3.4 HANGER INSTALLATION

.1 Install hanger so that rod is vertical under operating conditions.

.2 Adjust hangers to equalize load.

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

3.5 HORIZONTAL MOVEMENT

.1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4 degrees from vertical.

.2 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.

3.6 FINAL ADJUSTMENT

.1 Adjust hangers and supports:

.1 Ensure that rod is vertical under operating conditions.

.2 Equalize loads.

.2 Adjustable clevis:

.1 Tighten hanger load nut securely to ensure proper hanger performance.

.2 Tighten upper nut after adjustment.

.3 C-clamps:

.1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.

.4 Beam clamps:

.1 Hammer jaw firmly against underside of beam.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Materials and requirements for the identification of piping systems, duct work, valves and controllers, including the installation and location of identification systems.

.2 Sustainable requirements for construction and verification.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 21 – Construction/Demolition Waste Management and Disposal

.3 Section 09 91 23 - Interior Painting.

1.3 REFERENCES

.1 Canadian Gas Association (CGA)

.1 CSA/CGA B149.1, Natural Gas and Propane Installation Code.

.2 CSAZ7396.1 Medical Gas pipeline Systems – Part 1: Pipelines for medical gases and vacuum.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-24.3, Identification of Piping Systems.

.3 National Fire Protection Association (NFPA)

.1 NFPA 13, Standard for the Installation of Sprinkler Systems.

.2 NFPA 14, Standard for the Standpipe and Hose Systems.

1.4 SUBMITTALS

.1 Product Data:

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

.2 Product data to include paint colour chips, other products specified in this section.

.3 Samples:

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

.2 Samples to include nameplates, labels, tags, lists of proposed legends.

1.5 QUALITY ASSURANCE

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

.2 Health and Safety:

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

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with Section 01 61 00 – Common Product Requirements.

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

.2 Waste Management and Disposal:

.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.2 Dispose of unused paint coating material at official hazardous material collections site approved by Owner's Representative.

.3 Do not dispose of unused paint coating material into sewer system, into streams, lakes, onto ground or in locations where it will pose health or environmental hazard.

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's Representative.

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:

.1 Where not listed, obtain direction from Owner's Representative.

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

Background colour	Legend, arrows
Yellow	BLACK
Green	WHITE
Red	WHITE

.3 Background colour marking and legends for piping systems:

Contents	Background colour marking	Legend
** Add design temperature		
++ Add design temperature and pressure		
Raw water	Green	RAW WATER
River water	Green	RIVER WATER
Sea water	Green	SEA WATER
City water	Green	CITY WATER
Treated water	Green	TREATED WATER
Brine	Green	BRINE
Condenser water supply	Green	COND. WTR. SUPPLY
Condenser water return	Green	COND. WTR. RETURN
Chilled water supply	Green	CH. WTR. SUPPLY
Chilled water return	Green	CH. WTR. RETURN
Hot water heating supply	Yellow	HEATING SUPPLY
Hot water heating return	Yellow	HEATING RETURN
High temp HW Htg. supply	Yellow	HTHW HTG. SUPPLY++
High temp HW Htg. return	Yellow	HTHW HTG. RETURN++
Make-up water	Yellow	MAKE-UP WTR
Boiler feed water	Yellow	BLR. FEED WTR
Steam ___kPa	Yellow	___kPa STEAM
Steam condensate (gravity)	Yellow	ST.COND.RET (GRAVITY)

Contents	Background colour marking	Legend
** Add design temperature		
++ Add design temperature and pressure		
Steam condensate (pumped)	Yellow	ST.COND.RET (PUMPED)
Safety valve vent	Yellow	STEAM VENT
Intermittent blow-off	Yellow	INT. BLOW-OFF
Continuous blow-off	Yellow	CONT. BLOW-OFF
Chilled drinking water	Green	CH. DRINK WTR
Drinking water return	Green	CH. DRINK WTR. CIRC
Domestic hot water supply	Green	DOM. HW SUPPLY
Dom. HWS recirculation	Green	DOM. HW CIRC
Domestic cold water supply	Green	DOM. CWS
Waste water	Green	WASTE WATER
Contaminated lab waste	Yellow	CONT. LAB WASTE
Acid waste	Yellow	ACID WASTE (add source)
Storm water	Green	STORM
Sanitary	Green	SAN
Plumbing vent	Green	SAN. VENT
Refrigeration suction	Yellow	REF. SUCTION
Refrigeration liquid	Yellow	REF. LIQUID
Refrigeration hot gas	Yellow	REF. HOT GAS
No. ___ fuel oil suction	Yellow	# ___ FUEL OIL
No. ___ fuel oil return	Yellow	# ___ FUEL OIL
Engine exhaust	Yellow	ENGINE EXHAUST
Lubricating oil	Yellow	LUB. OIL
Hydraulic oil	Yellow	HYDRAULIC OIL
Gasoline	Yellow	GASOLINE
Natural gas	to Codes	
Propane	to Codes	
Gas regulator vents	to Codes	
Distilled water	Green	DISTILL. WTR
Demineralized water	Green	DEMIN. WATER
Chlorine	Yellow	CHLORINE
Nitrogen	Yellow	NITROGEN
Oxygen	Yellow	OXYGEN
Compressed air (<700kPa)	Green	COMP. AIR ___ kPa
Compressed air (>700kPa)	Yellow	COMP. AIR ___ kPa
Vacuum	Green	VACUUM
Fire protection water	Red	FIRE PROT. WTR
Sprinklers	Red	SPRINKLERS
Carbon dioxide	Red	CO2
Instrument air	Green	INSTRUMENT AIR
Control air tubing	To Section 25 05 54 – EMCS: Identification	
Conduit for low voltage control wiring	To Section 25 05 54 – EMCS: Identification	
Medical Gases	To Code	

2.6 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’s Representative. 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 11 – 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 Section Includes:

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

1.2 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 01 74 21 – Construction/Demolition Waste Management and Disposal

.3 Section 07 92 00 – Joint Sealing.

.4 Section 23 07 16 – HVAC Equipment Insulation.

.5 Section 23 05 53.01 – Mechanical Identification.

1.3 REFERENCES

.1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

.1 ASHRAE Standard 90.1, Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings (Including all Addenda).

.2 American Society for Testing and Materials (ASTM)

.1 ASTM B209M, Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate Metric.

.2 ASTM C335, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.

.3 ASTM C411, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.

.4 ASTM C449/C449M, Standard Specification for Mineral Fibre-Hydraulic-Setting Thermal Insulating and Finishing Cement.

.5 ASTM C533 Standard specification for Calium Silicate Insulation Block and Pipe.

.6 ASTM C547 Standard Specification for Mineral Fibre Pipe Insulation.

.7 ASTM C795, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.

.8 ASTM C921, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

.9 ASTM D1784, Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.

.3 Canadian General Standards Board (CGSB)

.1 CGSB 51-GP-52Ma, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.

.2 CAN/CGSB-51.53, Poly (Vinyl Chloride) Jacketting Sheet, for Insulated Pipes, Vessels and Round Ducts

.4 Department of Justice Canada (Jus)

.1 Canadian Environmental Assessment Act (CEAA), c. 37.

.2 Canadian Environmental Protection Act, (CEPA), c. 33.

.3 Transportation of Dangerous Goods Act (TDGA), c. 34.

.5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets.

.6 Manufacturer's Trade Associations

.1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards.

.7 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC-S102, Surface Burning Characteristics of Building Materials and Assemblies.

.8 National Energy Code of Canada for Buildings (NECB).

1.4 DEFINITIONS

.1 For purposes of this section:

.1 "CONCEALED" - insulated mechanical services in suspended ceilings and non-accessible chases and furred-in spaces.

.2 "EXPOSED" - will mean "not concealed" as defined herein.

.2 TIAC ss:

.1 CRF: Commercial Rectangular Finish

.2 CPF: Commercial Piping Finish.

1.5 SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) 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's Representative.

1.6 QUALITY ASSURANCE

.1 Qualifications:

.1 Installer: certified in performing work of this Section, and have at least 5 years successful experience in this size and type of project, qualified to standards of TIAC.

.2 Health and Safety:

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

1.7 DELIVERY, STORAGE AND HANDLING

.1 Packing, shipping, handling and unloading:

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

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

.3 Deliver materials to site in original factory packaging, labeled with manufacturer's name, address.

.2 Storage and Protection:

.1 Protect from weather, construction traffic.

.2 Protect against damage.

.3 Store at temperatures and conditions required by manufacturer.

.3 Waste Management and Disposal:

.1 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's Representative.

.4 Dispose of unused adhesive material at official hazardous material collections site approved by Owner's Representative.

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-2: Rigid moulded calcium silicate in sections and blocks, and with special shapes to suit project requirements.

.1 Insulation: to ASTM C533.

.2 Maximum "k" factor: to 0.075 W/m °C @ 500 °C .

.3 Design to permit periodic removal and re-installation.

.4 TIAC Code A-3: Rigid moulded mineral fibre with factory applied vapour retarder jacket.

.1 Mineral fibre: to CAN/ULC-S702 and ASTM C547.

.2 Jacket: to CGSB 51-GP-52Ma.

.3 Maximum "k" factor: to CAN/ULC-S702.

.5 TIAC Code A-6: Flexible unicellular tubular elastomer.

.1 Insulation: with vapour retarder jacket to ASTM C534.

.2 Jacket: to CGSB 51-GP-52Ma.

.3 Maximum "k" factor: 0.039 W/m – °C.

.4 To be certified by manufacturer to be free of potential stress corrosion cracking corrodants

.5 Flame spread index less than 25, and smoke developed index less than 50.

.6 TIAC Code C-2: Mineral fibre blanket faced with factory applied vapour retarder jacket (as scheduled in PART 3 of this section).

.1 Mineral fibre: to ASTM C547.

.2 Jacket: to CGSB 51-GP-52Ma.

.3 Maximum "k" factor: to CAN/ULC-S702.

2.3 INSULATION SECUREMENT

.1 Tape: Self-adhesive, aluminum, plain reinforced, 50 mm wide minimum.

.2 Contact adhesive: Quick setting.

.3 Canvas adhesive: Washable.

.4 Tie wire: 1.5 mm diameter stainless steel.

.5 Bands: Stainless steel, 19 mm wide, 0.5 mm thick.

2.4 CEMENT

.1 Thermal insulating and finishing cement:

.1 Hydraulic setting or air drying on mineral wool, to ASTM C449/C449M.

2.5 VAPOUR RETARDER LAP ADHESIVE

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

2.6 INDOOR VAPOUR RETARDER FINISH

.1 Vinyl emulsion type acrylic, compatible with insulation.

2.7 OUTDOOR VAPOUR RETARDER FINISH

.1 Vinyl emulsion type acrylic, compatible with insulation.

.2 Reinforcing fabric: Fibrous glass, untreated 305 g/m^2.

2.8 JACKETS

.1 Polyvinyl Chloride (PVC):

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

.2 Canvas:

.1 220gm/m^2 cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.
.2 Lagging adhesive: Compatible with insulation.

.3 Aluminum:

.1 To ASTM B209.

.2 Thickness: 0.50 mm sheet.

.3 Finish: Embossed or corrugated.

.4 Joining: Longitudinal and circumferential slip joints with 50 mm laps.

.5 Fittings: 0.5 mm thick die-shaped fitting covers with factory-attached protective liner.

.6 Metal jacket banding and mechanical seals: stainless steel, 19 mm wide, 0.5 mm thick at 300 mm spacing.

.4 Stainless steel:

.1 Type: 304 or type 316.

.2 Thickness: 0.25 mm.

.3 Finish: Smooth.

.4 Joining: Longitudinal and circumferential slip joints with 50 mm laps.

.5 Fittings: 0.5 mm thick die-shaped fitting covers with factory-attached protective liner.

.6 Metal jacket banding and mechanical seals: stainless steel, 19 mm wide, 0.5 mm thick at 300 mm spacing.

2.9 WEATHERPROOF CAULKING FOR JACKETS INSTALLED OUTDOORS

.1 Caulking to: Section 07 92 00 - Joint Sealing.

PART 3 EXECUTION

3.1 MANUFACTURE'S INSTRUCTIONS

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

3.2 PRE- INSTALLATION REQUIREMENT

.1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed and certified.

.2 Surfaces to be clean, dry, free from foreign material.

3.3 INSTALLATION

.1 Install in accordance with TIAC National Standards.

.2 Apply materials in accordance with manufacturers instructions and this specification.

.3 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm.

.4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.

.1 Install hangers, supports outside vapour retarder jacket.

.5 Supports, Hangers:

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

3.4 REMOVABLE, PRE-FABRICATED, INSULATION AND ENCLOSURES

.1 See Section 23 07 16 – HVAC Equipment Insulation.

3.5 INSTALLATION OF ELASTOMERIC INSULATION

.1 Insulation to remain dry. Overlaps to manufacturers instructions. Ensure tight joints.

.2 Provide vapour retarder as recommended by manufacturer.

3.6 PIPING INSULATION SCHEDULES

.1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified. Insulate vent pipes 3.0 m from roof penetration.

.2 TIAC Code: A-2.

.1 Insulation securements: 18 ga SS wire or 12 mm x 0.51 mm SS bands at 300 mm oc.
.2 Seals: lap seal adhesive, lagging adhesive.
.3 Installation: TIAC Code: 1501-H.

.3 TIAC Code: A-3.

.1 Securements: Tape at 300 mm oc.
.2 Seals: VR lap seal adhesive, VR lagging adhesive.
.3 Installation: TIAC Code: 1501-C.

.4 TIAC Code: A-6.

.1 Insulation securements: as per manufacturer's recommendation.
.2 Seals: lap seal adhesive, lagging adhesive.
.3 Installation: TIAC Code: 1501-CA.

.5 TIAC Code: C-2 with vapour retarder jacket.

.1 Insulation securements: 18 ga SS wire or 12 mm x 0.5 mm SS bands at 300 mm oc.
.2 Seals: lap seal adhesive, lagging adhesive.
.3 Installation: TIAC Code: 1501-C.

.6 Thickness of insulation to be as listed in following table.

.1 Run-outs to individual units and equipment not exceeding 4000 mm long.
.2 Do not insulate exposed runouts to plumbing fixtures, chrome plated piping, valves, fittings.

Application	**Temp °C**	**TIAC code**	**Pipe sizes (NPS) and insulation thickness (mm)**					
	Run out			***to 1***	***1 1/4 to 2***	***2 1/2 to 4***	***5 to 6***	***8 & over***

Application	**Temp °C**	**TIAC code**	**Pipe sizes (NPS) and insulation thickness (mm)**					
	Run out			***to 1***	***1 1/4 to 2***	***2 1/2 to 4***	***5 to 6***	***8 & over***
Steam	up to 175	A-3	38	50	65	75	90	90
Steam, Saturated and Superheated	over 175	A-3	38	65	65	75	90	90
Condensate Return	60 - 94	A-3	25	38	38	38	38	38
Pumped Condensate return	up to 94	A-3	25	38	38	38	38	38
Boiler Feed Water		A-3	25	25	25	25	25	25
Hot Water Heating	60 - 94	A-3	25	38	38	38	38	38
Hot Water Heating	up to 59	A-3	25	25	25	25	38	38
Glycol Heating	60 - 94	A-3	25	38	38	38	38	38
Glycol Heating	up to 59	A-3	25	25	25	25	38	38
Domestic HWS		A-3	25	25	25	38	38	38
Chilled Water	4 - 13	A-3	25	25	25	25	25	25
Chilled Water or Glycol	below 4	A-3	25	25	38	38	38	38
Dual Temp. Heating		A-3	25	38	38	38	38	38
Dual Temp. Cooling		A-3	25	25	38	38	38	38
Chilled Water Pump Casing		A-3	25	25	25	25	25	25
Condenser Water Outdoors		A-3	50	50	65	65	65	65

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***
Condenser Water Indoors		A-3	25	25	25	25	25	25
Refrigerated Drinking Water		A-3	25	25	25	25	25	25
Domestic CWS		A-3	25	25	25	25	25	25
Refrigerant hot gas, liquid, suction	4-13	A-6	25	25	25	25	25	25
Refrigerant hot gas, liquid, suction	below4	A-6	25	25	25	25	25	25
RWL and RWP		A-3	25	25	25	25	25	25
Cooling Coil cond. Drain		A-3	25	25	25	25	25	25
Diesel generator exhaust system		A-2	38	65	65	75	90	90
Roof Drain Body		C-2	25	25	25	25	25	25
Vent Pipe Steam		A-3	38	65	65	75	90	90

.7 Finishes:

.1 Exposed indoors: PVC jacket.

.2 Exposed in mechanical rooms: PVC jacket.

.3 Concealed, indoors: canvas on valves, fittings. No further finish.

.4 Use vapour retarder jacket on TIAC code A-3 insulation compatible with insulation.

.5 Outdoors: Water-proof Aluminium, or SS jacket.

.6 Finish attachments: SS screws or bands, at 150 mm oc. Seals: wing or closed.

.7 Installation: To appropriate TIAC code CPF/1 through CPF/5.

3.7 CLEANING

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

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

END OF SECTION

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 91 13 – General Commissioning (Cx) Requirements: supplemented as specified herein.

.2 Section 22 42 01 – Plumbing Specialities and Accessories.

.3 Section 23 05 93 – Testing, Adjusting and Balancing for HVAC.

.4 Section 23 08 02 – Cleaning and Start-up of Mechanical Piping Systems.

.5 Section 23 11 13 – Facility Fuel-Oil Piping.

.6 Section 22 11 18 – Domestic Water Piping Copper.

.7 Section 23 21 13.02 – Hydronic Systems: Steel.

.8 Section 23 23 00 – Copper Tubing and Fittings Refrigerant.

1.2 REFERENCES

.1 ASTM E202, Standard Test Methods for Analysis of Ethylene Glycols and Propylene Glycols.

1.3 CLEANING AND START-UP OF MECHANICAL PIPING SYSTEMS

.1 In accordance with Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.

1.4 HYDRONIC SYSTEMS - PERFORMANCE VERIFICATION (PV)

.1 Perform hydronic systems performance verification after cleaning is completed and system is in full operation.

.2 When systems are operational, perform following tests:

.1 Conduct full scale tests at maximum design flow rates, temperatures and pressures for continuous consecutive period of two (2) working days to demonstrate compliance with design criteria.

.2 Verify performance of hydronic system circulating pumps as specified in relevant technical sections, recording system pressures, temperatures, fluctuations by simulating maximum design conditions and varying.

.1 Pump operation.

.2 Boiler and/or chiller operation.

.3 Pressure bypass open/closed.

.4 Control pressure failure.

.5 Maximum heating demand.

.6 Maximum cooling demand.

.7 Boiler and/or chiller failure.

.8 Cooling tower (and/or industrial fluid cooler) fan failure.

.9 Outdoor reset. Re-check heat exchanger output supply temperature at 100% and 50% reset, maximum water temperature.

1.5 HYDRONIC SYSTEM CAPACITY TEST

.1 Timing: After:

.1 TAB has been completed

.2 Verification of operating, limit, safety controls.

.3 Verification of primary and secondary pump flow rates.

.4 Verification of accuracy of temperature and pressure sensors and gauges.

.2 Calculate system capacity at test conditions.

.3 Using manufacturer's published data and calculated capacity at test conditions, extrapolate system capacity at design conditions.

.4 When capacity test is completed, return controls and equipment status to normal operating conditions.

.5 Submit sample of system water to approved testing agency to determine if chemical treatment is correct. Include cost.

.6 Heating system capacity test:

.1 Perform capacity test when ambient temperature is within 10% of design conditions. Simulate design conditions by:

.1 Increasing OA flow rates through heating coils (in this case, monitor heating coil discharge temperatures at all times to ensure that coils are not subjected to freezing conditions) or

.2 Reducing space temperature by turning off heating system for sufficient period of time before starting testing.

.2 Test procedures:

.1 Open fully heat exchanger, heating coil and radiation control valves.

.2 With boilers on full firing and hot water heating supply temperature stabilized, record flow rates and supply and return temperatures simultaneously.

.3 Conduct flue gas analysis test on boilers at full load and at low fire conditions.

.7 Chilled water system capacity test:

.1 Perform capacity test when ambient temperature is within 10% of design conditions. Simulate design conditions by:

.1 Adding heat from building heating system or

.2 Raising space temperature by turning off cooling and air systems for sufficient period of time before starting testing and pre-heating building to summer design space temperature (occupied) or above. Set OAD and RAD for minimum outside

air if OAT is near outside design temperature or to maximum recirculation if RAT is greater that OAT. RAT to be at least 23^{0}C.

.2 Test procedures:

.1 Open fully cooling coil control valves.

.2 Set thermostats on associated AHU's for maximum cooling.

.3 Set AHU's for design maximum air flow rates.

.4 Set load or demand limiters on chillers to 100%

.5 After system has stabilized, record chilled water, condenser water, etc., flow rates and supply and return temperatures simultaneously.

1.6 CONDENSER WATER AND HUMIDIFICATION SYSTEMS

.1 In addition to procedures specified above, perform following:

.1 Add chemicals once or twice per week as required.

.2 Perform TAB as specified Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

.3 Set up and adjust drip feeders, timer controls, and pump strokes as required to maintain required chemical feed rates.

.4 Inject inhibitor into cooling tower sump.

1.7 STEAM SYSTEMS

.1 Performance verification:

.1 When systems are operational, perform relevant tests of steam and condensate return piping systems as specified under hydronic systems.

.2 Verify operation of components of steam system including:

.1 Steam traps by:

.1 Measuring temperature of condensate return and/or using audio-sensing devices.

.2 Use of other approved methods.

.2 Flash tanks.

.3 Thermostatic vents.

.3 Verify performance of condensation units, including:

.1 Pump capacity at design temperature.

.2 Controls.

.4 Verify performance of condensate return system to ensure return of maximum quantity of condensate return water at with minimum temperature drop.

.5 Adjust piping system as required to eliminate water hammer.

.2 Monitor system continuously until acceptance for proper operation components including steam traps, thermostatic vents, flash tanks and condensate pumping units.

1.8 GLYCOL SYSTEMS

.1 Test to prove concentration will prevent freezing to minus 40^0C Test inhibitor strength and include in procedural report. Refer to ASTM E202.

1.9 FUEL OIL SYSTEMS

.1 Environmental protection systems:

.1 Test oil storage tank leakage detection system using manufacturer's recommended procedures.

.2 Test spill protection and over-fill protection systems using manufacturer's recommended procedures.

.2 Fuel oil pumps:

.1 Check strainers on pump inlet, relief valve on pump outlet with discharge to oil return piping, pressure gauge on strainer inlet, pump inlet and pump discharge.

.2 Verify pump performance.

.3 Pump performance to be within plus 20% and minus 0% of design.

.3 Operational Tests:

.1 Timing: Perform at same time as 100% and 105% boiler PV tests.

.2 Charge system and verify operation.

.3 Verify adequacy of flow rates and pressure from storage facilities to burners.

.4 Verify accurate metering of fuel to burners.

.5 For further details refer to relevant sections of mechanical Division.

.4 Notify authorities having jurisdiction to enable witnessing of tests as required.

1.10 POTABLE WATER SYSTEMS

.1 When cleaning is completed and system filled:

.1 Verify performance of equipment and systems as specified elsewhere in mechanical Division.

.2 Check for proper operation of water hammer arrestors. Run one outlet for 10 seconds, then shut of water immediately. If water hammer occurs, replace water hammer arrestor. Repeat for each outlet and flush valve.

.3 Confirm water quality consistent with supply standards, verifying that no residuals remain as a result of flushing and/or cleaning.

1.11 WET AND DRY PIPE SPRINKLER SYSTEM, STANDPIPE AND HOSE SYSTEMS

.1 Cleaning, testing, start-up, performance verification of equipment, systems, components, and devices is specified elsewhere in other mechanical Divisions.

.2 Verification of controls, detection devices, alarm devices is specified other mechanical and electrical Divisions.

.3 Demonstrate that fire hose will reach to most remote location regardless of partitions, obstructions, etc.

.4 Verify operation of interlocks between HVAC systems and fire alarm systems.

1.12 SANITARY AND STORM DRAINAGE SYSTEMS

.1 Buried systems: Perform tests prior to back-filling. Perform hydraulic tests to verify grades and freedom from obstructions.

.2 Ensure that traps are fully and permanently primed.

.3 Ensure that fixtures are properly anchored, connected to system.

.4 Operate flush valves, tank and operate each fixture to verify drainage and no leakage.

.5 Cleanouts: Refer to Section 22 42 01 - Plumbing Specialities and Accessories.

.6 Roof drains:

.1 Refer to Section 22 42 01 - Plumbing Specialities and Accessories.

.2 Remove caps as required.

1.13 REPORTS

.1 In accordance with Section 01 91 13 – General Commissioning (Cx) Requirements: supplemented as specified herein.

1.14 TRAINING

.1 In accordance with Section 01 91 13 – General Commissioning (Cx) Requirements: supplemented as specified in relevant specification sections

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

PART 1 GENERAL

1.1 SYSTEM DESCRIPTION

.1 Section includes:

The variable capacity, cooling only air conditioning system shall be a Daikin inverter driven SkyAir series (heat/cool model) split system. The system shall consist of a ceiling mounted roundflow discharge sensing cassette indoor evaporator model exclusively matched to the outdoor condensing unit model as follows:

Outdoor Model	Indoor Model
RZA48AAVJU	FCA48AAVJU

The RZA outdoor condensing unit models shall be a direct expansion (DX), air-cooled heat pump air-conditioning system, with a variable speed inverter driven compressor & fan motor using R-32 refrigerant. The outdoor unit is a horizontal discharge, variable speed, dual fan unit using a single phase power supply.

1.2 QUALITY ASSURANCE

.1 The units shall be tested by a Nationally Recognized Testing Laboratory (NRTL), in accordance with ANSI/UL 1995 – Heating and Cooling Equipment and bear the Listed Mark.

.2 All wiring shall be in accordance with the National Electric Code (NEC).

.3 The system shall be rated in accordance with Air Conditioning Refrigeration Institute's (ARI) Standard 210/240 and bear the ARI label.

.4 The system will be produced in an ISO 9001 and ISO 14001 facility, which are standards set by the International Standard Organization (ISO). The system shall be factory tested for safety and function.

.5 The outdoor unit will be factory charged with R-410A.

.6 A holding charge of dry nitrogen shall be provided in the evaporator.

.7 System efficiency shall meet or exceed 18.0 SEER2, 9.0 EER2 and 9.0 HSPF2.

1.3 DELIVERY, STORAGE AND HANDLING

.1 American National Standards Institute/ American Society of Mechanical Engineers (ANSI/ASME)

.1 Unit shall be stored and handled according to the manufacturer's recommendations.

1.4 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 33 00 – Submittal Procedures.

1.5 OPERATION AND MAINTENANCE DATA

.1 Provide operation and maintenance data for incorporation into manual specified in Section 01 33 00 – Submittal Procedures.

1.6 CLOSEOUT PROCEDURES

.1 Provide maintenance data for incorporation into manual specified in Section 01 77 00 – Closeout Procedures.

.2 Data to include:

.1 Manufacturer's name, type, model year, capacity and serial number.

.2 Details of operation, servicing and maintenance.

.3 Recommended spare parts list with names and addresses.

PART 2 WARRANTY

2.1 LIMITED WARRANTY

.1 Daikin North America LLC ("Daikin") warrants to the customer who is the original owner and user of the Daikin products specified above ("Customer") that under normal use and maintenance for comfort cooling and conditioning applications such products (the "Products") will be free from defects in material or workmanship. Warranty coverage begins on the "installation date." Warranty last for a period of up to 10 years.

2.2 INSTALLATION REQUIREMENTS

.1 Installation must comply with installation manual. It is recommended the system be installed by a contractor/dealer who has been through Daikin training programs.

PART 3 PERFORMANCE

3.1 PERFORMANCE

.1 The system performance shall be in accordance with ARI 210/240 test conditions as shown in the performance table below:

System Model	Cooling Capacity	Heating Capacity	SEER	EER	HSPF
RZA48AAVJU_FCA48AAVJU	48,000	54,000	18	9	9.3

The cooling performance is based on 80°F DB / 67°F WB for the indoor unit and 95°F DB / 75°F WB for the outdoor unit with 25ft of interconnecting pipe-work & 0ft level difference.
The heating performance is based on 70°F DB / 60°F WB for the indoor unit and 47°F DB / 43°F WB for the outdoor unit with 25ft of interconnecting pipe-work & 0ft level difference.

3.2 COOLING OPERATING RANGE

.1 The operating range in cooling will be 23°F DB ~ 122°F DB and 0°F DB ~ 122°F DB when used with an optional wind baffle.

3.3 HEATING OPERATING RANGE

.1 The operating range in heating will be -4°F WB – 60°F WB.

3.4 REFRIGERANT PIPING

.1 The system shall be capable of refrigerant piping up to 230 total feet with a 98 feet maximum vertical difference, without any oil traps or additional components.

PART 4 PRODUCTS

4.1 OUTDOOR UNIT

A. General: The outdoor condensing unit is designed specifically for use with matched capacity SkyAir series indoor evaporator units.

.1 The outdoor unit shall be factory assembled and pre-wired with all necessary electronic and refrigerant controls. The refrigeration circuit of the condensing unit shall consist of a Daikin swing compressor, motors, fans, condenser coil, electronic expansion valves, solenoid valves, 4 way valve, distribution headers, capillaries, filters, shut off valves, service ports and suction accumulator.

.2 Both liquid and suction lines must be individually insulated between the outdoor and indoor units.

.3 The outdoor unit can be wired and piped in the front, lateral or downward directions, accessed from the right side of the unit.

.4 The sound pressure level standard shall be that value as listed in the Daikin engineering manual for the specified models at 3 feet from the front of the unit.

.5 The system will automatically restart operation after a power failure and will not cause any settings to be lost, thus eliminating the need for re-programming.

.6 The outdoor unit shall be modular in design and should allow for side-by-side installation with minimum spacing.

.7 The following safety devices shall be included on the condensing unit; high pressure switch, outdoor fan driver overload protector, inverter overload protector, fusible plugs, fuses.

.8 Each condensing unit shall utilize an algorithm to automatically adjust the refrigerant suction and condensing temperatures in response to the heating and cooling loads, and in response to the current weather conditions. The VRT control shall be capable of being customized in the following modes and sub modes:

i. Automatic (factory preset) – The Automatic VRT control shall allow the target evaporator temperature (Te) and target condensing temperature (Tc) to float based on outdoor ambient temperature conditions, and shall incorporate the following sub-modes:

1. Powerful

2. Quick

3. Mild (factory preset)

ii. High Sensible – The High Sensible mode shall allow the system Te and Tc values to be programmed to series of fixed Te and Tc values. The High Sensible mode shall also be capable of incorporating the following sub-modes:

1. Eco

iii. Basic – The Basic mode shall disable the VRT control of the outdoor unit and allow the system to operate with constant Te and Tc values.

B. Unit Cabinet:

1. The outdoor unit model RZA__AAVJU shall be completely weatherproof and corrosion resistant. The unit shall be constructed from rust-proofed mild steel panels coated with a baked enamel finish.

2. The outdoor unit will come furnished with four (4) mounting feet, mounted across the base pan, to allow bolting to a cement pad or optionally supplied mounting bracket.

C. Fan:

1. The condensing unit shall consist of one propeller type, direct-drive 70 W fan motor that has multiple speed operation via a DC (digitally commutating) inverter.

2. The fan shall be a horizontal discharge configuration with a nominal airflow maximum of 3,741 cfm.

3. The fan motor shall have inherent protection and permanently lubricated bearings and be mounted.

4. The fan motor shall be provided with a fan guard to prevent contact with moving parts.

D. Condenser Coil:

1. The condenser coil shall be manufactured from copper tubes expanded into aluminum fins to form a mechanical bond.

2. The heat exchanger coil shall be of a waffle louver fin and rifled bore tube design to ensure highly efficient performance.

3. The heat exchanger on the condensing units shall be manufactured from Hi-X seamless copper tube.

4. The fins are to be covered with an anti-corrosion acrylic resin and hydrophilic film type E1 rated for up to 1000 hours salt spray.

5. The pipe plates shall be treated with powdered polyester resin for corrosion prevention. The thickness of the coating must be between 2.0 to 3.0 microns.

E. Compressor:

1. The Daikin swing compressor shall be variable speed (PAM inverter) controlled which is capable of changing the speed to follow the variations in total cooling and heating load as determined by the suction gas pressure as measured in the condensing unit. In addition, samplings of evaporator and condenser temperatures shall be made so that the high/low pressures detected are read every 20 seconds and calculated. With each reading, the compressor capacity shall be controlled to eliminate deviation from target value.

2. The inverter driven compressor shall be of highly efficient reluctance DC (digitally commutating), hermetically sealed swing type.

3. Neodymium magnets shall be adopted in the rotor construction to yield a higher torque and efficiency in the compressor instead of the normal ferrite magnet type. At complete stop of the compressor, the neodymium magnets will position the rotor into the optimum position for a low torque start.

4. The capacity control range shall be as shown below:

Model Number	Capacity Control Range
RZA48AAVJU	14-100%

5. The compressor shall be equipped with a crankcase heater, high pressure safety switch, and internal thermal overload protector.

6. The compressor shall be mounted to avoid the transmission of vibration.

F. Electrical:

1. The power supply to the outdoor unit shall be 208-230 volts, 1 phase, 60 hertz +/- 10%.

Power Supply Voltage	Voltage Range
208-230V/1/60	187V-253V

Model	MCA	MOP
RZQ48TAVJUA	34.6	35

2. The control voltage between the indoor and outdoor unit shall be 16VDC non-shielded, stranded 2 conductor cable.

3. The control wiring shall be a two-wire multiplex transmission system.

4. The control wiring lengths shall be as shown below:

	Outdoor to Indoor Unit	Indoor Unit to Remote Control
Control Wiring Length	3,280	1,640
Wire Type	18 AWG, 2 wire, non-polarity, non-shielded, stranded	

4.2 FCA INDOOR UNIT – ROUNDFLOW SENSING CASSETTE UNIT

A. General:

Daikin indoor unit model FCQ shall be a roundflow sensing ceiling cassette fan coil unit, operable with R-410A refrigerant, equipped with an electronic expansion valve, for installation into the ceiling cavity and equipped with an air panel grille. It shall be available from 30,000 Btu/h to 48,000 Btu/h. Model numbers are FCA30AAVJ, FCA36AAVJ, FCA42AAVJU and FCA48AAVJU to be connected to the corresponding SkyAir series outdoor condensing unit model RZA30AAVJU, RZA36AAVJU, RZA42AAVJU and RZQ48AAVJU. It shall be a round-flow air distribution type, fresh white, impact resistant decoration panel, or optional self-cleaning filter panel. The supply air is distributed via four individually motorized louvers. To save energy and optimize occupancy comfort, the indoor unit shall be equipped with built in occupancy sensor and surface temperature sensor. Computerized PID control shall be used to control superheat to deliver a comfortable room temperature condition.

B. Performance:

Each units performance is based on nominal operating conditions:

Model Number	Cooling (Indoor 80°F DB / 67°F WB, Outdoor 95°F DB, 25 ft pipe length)	Heating (Indoor 70°F DB / 60°F WB, Outdoor 47°F DB, 25 ft pipe length
FCA48AAVJU	48,000	54,000

C. Indoor Unit:

1. The Daikin indoor unit FCQ shall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, condensate drain pan, condensate drain pump, condensate safety shutoff and alarm, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch.

2. Indoor unit and refrigerant pipes will be charged with dehydrated air prior to shipment from the factory.

3. Both refrigerant lines shall be insulated from the outdoor unit.

4. The round-flow supply air flow can be field modified to 23 different airflow patterns to accommodate various installation configurations including corner installations.

5. The round-flow supply air flow can be field modified to 23 different airflow patterns to accommodate various installation configurations including corner installations.

6. The indoor units shall be equipped with a condensate pan with antibacterial treatment and condensate pump. The condensate pump provides up to 26-1/2" of lift and has a built in safety shutoff and alarm.

7. The indoor units shall be equipped with a return air thermistor.

8. The indoor unit will be separately powered with 208~230V/1-phase/60Hz.

9. The voltage range will be 253 volts maximum and 187 volts minimum.

10. To save energy and optimize occupancy comfort, the indoor unit shall be equipped with built in occupancy sensor and surface temperature sensor.

11. Supplied air shall be directed automatically by four individually controlled louvers.

12. **To be complete with Factory-Installed integrated leak sensor.**

13. **To have Dispersion Mode: Higher airflow rate for leak mitigation through circulation.**

D. Unit Cabinet:

1. The cabinet shall be space saving and shall be located into the ceiling.

2. The airflow of the unit shall have the ability to shut down outlets with multiple patterns allowing for simpler installation in irregular spaces.

3. Fresh air intake shall be possible by way of Daikin's optional fresh air intake kit.

4. A branch duct knockout shall exist for branch ducting supply air.

5. The cabinet shall be constructed with sound absorbing foamed polystyrene and polyethylene insulation.

E. Fan:

1. The fan shall be direct-drive turbo fan type with statically and dynamically balanced impeller with three fan speeds available.

2. The fan motor shall operate on 208/230 volts, 1 phase, 60 hertz with a motor output of 106 W.

3. The airflow rate shall be available in three manual settings.

4. The fan motor shall be thermally protected.

F. Filter:

1. The return air shall be filtered by means of a washable long-life filter with mildew resistant resin and antibacterial treatment.

2. Optional Self-Cleaning Filter Panel, which performs automatic filter cleaning up to once a day, with dust collection box that indicates when to be emptied.

G. Coil:

1. Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.

2. The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.

3. The coil shall be a 2-row cross fin copper evaporator coil with 21 FPI design completely factory tested.

4. The refrigerant connections shall be flare connections and the condensate will be 1 -1/4 inch outside diameter PVC.

5. A condensate pan with antibacterial treatment shall be located under the coil.

6. A condensate pump with a 26-1/2 inch lift shall be located below the coil in the condensate pan.

7. A thermistor will be located on the liquid and gas line.

H. Electrical:

1. A separate power supply will be required of 208-230 volts, 1 phase, 60 hertz. The acceptable voltage range shall be 187 to 253 volts.

2. Transmission (control) wiring between the indoor and outdoor unit shall be a maximum of 3,280 feet.

3. Transmission (control) wiring between the indoor unit and remote controller shall be a maximum distance of 1,640 feet.

I. Control:

1. The unit shall have controls provided by Daikin to perform input functions necessary to operate the system.

2. A full array of fault diagnostics shall be accessible via the remote controller.

3. The unit shall be compatible with interfacing with connection to BACnet and LonWorks networks or interfacing with connection to BMS system. Consult with Daikin prior to applying controls.

J. Accessories Available:

1. Fresh air intake and supply air duct connections.

2. Remote "in-room" sensor kit (KRCS01-4B)
   i. The Daikin wall mounted, hard wired remote sensor kit is recommended for ceiling-embedded type fan coils, which often result in a difference between set temperature and actual temperature. The sensor for detecting the temperature can be placed away from the indoor unit (branch wiring is included in the kit).

3. Navigation Remote Controller (BRC1E73)

4. Simplified Wired Controller (BRC2A71)

5. DKN Cloud Wi-Fi Adapter (AZAI6WSCDKA)

6. DKN Plus Interface (AZAI6WSPDKC)

7. Madoka Wired Controller (BRC1H71W)

PART 5 EXECUTION

5.1 GENERAL

.1 Install as indicated and to manufacturer's recommendations.

5.2 EQUIPMENT PREPARATION AND START-UP

.1 Provide services of manufacturer's field engineer to set up and adjust equipment for operation as specified.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

.1 Section Includes.

.1 Methods and procedures for start-up, verification and commissioning, for building Energy Monitoring and Control System (EMCS) and includes:

.1 Start-up testing and verification of systems

.2 Check-out demonstration or proper operation of components.

.3 On-site operational tests

1.2 RELATED SECTIONS

.1 The contractor is to ensure that all related work is co-ordinated among all specification sections, as well as between all Divisions, and that the tender price includes all related work. The referenced sections below are for guidance only and are not necessarily a complete list of related sections.

.2 Section 01 33 00 - Submittal Procedures.

.3 Section 01 78 00 - Closeout Submittals.

.4 Section 01 91 13 - General Commissioning (Cx) Requirements.

.5 Section 25 05 01 - EMCS: General Requirements.

1.3 DEFINITIONS

.1 For additional acronyms and definitions refer to Section 25 05 01 - EMCS: General Requirements.

.2 AEL (Average Effectiveness Level): ratio between total test period less any system downtime accumulated within that period and test period.

.3 Downtime: results whenever EMCS is unable to fulfill required functions due to malfunction of equipment defined under responsibility of EMCS contractor. Downtime is measured by duration, in time, between time that Contractor is notified of failure and time system is restored to proper operating condition. Downtime not to include following:

.1 Outage of main power supply in excess of back-up power sources, provided that:

.1 Automatic initiation of back-up was accomplished.

.2 Automatic shut-down and re-start of components was as specified.

.2 Failure of communications link, provided that:

.1 Controller automatically and correctly operated in stand-alone mode.

.2 Failure was not due to failure of any specified EMCS equipment.

.3 Functional failure resulting from individual sensor inputs or output devices, provided that:

.1 System recorded said fault.

.2 Equipment defaulted to fail-safe mode.

.3 AEL of total of all input sensors and output devices is at least 99 % during test period.

1.4 DESIGN REQUIREMENTS

.1 Confirm with Owner's Representative that Design Criteria and Design Intents are still applicable.

.2 Commissioning personnel to be fully aware of and qualified to interpret Design Criteria and Design Intents.

1.5 SUBMITTALS

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

.2 Final Report: submit report to Owner's Representative.

.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's Representative 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's Representative 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's Representative before interim acceptance in accordance with Section 01 78 00 - Closeout Submittals and Section 25 05 03 – EMCS: Project Record Documents.

1.7 COMMISSIONING

.1 Do commissioning in accordance with Section 01 91 13 – General Commissioning (Cx) Requirements.

.2 Carry out commissioning under direction of Owner's Representative and in presence of Owner's Representative and Commissioning Co-ordinator.

.3 Inform, and obtain approval from, Owner's Representative in writing at least 14 days prior to commissioning or each test. Indicate:

.1 Location and part of system to be tested or commissioned.

.2 Testing/commissioning procedures, anticipated results.

.3 Names of testing/commissioning personnel.

.4 Correct deficiencies, re-test in presence of Owner's Representative until satisfactory performance is obtained.

.5 Acceptance of tests will not relieve Contractor from responsibility for ensuring that complete systems meet every requirement of Contract.

.6 Perform tests as required.

1.8 COMPLETION OF COMMISSIONING

.1 Commissioning to be considered as satisfactorily completed when objectives of commissioning have been achieved and reviewed by Owner's Representative and Commissioning Co-ordinator.

1.9 ISSUANCE OF FINAL CERTIFICATE OF COMPLETION

.1 Final Certificate of Completion will not be issued until receipt of written approval indicating successful completion of specified commissioning activities including receipt of commissioning documentation.

PART 2 PRODUCTS

2.1 EQUIPMENT

.1 Provide sufficient instrumentation to verify and commission the installed system. Provide two-way radios.

.2 Instrumentation accuracy tolerances: higher order of magnitude than equipment or system being tested.

.3 Independent testing laboratory to certify test equipment as accurate to within approved tolerances no more than 2 months prior to tests.

.4 Locations to be approved, readily accessible and readable.

.5 Application: to conform to normal industry standards.

PART 3 EXECUTION

3.1 PROCEDURES

.1 Test each system independently and then in unison with other related systems.

.2 Commission each system using procedures prescribed by the Commissioning Co-ordinator and/or Owner's Representative.

.3 Commission integrated systems using procedures prescribed by Commissioning Co-ordinator and/or Owner's Representative.

.4 Debug system software.

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

.6 Test full scale emergency evacuation and life safety procedures including operation and integrity of smoke management systems under normal and emergency power conditions as applicable.

3.2 FIELD QUALITY CONTROL

.1 Pre-Installation Testing.

.1 General: consists of field tests of equipment just prior to installation.

.2 Testing may be on site or at Contractor's premises as approved by Owner's Representative.

.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's Representative to mark instruments tracking within 0.5 % in both directions as "approved for installation".

.9 Transmitters above 0.5 % error will be rejected.

.10 DP switches to open and close within 2% of setpoint.

.2 Completion Testing.

.1 General: test after installation of each part of system and after completion of mechanical and electrical hook-ups, to verify correct installation and functioning.

.2 Include following activities:

.1 Test and calibrate field hardware including stand-alone capability of each controller.

.2 Verify each A-to-D convertor.

.3 Test and calibrate each AI using calibrated digital instruments.

.4 Test each DI to ensure proper settings and switching contacts.

.5 Test each DO to ensure proper operation and lag time.

.6 Test each AO to ensure proper operation of controlled devices. Verify tight closure and signals.

.7 Test operating software.

.8 Test application software and provide samples of logs and commands.

.9 Verify each CDL including energy optimization programs.

.10 Debug software.

.11 Blow out flow measuring and static pressure stations with high pressure air at 700 kPa.

.12 Provide point verification list in table format including point identifier, point identifier expansion, point type and address, low and high limits and Engineering units. This document will be used in final startup testing.

.3 Final Startup Testing: Upon satisfactory completion of tests, perform point-by-point test of entire system under direction of Owner's Representative 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 Representative'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's Representative.

.7 Commission systems considered as life safety systems before affected parts of the facility are occupied.

.8 Operate systems as long as necessary to commission entire project.

.9 Monitor progress and keep detailed records of activities and results.

.4 Final Operational Testing: to demonstrate that EMCS functions in accordance with contract requirements.

.1 Prior to beginning of 30 day test demonstrate that operating parameters (setpoints, alarm limits, operating control software, sequences of operation, trends, graphics and CDL's) have been implemented to ensure proper operation and operator notification in event of off-normal operation.

.1 Repetitive alarm conditions to be resolved to minimize reporting of nuisance conditions.

.2 Test to last at least 30 consecutive 24 hour days.

.3 Tests to include:

.1 Demonstration of correct operation of monitored and controlled points.

.2 Operation and capabilities of sequences, reports, special control algorithms, diagnostics, software.

.4 System will be accepted when:

.1 EMCS equipment operates to meet overall performance requirements. Downtime as defined in this Section must not exceed allowable time calculated for this site.

.2 Requirements of Contract have been met.

.5 In event of failure to attain specified AEL during test period, extend test period on day-to-day basis until specified AEL is attained for test period.

.6 Correct defects when they occur and before resuming tests.

.5 Commissioning Co-ordinator and/or Owner's Representative to verify reported results.

3.3 ADJUSTING

.1 Final adjusting: upon completion of commissioning as reviewed by Owner's Representative set and lock devices in final position and permanently mark settings.

3.4 DEMONSTRATION

.1 Demonstrate to Commissioning Manager and/or Owner's Representative operation of systems including sequence of operations in regular and emergency modes, under normal and emergency conditions, start-up, shut-down interlocks and lock-outs in accordance with Section 01 91 13 – General Commissioning (Cx) Requirements.

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's Representative 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's Representative.

.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's Representative.

2.5 WIRING

.1 Supply and install numbered tape markings on wiring at panels, junction boxes, splitters, cabinets and outlet boxes.

.2 Colour coding: to CSA C22.1. Use colour coded wiring in communications cables, matched throughout system.

.3 Power wiring: identify circuit breaker panel/circuit breaker number inside each EMCS panel.

2.6 PNEUMATIC TUBING

.1 Numbered tape markings on tubing to provide uninterrupted tracing capability.

2.7 CONDUIT

.1 Colour code EMCS conduit.

.2 Pre-paint box covers and conduit fittings.

.3 Coding: use fluorescent orange paint and confirm colour with Owner's Representative 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-Mechanical.

.5 Section 21 07 19 – Thermal Insulation of Piping.

.6 Section 22 13 17 – Drainage Waste and Vent Piping – Cast Iron and Copper.

.7 Section 23 05 05 – Installation of 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's Representative 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's Representative existing materials removed from work not identified for re-use.

PART 2 PRODUCTS

2.1 PIPING

.1 Domestic H&CWS: refer to Section 22 11 18-Domestic Water Piping Copper and Section 22 11 18.01 – Domestic Water Piping Plastic.

.2 Sanitary, storm water: refer to Section 22 13 17- Drainage Waste, Vent Piping – Cast Iron and Copper and Section 22 13 18 – Drainage, Waste and Vent Piping – Plastic.

.3 Hot water heating, chilled water: refer to Section 23 21 13.02 – Hydronic Systems: Steel and Section 23 20 12 Pressure Piping – Plastic.

.4 Condenser water: refer to Section 23 21 13 02– Hydronic Systems: Steel.

.5 Refrigeration: refer to Section 23 23 00 - Refrigerant Piping.

.6 Sleeves, escutcheons: refer to Section 23 05 05 – Installation of Pipework.

.7 Hangers and supports: refer to Section 23 05 29– Hangers and Supports for HVAC Piping and Equipment.

.8 Insulation: refer to Section 21 07 19 – Thermal Insulation for Piping and 23 07 13 – Thermal Insulation for Ducting.

2.2 SPECIAL SUPPORTS

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

2.3 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 23□C installed in conduit.

.2 Fittings: compression or barbed type as required.

2.4 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.

2.5 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.

2.6 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.

2.7 SUPPORTS FOR CONDUIT, FASTENINGS, EQUIPMENT

.1 Solid masonry, tile and plastic surfaces: lead anchors or nylon shields.

.1 Hollow masonry walls, suspended drywall ceilings: toggle bolts.

.2 Exposed conduits or cables:

.1 50 mm diameter and smaller: one-hole steel straps.

.2 Larger than 50 mm diameter: two-hole steel straps.

.3 Suspended support systems:

.1 Individual cable or conduit runs: support with 6 mm diameter threaded rods and support clips.

.2 Two or more suspended cables or conduits: support channels supported by 6 mm diameter threaded rod hangers.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install equipment, components so that manufacturer's and CSA labels are visible and legible after commissioning is complete.

3.2 PIPING

.1 Domestic H&CWS: refer to Section 22 11 18 –Domestic Water Piping Copper.

.2 Sanitary, storm water: refer to Section 22 13 17- Drainage Waste and Vent Piping – Cast Iron and Copper.

.3 Hot water heating, chilled water: refer to Section 23 21 13.02 – Hydronic Systems:Steel.

.4 Condenser water: refer to Section 23 21 13.02 – Hydronic Systems:Steel.

.5 Refrigeration: refer to Section 23 23 00 - Copper Tubing and Fittings Refrigerant..

.6 Insulation: refer to Section 21 07 19 – Thermal Insulation for Piping and 23 07 13 – Thermal Insulation for Ducting.

3.3 MECHANICAL PIPING

.1 Install piping in accordance with Section 23 05 05 – Installation of Pipework.

3.4 SUPPORTS

.1 Install special supports as required and as indicated.

3.5 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.

3.6 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.

3.7 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’s Representative 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's Representative.

.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 Representative'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.

3.8 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's Representative 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.

3.9 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.

3.10 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.

3.11 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.

3.12 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's Representative and authority having jurisdiction.

.4 Conceal work only after tests satisfactorily completed.

.5 Report results of tests to Owner's Representative 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's Representative and authority having jurisdiction.

3.13 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's Representative.

.3 Submit detailed inspection reports Owner's Representative.

.4 Submit dated, maintenance task lists to Owner's Representative and include the following sensor and output point detail, as proof of system verification:

.1 Point name and location.

.2 Device type and range.

.3 Measured value.

.4 System displayed value.

.5 Calibration detail

.6 Indication if adjustment required,

.7 Other action taken or recommended.

.5 Submit network analysis report showing results with detailed recommendations to correct problems found.

.6 Records and logs: in accordance with Section 01 78 00 - Closeout Submittals.

.1 Maintain records and logs of each maintenance task on site.

.2 Organize cumulative records for each major component and for entire EMCS chronologically.

.3 Submit records to Owner's Representative, after inspection indicating that planned and systematic maintenance have been accomplished.

.7 Revise and submit to Owner's Representative 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's Representative with telephone number where service personnel may be reached at any time.

.4 Service personnel to be on site ready to service EMCS after receiving request for service.

.5 Perform work continuously until EMCS restored to reliable operating condition.

.3 Operation: foregoing and other servicing to provide proper sequencing of equipment and satisfactory operation of EMCS based on original design conditions and as recommended by manufacturer.

.4 Work requests: record each service call request, when received separately on approved form and include:

.1 Serial number identifying component involved.

.2 Location, date and time call received.

.3 Nature of trouble.

.4 Names of personnel assigned.

.5 Instructions of work to be done.

.6 Amount and nature of materials used.

.7 Time and date work started.

.8 Time and date of completion.

.5 Provide system modifications in writing.

.1 No system modification, including operating parameters and control settings, to be made without prior written approval of Owner's Representative.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 FIELD QUALITY CONTROL

.1 Perform as minimum (3) three minor inspections and one major inspection (more often if required by manufacturer) per year. Provide detailed written report to Owner's Representative as described in Submittal article.

.2 Perform inspections during regular working hours, 0800 to 1630 h, Monday through Friday, excluding statutory holidays.

.3 Following inspections are minimum requirements and should not be interpreted to mean satisfactory performance:

.1 Perform calibrations using test equipment having traceable, certifiable accuracy at minimum 50% greater than accuracy of system displaying or logging value.

.2 Check and calibrate random sample of 10% field input/output devices in accordance with Canada Labour Code - Part I and CSA Z204.

.3 Provide dated, maintenance task lists, as proof of execution of complete system verification.

.4 Minor inspections to include, but not limited to:

.1 Perform visual, operational checks to BC's, peripheral equipment, interface equipment and other panels.

.2 Check equipment cooling fans as required.

.3 Visually check for mechanical faults, air leaks and proper pressure settings on pneumatic components.

.4 Review system performance with Operations Supervisor and/or Owner's Representative to discuss suggested or required changes.

.5 Major inspections to include, but not limited to:

.1 Minor inspection.

.2 Clean OWS(s) peripheral equipment, BC(s), interface and other panels, micro-processor interior and exterior surfaces.

.3 Check signal, voltage and system isolation of BC(s), peripherals, interface and other panels.

.4 Verify calibration/accuracy of each input and output device and recalibrate or replace as required (as per 3.1. 3.2).

.5 Provide mechanical adjustments, and necessary maintenance on printers.

.6 Run system software diagnostics as required.

.7 Install software and firmware enhancements to ensure components are operating at most current revision for maximum capability and reliability.

.1 Perform network analysis and provide report as described in Submittal article.

.6 Rectify deficiencies revealed by maintenance inspections and environmental checks.

.7 Continue system debugging and optimization.

.8 Testing/verification of occupancy and seasonal-sensitive systems to take place during four (4) consecutive seasons, after facility has been accepted, taken over and fully occupied.

.1 Test weather-sensitive systems twice: first at near winter design conditions and secondly under near summer design conditions.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 System requirements for Local Area Network (LAN) for Building Energy Monitoring and Control System (EMCS).

.2 Related Sections:

.1 Section 25 05 01 – EMCS: General Requirements.

1.2 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.

1.3 DEFINITIONS

.1 Acronyms and definitions: refer to Section 25 05 01 – EMCS: General Requirements.

1.4 SYSTEM DESCRIPTION

.1 Data communication network to link Operator Workstations and Master Control Units (MCU) in accordance with CSA T529, TIA/EIA-568, CSA T530 and TIA/EIA-569-A.

.1 Provide reliable and secure connectivity of adequate performance between different sections segments of network.

.2 Allow for future expansion of network, with selection of networking technology and

communication protocols.

.2 Data communication network to included, but not limited to:

.1 EMCS-LAN.

.2 Modems.

.3 Network interface cards.

.4 Network management hardware and software.

.5 Network components necessary for complete network.

1.5 DESIGN REQUIREMENTS

.1 EMCS Local Area Network (EMCS-LAN).

.1 High Speed, high performance, local area network over MS/TP with MCUs and OWSs communicate with each other directly on peer to peer basis in accordance with IEEE 802.3/Ethernet Standard.

.2 EMCS-LAN to be: BACnet Protocol

.3 Each EMCS-LAN to be capable of supporting at least 50 devices.

.4 Support of combination of MCUs and OWSs directly connected to EMCS-LAN.

.5 High speed data transfer rates for alarm reporting, quick report generation from multiple controllers, upload/download information between network devices. Bit rate to be 10 Megabits per second minimum.

.6 Detection and accommodation of single or multiple failures of either OWSs, MCUs or network media. Operational equipment to continue to perform designated functions effectively in event of single or multiple failures.

.7 Commonly available, multiple sourced, networking components and protocols to allow system to co-exist with other networking applications including office automation.

.2 Dynamic Data Access.

.1 LAN to provide capabilities for OWSs, either network resident or connected remotely to access point status and application report data or execute control functions for other devices via LAN.

.2 Access to data to be based upon logical identification of building equipment.

.3 Network Medium.

.1 Network medium: twisted cable, shielded twisted cable, or fibre optic cable compatible with network protocol to be used within buildings. Fibre optic cable to be used between buildings.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

PART 1 GENERAL

1.1 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 Record Documents.

.4 Section 25 30 01 – EMCS: Building Controllers.

.5 Section 25 90 01 – EMCS: Site Requirements, Applications and Systems Sequences of Operation.

1.2 DEFINITIONS

.1 Acronyms and definitions: refer to Section 25 05 01 - EMCS: General Requirements.

1.3 SUBMITTALS

.1 In accordance with Section 25 05 02 - EMCS: Submittals and Review Process.

1.4 MAINTENANCE

.1 In accordance with Section 25 08 20 – EMCS: Warranty and Maintenance and Section 25 05 03 - EMCS: Project Records Documents.

PART 2 PRODUCTS

2.1 OWS HARDWARE

.1 No EMCS operator workstation is required for this project.

2.2 OPERATOR'S CONTROL SOFTWARE

.1 No graphics is required by the EMCS contractor for this project.

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 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's Representative at time of preliminary design review.

.2 Controllers: stand-alone intelligent Control Units:

.1 Incorporate programmable microprocessor, non-volatile program memory, RAM, power supplies, as required to perform specified functions.

.2 Incorporate communication interface ports for communication LANs to exchange information with other Controllers.

.3 Capable of interfacing with operator interface device.

.4 Execute its logic and control using primary inputs and outputs connected directly to its onboard input/output field terminations or slave devices, and without need with other controller. Secondary input used for reset such as outdoor air temperature may be located in other Controller(s).

1.6 DESIGN REQUIREMENTS

.1 To include:

.1 Scanning of AI and DI connected inputs for detection of change of value and processing the detection of alarm conditions.

.2 Perform On-Off digital control of connected points, including the resulting required states generated through programmable logic output.

.3 Perform Analog control using programmable logic, (including PID) with adjustable dead bands and deviation alarms.

.4 Control of systems as described in sequence of operations.

.5 Execution of optimization routines as listed in this section.

.2 Total spare capacity for MCUs and LCUs: at least 25% of each point type distributed throughout the MCUs and LCUs.

.3 Field Termination and Interface Devices.

.1 To conform to CSA C22.2 No. 205.

.2 Electronically interface sensors and control devices to processor unit.

.3 Include, but not be limited to, following:

.1 Programmed firmware or logic circuits to meet functional and technical requirements.

.2 Power supplies for operation of logic devices and associated field equipment.

.3 Lockable wall cabinet.

.4 Required communications equipment and wiring .

.5 Leave controlled system in "fail-safe" mode in event of loss of communication

with, or failure of, processor unit.

.6 Input/Output interface to accept as minimum AI, AO, DI, DO functions as specified.

.7 Wiring terminations: use conveniently located screw type or spade lug terminals.

.4 AI interface equipment to:

.1 Convert analog signals to digital format with 12 bit analog-to-digital resolution.

.2 Provide for following input signal types and ranges:

.1 4 - 20 mA;

.2 0-10V DC

.3 10 K ohm.

.3 Meet IEEE C37.90.1 surge withstand capability.

.4 Have common mode signal rejection greater than 60 dB to 60 Hz.

.5 Where required, dropping resistors to be certified precision devices which complement accuracy of sensor and transmitter range specified.

.5 AO interface equipment:

.1 Convert digital data from controller processor to acceptable analog output signals using 12 bit digital-to-analog resolution.

.2 Provide for following output signal types and ranges:

.1 4 - 20 mA.

.2 0 - 10 V DC.

.3 Meet IEEE C37.90.1 surge withstand capability.

.6 DI interface equipment:

.1 Able to reliably detect contact change of sensed field contact and transmit condition to controller.

.2 Meet IEEE C37.90.1 surge withstand capability.

.3 Accept pulsed inputs up to 2 kHz.

.7 DO interface equipment:

.1 Respond to controller processor output, switch respective outputs. Each DO hardware to be capable of switching up to 0.5 amps at 24 V AC.

.2 Switch up to 5 amps at 220 V AC using optional interface relay.

.4 Controller's and associated hardware and software: operate in conditions of 0°C to 44°C and 20 % to 90 % non-condensing RH.

.5 Controllers (MCU, LCU): mount in wall mounted cabinet with hinged, keyed-alike locked door.

.1 Provide for conduit entrance from top, bottom or sides of panel.

.2 ECUs to be mounted in equipment enclosures or separate enclosures.

.3 Mounting details as approved by Owner's Representative 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.

.2 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's Representative.

.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's Representative.

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 33 56 13 - Aboveground Fuel Storage Tanks.

.2 Section 25 05 02 - EMCS: Submittals and Review Process.

.3 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's Representative, for testing before installation. Replace devices not meeting specified performance and accuracy.

.4 Manufacturer's Instructions

.1 Submit manufacturer's installation instructions for specified equipment and devices.

1.4 CLOSEOUT SUBMITTALS

.1 Submit operating and maintenance data for inclusion in operation and maintenance manual in accordance with Section 25 05 03 - EMCS: Project Records Documents.

PART 2 PRODUCTS

2.1 GENERAL

.1 Control devices of each category to be of same type and manufacturer.

.2 External trim materials to be corrosion resistant. Internal parts to be assembled in watertight, shockproof, vibration-proof, heat resistant assembly.

.3 Operating conditions: 0 - 32 °C with 10 - 90 % RH (non-condensing) unless otherwise specified.

.4 Terminations: use standard conduit box with slot screwdriver compression connector block unless otherwise specified.

.5 Transmitters to be unaffected by external transmitters (eg. walkie talkies).

.6 Account for hysteresis, relaxation time, maximum and minimum limits in applications of sensors and controls.

.7 Outdoor installations: use weatherproof construction in CSA 4X enclosures.

.8 Devices to be installed in user occupied space must not exceed Noise Criteria (NC) of 35. Noise generated by any device must not be detectable above space ambient conditions.

2.2 TEMPERATURE SENSORS

.1 General: except for VAV box control to be resistance or thermocouple type to following requirements:

.1 Thermisters 10 K ohm, $\pm$ 0.2^{o} C accuracy, less than 0.1^{o} C drift over 10 year span. Power supply 5 V dc, 10-35 Vdc, 24 Vac..

.2 RTD's: 1000 ohm at 0 °C (plus or minus 0.2 ohms) platinum element with strain minimizing construction, 3 integral anchored leadwires. Coefficient of resistivity: 0.00385 ohms/ohm□C.

.3 Immersion wells: NPS 3/4, stainless steel spring loaded construction, with heat transfer compound compatible with sensor. Insertion length 100 mm as indicated.

.2 Sensors:

.1 Room type: wall mounting, in slotted type covers, LCD display ^{o}C or ^{o}F, with guard as indicated. Dual set point momentary push button, override switch.

.2 Room type for VAV boxes: as for room type, above. Include setpoint adjustment, local indication, push button override for night set back function.

.3 General purpose duct type: suitable for insertion into ducts at any angle, insertion length 460 mm.

.4 Averaging duct type: continuous filament with minimum immersion length 6000 mm. Bend probe at field installation time to 100 mm radius at any point along probe without degradation of performance.

.5 Outside air type: complete with probe length 100 - 150 mm long, non-corroding shield to minimize solar and wind effects, threaded fitting for mating to 13 mm conduit, weatherproof construction in CSA 4X enclosure.

.6 Immersion type: spring loaded probe, NPT ½ fitting insertion to suit pipe size.

2.3 TEMPERATURE TRANSMITTERS

.1 Requirements:

.1 Input circuit: to accept 3-lead, 100 ohm at 0 deg C, platinum resistance detector type sensors.

.2 Power supply: 575 ohms at 24 V DC into load of 575 ohms. Power supply effect less than 0.01 deg C per volt change.

.3 Output signal: 4 - 20 mA into 500 ohm maximum load.

.4 Input and output short circuit and open circuit protection.

.5 Output variation: less than 0.2 % of full scale for supply voltage variation of plus or minus 10 %.

.6 Combined non-linearity, repeatability, hysteresis effects: not to exceed plus or minus 0.5 % of full scale output.

.7 Maximum current to 100 ohm RTD sensor: not to exceed 22.5 mA.

.8 Integral zero and span adjustments.

.9 Temperature effects: not to exceed plus or minus 1.0 % of full scale/ 50 °C.

.10 Long term output drift: not to exceed 0.25 % of full scale/ 6 months.

.11 Transmitter ranges: Select narrowest range to suit application from following:

.1 Minus 50 °C to plus 50 °C, plus or minus 0.5 °C.

.2 0 to 100 °C, plus or minus 0.5 °C.

.3 0 to 50 °C, plus or minus 0.25 °C.

.4 0 to 25 °C, plus or minus 0.1 °C.

.5 10 to 35 °C, plus or minus 0.25°C.

2.4 HUMIDITY SENSORS

.1 Requirements:

.1 Range: 5 - 95 % RH minimum.

.2 Operating temperature range: -40°C to 85°C.

.3 Absolute accuracy:

.1 Duct sensors: plus or minus 5 %.

.2 Room sensors: plus or minus 2 % .

.4 Sheath: stainless steel with integral shroud for specified operation in air streams of up to 10 m/s.

.5 Maintenance: by simple field method such as washing with solvent or mild detergent solution so as to remove anticipated airborne contaminants.

.6 Maximum sensor non-linearity: plus or minus 0.5% RH with defined curves.

.7 Room sensors: wall mounted as indicated.

.8 Duct mounted sensors: locate so that sensing element is between 1/3 and 2/3 distance across any duct dimension.

.9 Sensors to be unaffected by external transmitters such as walkie-talkies. Demonstrate to Owner's Representative.

.10 Power supply: 18-35 Vdc, 18-32 Vac with temperature sensor.

2.5 HUMIDITY TRANSMITTERS

.1 Requirements:

.1 Input signal: from 1000 ohm RTD.

.2 Output signal: 4 - 20 mA into 1000 ohm maximum load, 0-5 Vdc, 0-10 Vdc.

.3 Input and output short circuit and open circuit protection.

.4 Output accuracy: not to exceed 0.1 % of full span.

.5 Output linearity error: plus or minus 1.0 % maximum of full scale output.

.6 Integral zero and span adjustment.

.7 Temperature range: 0-70°C, -40°C to 85°C for outside air.

.8 Long term output drift: not to exceed 0.25 % of full scale output/ 6 months.

2.6 PRESSURE/CURRENT (P/I) TRANSMITTERS

.1 Requirements:

.1 Range: as indicated in I/O summaries.

.1 Pressure sensing elements: bourdon tube, bellows or diaphragm type.

.2 Internal materials: suitable for continuous contact with industrial standard instrument air, compressed air, water, steam, as applicable.

.2 Output signal: 4 - 20 mA, 0-5V, 0-10V.

.3 Output variations: $\pm$ 1 % full scale for supply voltage variations of plus or minus 10 %.

.4 Combined non-linearity, repeatability, and hysteresis effects: not to exceed plus or minus 1% of full scale output over entire range.

.5 Integral zero and span adjustment.

.6 Temperature effects: not to exceed plus or minus 1.5 % full scale/ 50 °C.

.7 Over-pressure input protection to at least twice rated input pressure.

.8 Output short circuit and open circuit protection.

.9 Pressure ranges: see I/O Summaries.

.10 Accuracy: plus or minus 1 % of full scale.

.11 LCD Display.

2.7 DIFFERENTIAL PRESSURE (KPA) TRANSMITTERS

.1 Requirements:

.1 Internal materials: suitable for continuous contact with industrial standard instrument air, compressed air, water, steam, as applicable.

.2 Output signal: 4 - 20 mA, 0-5V, 0-10V.

.3 Output variations: $\pm$ 1 % full scale for supply voltage variations of plus or minus 10 %.

.4 Combined non-linearity, repeatability, and hysteresis effects: not to exceed plus or minus 1 % of full scale output over entire range.

.5 Integral zero and span adjustment.

.6 Temperature effects: not to exceed plus or minus 1.5 % full scale/ 50 °C.

.7 Over-pressure input protection to at least twice rated input pressure.

.8 Output short circuit and open circuit protection.

.9 The unit to have a NPT connections. The enclosure shall be an integral part of the unit.

.10 LCD Display.

2.8 DIFFERENTIAL PRESSURE (PA) TRANSMITTERS

.1 Requirements:

.1 Output signal: 4 - 20 mA in 400 ohms, 0-5V into 5K ohms minimum, 0-10 V into 10K ohms minimum.

.2 Output variations: ± 1% full scale for supply voltage variations of plus or minus 10%.

.3 Integral zero and span adjustment.

.4 Temperature effects: not to exceed plus or minus 3% full scale/ 50 °C.

.5 Output short circuit and open circuit protection.

.6 The unit to have a NPT ½ conduit connection. The enclosure shall be an integral part of the unit.

.7 Pressure ranges: see I/O Summaries.

.8 LCD Display.

2.9 FAN SYSTEM STATIC PRESSURE SENSORS

.1 As per 2.10

2.10 FAN SYSTEM STATIC PRESSURE TRANSMITTERS

.1 Requirements:

.1 Output signal: 4 - 20 mA in 400 ohms, 0-5V into 5K ohms minimum, 0-10 V into 10K ohms minimum.

.2 Output variations: ± 1% full scale for supply voltage variations of plus or minus 10%.

.3 Integral zero and span adjustment.

.4 Temperature effects: not to exceed plus or minus 3% full scale/ 50 °C.

.5 Output short circuit and open circuit protection.

.6 The unit to have a NPT ½ conduit connection. The enclosure shall be an integral part of the unit.

.7 Pressure ranges: see I/O Summaries.

.8 LCD Display.

2.11 DUCT SYSTEM VELOCITY PRESSURE SENSORS

.1 Requirements:

.1 Multipoint static and total pressure sensing element with self-averaging manifold with integral air equalizer and straightener section.

.2 Maximum pressure loss: 37 Pa at 1000 m/s.

.3 Accuracy: plus or minus 1 % of actual duct velocity.

2.12 FAN SYSTEM VELOCITY PRESSURE TRANSMITTERS

.1 Requirements:

.1 Output signal: 4 - 20 mA linear into 500 ohm maximum load.

.2 Calibrated span: not to exceed 25 % of duct velocity pressure at maximum flow.

.3 Accuracy: 0.4 % of span.

.4 Repeatability: within 0.1 % of output.

.5 Linearity: within 0.5 % of span.

.6 Deadband or hysteresis: 0.1 % of span.

.7 External exposed zero and span adjustment.

.8 The unit to have a NPT ½ conduit connection. The enclosure shall be an integral part of the unit.

2.13 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.

2.14 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.

2.15 PRESSURE AND DIFFERENTIAL PRESSURE SENSORS AND SWITCHES

.1 Requirements:

.1 Range: as indicated in I/O summaries.

.1 Pressure sensing elements: bourdon tube, bellows or diaphragm type.

.2 Adjustable setpoint and differential.

.3 Switch: snap action type, rated at 120V, 15 amps AC or 24 V DC.

.4 Sensor assembly: to operate automatically and reset automatically when conditions return to normal. Over-pressure input protection to at least twice rated input pressure.

.5 Accuracy: within 2% repetitive switching.

.6 Provide sensor pressure and accuracy ratings:

.1 Chilled and condenser water: 860 kPa.

.2 Hot water: 860 kPa.

.3 Low pressure steam, compressed air: 1050 kPa. Range: 0 to 200 kPa. Accuracy: plus or minus 3 kPa.

.4 Medium pressure steam, compressed air: 1050 kPa. Range: 0 to 700 kPa. Accuracy: plus or minus 7 kPa.

.5 High pressure steam: 2100 kPa. Range: 0 to 2100 kPa. Accuracy: plus or minus 14 kPa.

.6 High temperature water: 2700 kPa. Range: 0-2700 kPa. Accuracy: plus or minus 25 kPa.

.7 For fan operation: Range: 0 to 3000 Pa. Adjustable differential: 10 to 300 Pa.

.7 Provide sensors with isolation valve and snubber between sensor and pressure source on liquid service.

.8 Sensors on steam and high temperature hot water service: provide pigtail syphon.

2.16 TEMPERATURE SWITCHES

.1 Requirements:

.1 Range: see I/O summaries.

.2 Temperature sensor: liquid, vapour or bimetallic type. Operate automatically. Reset automatically, except as follows:

.1 Freeze protection: manual reset. Optional if software does not auto restart.

.2 Fire detection: manual reset. Optional if software does not auto restart.

.3 Duct Heater: high limit manual reset in addition to automatic reset.

.3 Adjustable setpoint and differential.

.4 Accuracy: plus or minus 1 °C.

.5 Snap action rating: 120V, 15 amps or 24V DC as required. Switch to be DPST for hardwire and EMCS connections.

.6 Type as follows:

.1 Room: for wall mounting on standard electrical box with or without protective guard as indicated.

.2 Duct, general purpose: insertion length = 460 mm.

.3 Thermowell: stainless steel, with compression fitting for NPS 3/4 thermowell. Immersion length: 100 mm.

.4 Freeze detection: continuous element with 6000 mm insertion length, duct mounting, to detect coldest temperature in any 300 mm length.

.5 Strap-on: with helical screw stainless steel clamp.

2.17 TANK LEVEL SWITCHES

.1 Requirements:

.1 Indicate high/low water level and to alarm.

.2 For mounting on top of tank.

.3 Maximum operating temperature: 120 °C.

.4 Mechanical switch or snap action contacts rated 15 amp at 120 V.

.5 Adjustable setpoint and differential.

2.18 LIQUID LEVEL SWITCHES

.1 Requirements:

.1 Liquid level activated switch sealed in waterproof and shockproof enclosure.

.2 Complete with float, flexible cord, weight. Instrument casing to be suitable for immersion in measured liquid.

.3 N.O./N.C. Contacts rated at 15 amps at 120V AC. CSA approval for up to 250 volt 10 amps AC.

2.19 WIND VELOCITY TRANSMITTERS

.1 Requirements:

.1 3-cup anemometer and airfoil vane mounted on common vertical axis, designed for mast mounting.

.2 Anemometer:

.1 Range: 0-160 km/h.

.2 Threshold: 3.0 km/h.

.3 Accuracy: +/- 2%.

.3 Airfoil vane

.1 Anemometer range: 0-360^{o} with infinite resolution potentiometer with no loss of reading at transition point.

.2 Starting threshold: 1.1 m/s.

.3 Accuracy: +/- 0.5%.

.4 Output signal: 4 to 20 mA into 500 ohm load.

.5 Provide two output signals: velocity, direction.

.6 Mast: aluminum, size and height as indicated. Provide at least 3 stainless steel guys, turnbuckles, anchor bolts. Follow manufacturers installation guidelines. Lightning protection as indicated on electrical drawings.

2.20 SOLAR SENSORS

.1 Monitor solar irradiation as indicated.

.2 Pyranometer, black and white, producing proportional 0-50 mV signal. Include converter for 4-20 mA signal.

2.21 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).

2.22 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 .07 l/s air at 104 kPa differential.

2.23 AIR PRESSURE GAUGES

.1 Diameter: 38 mm minimum.

.2 Range: zero to two times operating pressure of measured pressure media to nearest standard range.

2.24 ELECTRICAL RELAYS

.1 Requirements:

.1 Double voltage, DPDT, plug-in type with termination base.
.2 Coils: rated for 120V AC or 24V DC. Other voltage: provide transformer.
.3 Contacts: rated at 5 amps at 120 V AC.
.4 Relay to have visual status indication

2.25 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.

2.26 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.

2.27 CURRENT SENSING RELAYS

.1 Requirements:

.1 Complete with metering transformer ranged to match load, plug-in base and shorting shunt to protect current transformer when relay is removed from socket.

.2 Suitable for single or 3 phase metering into single relay.

.3 To have adjustable latch level, adjustable delay on latch and minimum differential of 10 % of latch setting between latch level and release level.

.4 3-Phase application: provide for discrimination between phases.

.5 To have adjustable latch level to allow detection of worst case selection. To be powered from control circuit of motor starter being metered. Relay and base to be mounted in adjacent auxiliary cabinet only if control circuit power to be brought into auxiliary cabinet. Adjustments to be acceptable from auxiliary cabinet.

.6 Relay contacts: capable of handling 10 amps at 240 V AC.

2.28 CONTROL DAMPERS

.1 Construction: blades, 152 mm wide, 1219 mm long, maximum. Modular maximum size, 1219 mm wide x 2438 mm high. Multiple sections to have stiffening mullions and jack shafts.

.2 Materials

.1 Frame: 2.3 mm minimum thickness galvanized steel.

.2 Blades: galvanized steel with two sheets 0.5 mm thick or otherwise reinforced to ensure specified low leakage when fully closed.

.3 Bearings: oil impregnated sintered bronze. Provide thrust bearings for vertical blades.

.4 Linkage and shafts: zinc plated steel.

.5 Seals: replaceable neoprene or stainless steel spring on sides, top, bottom of frame, along all blade edges and blade ends.

.3 Performance:

.1 Capacity: refer to I/O Summaries.

.2 0.02 L/s.m 2 maximum allowable leakage against 1000 Pa static pressure.

.3 Temperature range: minus 50°C to plus 100°C.

.4 Arrangements: dampers mixing warm and cold air to be parallel blade, mounted at right angles to each other, with blades opening to mix air stream.

2.29 PNEUMATIC CONTROL DAMPER OPERATORS

.1 Requirements:

.1 Piston type with spring return for "fail-safe" in Normally Open or Normally Closed position, as indicated.

.2 Operator: size so as to control dampers against maximum pressure or dynamic closing pressure (whichever is greater).

.3 Adjustable spring and stroke external stops to limit strokes in either direction.

.4 Full relay type positioner with interconnecting linkage for mechanical feedback of actual damper position.

.5 Multiple section dampers over 1200 mm long: to be driven from both ends.

2.30 ELECTRONIC CONTROL DAMPER OPERATORS

.1 Requirements

.1 Push-pull proportional type as indicated.

.2 Spring return for "fail-safe" in Normally Open or Normally Closed position as indicated.

.3 Operator: size so as to control dampers against maximum pressure or dynamic closing pressure (whichever is greater).

.4 Power requirements: 5 VA maximum at 24 V AC.

.5 Operating range: 4-20 mA. 0-10 V DC, 2-10 V DC.

2.31 CONTROL VALVES

.1 Requirements:

.1 NPS 2 and under: bronze with screwed ends.

.2 NPS 2 1/2 and over: cast iron with flanged ends.

.3 Trim: type 316 stainless steel.

.4 Leakage: 0.5 % of rated flow maximum.

.5 Two or three port as indicated. Normally Open or Normally Closed, as indicated.

.6 Flow characteristics: linear or equal percentage as indicated.

.7 Rangeability: 50:1 minimum.

.8 Performance: Capacity refer to I/O Summaries and Valve Schedule.

2.32 PNEUMATIC VALVE ACTUATORS

.1 Requirements:

.1 Construction: steel, cast iron, aluminum.

.2 Diaphragm: moulded Buna-N rubber, nylon reinforced.

.3 Spring return to normal position.

.4 Spring range adjustment and position indicator.

2.33 ELECTRONIC/ELECTRIC VALVE ACTUATORS

.1 Requirements:

.1 Construction: steel, cast iron, aluminum.

.2 Control voltage: 0-5, 0-10, 2-10V DC, or 4-20 mA.

.3 Positioning time: to suit application, 90 sec maximum.

.4 Spring return to normal position as indicated.

2.34 WATTHOUR METERS AND CURRENT TRANSFORMERS

.1 Requirements:

.1 Include three phases, test and terminal blocks for watthour meter connections and connections to FID for monitoring of current. Provide three potentiometer transformers for 600 V 4 wire systems for watthour meter use. Accuracy: plus or minus 0.25 % of full scale. For chiller applications: To have instantaneous indicator with analog or digital display.

.2 Watthour meter sockets: to ANSI C12.7.

.3 Potentiometer and current transformers: to ANSI/IEEE C57.13.

.4 Potential transformers: provide two primary fuses.

.5 Demand meters: configure to measure demand at 15 minute intervals.

2.35 SURFACE WATER DETECTORS

.1 Requirements:

.1 Provide alarm on presence of water on floor.

.2 Expendable cartridge sensor.

.3 Internal waterproof switch.

.4 One set of dry contacts 2 amps at 24 V.

.5 Unaffected by moisture in air.

.6 Self-powered.

2.36 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's Representative without adding additional cabinets.

.3 Panels to be lockable with same key.

2.37 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.

.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.

2.38 ELECTRONIC VAV TERMINAL CONTROL BOX

.1 Terminal box sized to deliver air quantities as per mechanical VAV Box Schedule.

.2 Box complete with factory installed averaging air velocity sensor.

.1 Provide removable air flow sensor with minimum 4 point sensing with +/- 5% accuracy at 10 deg C to 35 deg C and 40 to 1000 l/s.

.3 Box to include direct damper shaft mounted actuator, of the non stall, full linear with position feedback type. Actuator to de-energize when at desired position.

.4 Box to be complete with power transformer and control wiring to damper actuator and termination terminals for room sensors and other specified sensors and auxiliary devices.

.5 Box to include VAV Controller as described in Section 25 30 01-EMCS: Building Controllers with appropriate mounting plate and protective cover.

2.39 ELECTRONIC AIR FLOW MEASUREMENT STATIONS AND TRANSMITTERS

.1 Each station to contain an array of velocity sensing elements and straightening vanes inside a flanged sheet metal casing. The velocity sensing elements to be of the thermal, temperature compensated thermistor type, with linearizing means. The sensing elements to be distributed across the duct cross section in the quantity and pattern set forth for measurements and instruments of ASHRAE and SMACNA for the traversing of ducted air flows. The resistance to air flow through the airflow measurement station not to exceed 20 Pa gauge at an airflow of 10 m/s. Station construction suitable for operation at airflows of up to 25 m/s over a temperature range of 5 to 50 degrees C, and accuracy plus or minus 3 percent over a range of 0.625 to 12.5 m/s scaled to air volume.

.2 Transmitters to produce a linear, temperature compensated 4-20 mAdc output corresponding to the required velocity pressure measurement. The transmitter to be a 2-wire, loop powered device with local indication where indicated. The output error of the transmitter not to exceed 0.5 percent of the calibrated measurement.

2.40 FUEL TANK LEVEL SENSOR

.1 Provide suitable electronic, ULC approved oil tank level sensor to measure product and water level in oil tank specified in Section 33 56 13 – Aboveground Fuel Storage Tanks. Components in oil tank to be of stainless steel construction, electrical enclosures CSA rated. Float type probes to be provided with riser to suit oil tank c/w suitable tapping adaptor and S.S. guide tube with foot.

.2 Sensor to communicate with EMCS system for oil and water level in tank.

PART 3 EXECUTION.

3.1 INSTALLATION

.1 Install field control devices, conduit and wire in accordance with manufacturers recommended methods, procedures and instructions. Wiring and conduit above 50 volts by electrical Division. Coordinate requirements with Electrical Contactor.

.2 Temperature transmitters, humidity transmitters, current-to-pneumatic transducers, solenoid air valves, controllers, relays: install in CSA 2 enclosures or as required for specific applications. Provide for electrolytic isolation in all cases when dissimilar metals make contact.

.3 Support field-mounted transmitters, sensors on pipe stands or channel brackets.

.4 Install wall mounted devices on plywood panel properly attached to wall.

3.2 TEMPERATURE AND HUMIDITY SENSORS

.1 Stabilize to ensure minimum field adjustments or calibrations.

.2 To be readily accessible and adaptable to each type of application so as to allow for quick easy replacement and servicing without special tools or skills.

.3 Outdoor installation:

.1 Protect from solar radiation and wind effects by stainless steel shields.

.2 Install in CSA 4X enclosures.

.4 Duct installations

.1 Do not mount in dead air space.

.2 Location to be within sensor vibration and velocity limits.

.3 Securely mount extended surface sensor used to sense average temperature.

.4 Thermally isolate elements from brackets and supports so as to respond to air temperature only.

.5 Support sensor element separately from coils, filter racks.

.5 Averaging duct type temperature sensors:

.1 Sensor length to be not less than 1000 mm per square metre of duct cross-sectional area.

.2 Use multiple sensors where single sensor does not meet minimum length ratio. Wire multiple sensors in series for freeze protection applications.

.3 Wire multiple sensors separately for temperature measurement.

.4 Use either software averaging algorithm to derive overall average for control purposes or separate inputs, based on site requirements.

.6 Thermowells: install for piping installations. Where pipe diameter is less than well insertion length, locate well in elbow. Thermowell to restrict flow by less than 30%.

3.3 PANELS

.1 Arrange for conduit and tubing entry from top, bottom or either side.

.2 Use modular multiple panels if necessary to handle all requirements, with space for additional 20% PCU or FID if applicable without adding additional panels. Space to accommodate maximum capacity of associated controller (ECU, LCU, MCU, PCU, TCU).

.3 Wiring and tubing within panels: locate in trays or individually clipped to back of panel.

.4 Identify wiring and conduit clearly.

3.4 MAGNEHELIC PRESSURE INDICATORS

.1 Install adjacent to fan system static pressure sensor and duct system velocity pressure sensors (as approved by the Owner's Representative).

.2 Locations to be as indicated or specified.

3.5 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.

3.6 I/P TRANSDUCERS

.1 Install air pressure gauge on outlet.

3.7 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.

3.8 AIR PRESSURE GAUGES

.1 Install on pneumatic systems only.

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

3.9 PNEUMATIC VALVE ACTUATORS

.1 Install full relay type positioner having interlocking linkage for mechanical feedback of actual valve position on all modulating valves except radiation and unit heaters.

3.10 TANK LEVEL SWITCHES

.1 Mount in top of tank in threaded coupling.

3.11 LIQUID LEVEL SWITCHES

.1 Suspend float in sump from flexible cord and with weight mounted not more than 50 mm above switch.

3.12 IDENTIFICATION

.1 Identify field devices properly.

.2 Refer to Section 25 05 54 - EMCS: Identification.

3.13 AIR FLOW MEASURING STATIONS

.1 Cap manifold until cleaning of ducts is completed.

3.14 TESTING

.1 Calibrate and test field devices for accuracy and performance. Submit report detailing tests performed, results obtained to Owner's Representative for approval. Owner's Representative will verify results at random. Provide testing equipment and manpower necessary for this verification.

3.15 COMMISSIONING

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

END OF SECTION

PART 1 GENERAL

1.1 DESIGN DOCUMENTATION

.1 Design documentation for each system to include, as a minimum:

Narrative type of Sequence of Operation.

Control Description Logic (CDL).

Input/Output Summary Schedules.

Schematics.

1.2 EMCS LANGUAGE DESIGN CRITERIA

.1 Language: refer to Section 25 05 01 EMCS: General Requirements.

.2 Levels of EMCS Language

Level 1: alarm and operational messages to convey alarm conditions or operational messages.

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.

Level 3: system, equipment, component and control point descriptors: unique, alphanumeric identifiers derived from full names of corresponding system component and control point.

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.

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:

Full names of the equipment, component and control points shall be not more than 40 characters, including numerals.

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.

Table:
Identifiers and Expansions

English Identifier (10 characters max)	English Expansion (40 characters max)
OAD	Outside air damper
OAT	Outside air temperature
OAH	Outside air humidity
OAV	Outside air volume
RAD	Return air damper
RAT	Return air temperature
RAH	Return air humidity
RASP	Return air static pressure
MAD	** Mixed air dampers **
MAT	Mixed air temperature
MAPSP	Mixed air plenum static pressure

** MAD shall be used for applications where outside air and return air dampers are controlled from one (1) only output signal.

EAD	Exhaust air damper
PFPD	Pre-filter pressure drop
PFALM	Pre-filter pressure drop alarm
FFPD	Final filter pressure drop
FFALM	Final filter pressure drop alarm
HCVLV	Heating coil valve
HCVLVC	Heating coil valve control
HCVLVS	Heating coil valve status
BPD	Heating coil face and bypass damper
HCFA	Heating coil freeze alarm
CCVLV	Cooling coil valve
CCVLVC	Cooling coil valve control
CCVLVS	Cooling coil valve status
SVLV	Steam valve
SVLVC	Steam valve control
SVLVS	Steam valve status
SF#-C	Supply fan # control
SF#-S	Supply fan # status
SF#-VSD	Supply fan # VSD control

SF#-VSDF	Supply fan # VSD fault
SAV	Supply air volume
SAVC	Supply air volume control
SAT	Supply air temperature
SAH	Supply air humidity
SAVP	Supply air velocity pressure
SASP	Supply air static pressure
RF#-C	Return fan #control
RF#-S	Return fan # status
RF#-VSD	Return fan # VSD control
RF#-VSDF	Return fan # VSD fault
RAV	Return air volume
RAVC	Return air volume control
RAT	Return air temperature
RAH	Return air humidity
RAVP	Return air velocity pressure
RASP	Return air static pressure
EF#-C	Exhaust fan # control
EF#-S	Exhaust fan s# status
EXAT	exhaust air temperature
EXAV	exhaust air volume
Chiller #1:	
CH1F	flow rate
CH1LWT	leaving chilled water temperature
CH1LWP	Leaving chilled water pressure
CH1EWT	Entering chilled water temperature
CH1EWP	Entering chilled water pressure
CD1EWT	Entering condenser water temperature
CD1EWP	Entering condenser water pressure
CD1LWT	Leaving condenser water temperature
CD1LWP	Leaving condenser water pressure
CHP1F	Chilled water pump #1 flow rate
CHP1DP	Chilled water pump #1 discharge pressure
CHP1S	Chilled water pump #1 status
CP3C	Circulating pump #3 control
CP3F	Circulating pump #3 flow rate
CP3DP	Circulating pump #3 discharge pressure
CP3S	Circulating pump #3 status
HTA	High temperature alarm

LTA	Low temperature alarm
HTCO	High temperature cutout
LTCO	Low temperature cutout
HLA	High level alarm
LLA	Low level alarm
HLCO	High level cutout
LLCO	Low level cutout
HWF	Heating water flow rate
HWST	Heating water supply temperature
HWRT	Heating water return temperature
STP	Steam pressure
STF	Steam flow rate
RM-T	Room temperature
RM-H	Room humidity
RM-SP	Room static pressure (add reference point)

Examples of specific space conditions:

RM-TNPER 2	Space temperature, North Perimeter, 2nd floor
RM-SPSPER I9	Space static pressure, South Perimeter, 19th floor
RM-HEINT 9	Space humidity, East Interior, 9th floor
AFS	Air Flow Switch
AFM	Air Flow Monitor
F	Flow
P	Pressure
ST	Supply temperature
RT	Return temperature
FA	Fire alarm
FTA	Fire trouble alarm
CW	Chilled water system
CD	Condenser Water System
HWH	Hot water heating system
RADN	Radiation system
CDR	Condensate return system
HPS	Steam - High pressure system
LPS	Steam - Low pressure system
DCW	Domestic cold water system
DHW	Domestic hot water system
DHWR	Domestic hot water system Recirculation

SANP	Sanitary sewage - pumped system
STMP	Storm water - pumped system
SPRD	Sprinkler - Dry pipe system
SPRW	Sprinkler - Wet pipe system
FSTP	Fire standpipe & hose system
VBA	Volume Box Control Assembly

1.3 I/O SUMMARY SCHEDULES

.1 General:

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.

PCU no: identifies the PCU to which all points in the I/O Summary Schedule are wired.

Building/Area: unique label given to each building forming part of a multi-building facility.

Area/System Label: unique label given to each area of the building or to each system.

.1 Column 1: Point no: I/O Summary Schedule reference number.

.2 Column 2: Point label: unique label for each point in the system. Point labels may be repeated for other buildings or systems.

.3 Column 3: Description: describes the point label in expanded terms.

.4 Column 4: Type: (eg. AI, AO, DI, DO).

.5 Column 5: Eng. Units: Describes the engineering units used (eg. for AI, AO: C, kPa, Amp Volt. For DI, DO: OFF, ON).

.6 Column 6: Access level: Defines the level of access for varying complexity of functions. Usually associated with password feature. Usually assigned value between 0 (lowest) and 4 (highest).

.7 Column 7: Sensor type: describes in 2 or 3words.

.8 Column 8: Assoc. Point: Identifies/ describes points for purposes of alarm suppression, software interlocks.

.9 Column 9: Type: defines the type of alarm (eg. CR = CRITICAL, CA = CAUTIONARY, M = MAINTENANCE).

.10 Column 10: DI/DO, NO/NC: defines the NORMAL condition of alarm. (NC = NORMALLY CLOSED. NO = NORMALLY OPEN).

.11 Column 11: Limits: Defines alarm levels (eg. L2 = Low alarm, Level2. H1 = High alarm, Level1).

.12 Column 12: Alarm Mess: Defines alarm message number. This number is related to pre-composed message detailing the problem and describing the required action.

.13 Column 13: Maint Mess: defines maintenance message number. This number as related to pre-composed message detailing the problem and describing the required action.

.14 Column 14: Set Point: Defines the design set-point of the control loop.

.15 Column 15: Dead band: defines the range above or below the set-point at which no change in output signal is to occur.

.16 Column 16: Dev alarm limit: defines the limit on deviation of the measured value from the set-point (sometimes also referred to as the "error limit").

.17 Column 17: NC/NO: defines NORMAL condition when de-energized. NC - NORMALLY CLOSED. NO = NORMALLY OPEN. DA/RA: defines the form of action. DA = direct acting. RA = REVERSE ACTING.

.18 Column 18: Contacts: NO/NC: defines NORMAL condition when de-energized. NC = NORMALLY CLOSED. NO = NORMALLY OPEN.

.19 Column 19: Delay Succ starts: defines the time limits (usually in seconds). To prevent overheating of motors or equipment from frequent re-starting.

.20 Column 20: Heavy motor delay: defines the time (usually up to 60seconds). To prevent heavy electrical load from simultaneous starting of large consumption equipment.

.21 Column 21: auto-reset: A = AUTOMATIC. M=MANUAL.

.22 Column 22: Programs:

.1 Examples of Applications Programs include: Night set-back; optimum start/stop; demand limiting (load shedding).

.2 Optimization routines (eg. chiller optimization, supply air temperature optimization, enthalpy control) should be described as part of CDL's.

.3 Parameters for all application programs should be provided separately as part of the design documentation (eg. the Systems Operation Manual).

.4 Note requirements for computer totalization, recording, print-out of accumulated value of a point over a period of time. If totalization depends upon a number of analog points, include for pseudo energy points.

.5 Run time totals: for calculation of operation of digital points.

.6 Optimum start/stop: Example: HVAC unit to start before scheduled occupancy, based upon HVAC unit capacity, heat loss, interior and exterior environmental conditions, etc.

.1 Schedule:

INPUT/OUTPUT			SCHEDULE PCU NO.					(see 1.3.2)		
PROJECT NO.			BLDG/AREA			NAME		(see 1.3.3)		
PROJECT NAME			AREA/SYSTEM			NAME		(see 1.3.3)		
POINT IDENTIFICATION								ALARMS		
1	2	3	4	5	6	7	8	9	10	11
Point. No	Point Label	Descrip	Type	Eng. Unit	Access Level	Sensor type	Assoc Point	Type (M,CR)	DI/D0 NO/NC	Limits

MESSAGES								DI/DO		
12	13	14	15	16	17	18	19	20	21	22
Alarm	Maint	Set-	Dead	Dev.	NO/NC	Cont's	Delay	Heavy	Auto	Prog

Limit	Point MO/MA	band	start	alarm delay	DA/RA	NO/NC	succ.	Motor	reset

1.4 CONTROL NARRATIVE SEQUENCE OF OPERATIONS

.1 General Heat Pump Operation:

System Start-Stop Control: the system occupied and unoccupied modes will be controlled manually or by a seven day time schedule. The manual override will be done from the override button on the thermostat, the thermostat will have an occupied and unoccupied mode indication in the form of an LED displaying green in the occupied and red for unoccupied mode. The Heat Pumps will be scheduled from the Central Computer and will have operator adjustable schedules.

Fan Operation: Fan operation will be constant during the occupied period and will be intermittent during the unoccupied period. The system will be started whenever the manual after hours override button on the thermostat is activated. The system will operate in Occupied Mode until the switch times out. The override time will be an operator adjustable parameter.

Night Cycle: the system will cycle on and off at night to prevent the space from getting too hot or too cold. When the room temperature falls below the unoccupied heating setpoint, then the system will start and continue to run until the room temperature rises by 3°C. if the room temperature rises above the unoccupied cooling setpoint, then the system will start and continue to run until the room temperature falls by 3°C. All setpoints to be operator adjustable in a simple graphics or text based format.

Unoccupied Mode: Anytime the system operates prior to or after scheduled occupied periods, the system will operate with the following room temperature setpoints.

Heating	13°C
Cooling	32°C

During the Unoccupied Mode the water source control valve is closed, the compressor and supply fan are off.

System “ON” (Occupied) Mode (Room Temperature Control) During occupied periods, the system will operate with the following room temperature setpoints:

Heating	20°C
Cooling	23°C

Space temperature deviation above the cooling set point or below the heating set point will generate a demand signal to control the system as follows:

Heating Stages: A PI control algorithm will cycle on and off the compressor and auxiliary heat outputs as required to maintain room temperature heating setpoint. The auxiliary heat will be controlled at 1°C below heating set point on single compressor units and 2°C below heating set point on double compressor models.

Cooling Stages: A PI control algorithm will cycle on and off the compressor as required to maintain room temperature cooling setpoint.

Operation Minimum ON/OFF Times: the control algorithm will provide for user adjustable minimum ON and OFF times for equipment stages. The program will maintain a minimum operation time of 4 minutes “ON” and 4 minutes “OFF” for compressor stages and 2 minutes “ON” and 2 minutes “OFF” for auxiliary heat.

Automatic System Change-Over: the heating-cooling mode will be determined based on room temperature and the occupied/unoccupied heating and cooling setpoints. The refrigerant reversing valve will be controlled to the appropriate heating-cooling mode position for that heat pump with dual refrigerant circuits (2 compressors, 2 reversing valves and 2 emergency shutdown circuits). Provide for 2-stage heating and cooling with duplicate operating, monitoring and alarm points.

Power Interruption: during an interruption of ac power, backup power will be provided to maintain operational parameters. The system will cycle off and provide timed restaging of heating or cooling equipment upon restoration of power. The restaging operation will occur according to minimum stage operating times incorporated in the control algorithm.

.2 Sequence of Operation – Heat Pump

.1 This section to be read in conjunction with subsection 1.4.1 General Heat Pump Operation.

.2 Room thermostat monitors space temperature and provides setpoint adjustment, over-ride and over-ride indication. Night set back schedule to be programmed for each heat pump at central work station.

.3 Heat pumps will be on a time-of-day schedule for occupied and unoccupied modes from the building automation system.

.4 On a call for heating or cooling, the slow closing water solenoid valve is energized and opened to allow water flow through the heat pump. The reversing valve is positioned in the required position depending on whether heating or cooling is required.

.5 The evaporator fan runs continuously during the occupied period but is cycled on-off during the unoccupied period to maintain the night-setback temperature. The cooling cycle will be locked out during the unoccupied periods.

.6 The heat pump will start the compressor only after the system has verified that the heat pump emergency shutdown conditions are not present. These emergency shutdown conditions shall include high discharge pressure, low suction pressure, high water level and freeze protection.

.7 Heat pump controller will position the reversing valve depending on whether heating or cooling is required. A replay across the emergency shut-down circuit will be monitored by the Building Automation System to signal when the heat pump has been shut down on an emergency condition.

.8 Heat pump controller shall have capability of monitoring CO_2 levels.

.9 Provide programming for individual time-of-day scheduled operation for each heat pump.

1.5 INPUT/OUTPUT POINT SUMMARY TABLE

.1 Provide an input/output table summarizes the Input/Output (I/O) points for the various systems as outlined within the EMCS specifications and control schematic drawings. All points and field devices required to accomplish the specified sequence of operation shall be provided.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

PART 1 GENERAL

1.1 GENERAL

.1 This Section covers items common to Sections of Division 26. This section supplements requirements of Division 1, Division 23, Division 27, Division 28, Division 33 and Division 34. Refer to Section 01 00 00 – Bid Depository Sections where applicable for bid depository.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

.2 CAN/CSA-22.3 No. 1, Overhead Systems.

.3 CAN3-C235, Preferred Voltage Levels for AC Systems, 0 to 50,000 V.

1.3 CARE, OPERATION AND START-UP

.1 Instruct Owner's Representative and operating personnel in the operation, care and maintenance of systems, system equipment and components.

.2 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with all aspects of its care and operation.

1.4 DESIGN REQUIREMENTS

.1 Operating voltages: to CAN3-C235

.2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

1.5 SUBMITTALS

.1 Submit shop drawings in accordance with Section 10 33 00 – Submittal Procedures.

.2 Quality Control: in accordance with Section 01 45 00 - Quality Control.

.1 Provide CSA certified equipment and material. Where CSA certified equipment and material is not available, submit such equipment and material to authority having jurisdiction for approval before delivery to site.

.2 Submit test results of installed electrical systems and instrumentation.

.3 Submit, upon completion of Work, load balance report as described in sentence 3.4.6.

.4 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Owner's Representative.

1.6 PERMITS, FEES AND INSPECTION

.1 Submit to Electrical Inspection Division and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work.

.2 Pay associated fees.

.3 Owner's Representative will provide drawings and specifications required by Electrical Inspection Division and Supply Authority at no cost.

.4 Notify Owner's Representative of changes required by Electrical Inspection Division prior to making changes.

.5 Furnish Certificates of Acceptance from Electrical Inspection Division or authorities having jurisdiction on completion of work to Owner's Representative.

1.7 CO-ORDINATION

.1 Co-ordinate work with work of other divisions to avoid conflict.

.2 Locate distribution systems, equipment, and materials to provide minimum interference and maximum usable space.

.3 Locate all existing underground services and make all parties aware of their existence and location.

.4 Where interference occurs, Owner's Representative must approve relocation of equipment and materials regardless of installation order.

.5 Notwithstanding the review of shop drawings, this division may be required to relocate electrical equipment which interferes with the equipment of other trades, due to lack of co-ordination by this Division. The cost of this relocation shall be the responsibility of this Division. The Owner's Representative shall decide the extent of relocation required.

1.8 CUTTING AND PATCHING

.1 Inform all other divisions in time, concerning required openings. Where this requirement is not met, bear the cost of all cutting. Openings of 200 mm or smaller shall be the responsibility of Division 26. Openings larger than 200 mm shall be the responsibility of Division 1. Obtain written approval of Structural engineer before drilling any beams or floors.

1.9 PROTECTION

.1 Protect exposed live equipment during construction for personnel safety.

.2 Shield and mark all live parts "LIVE 120 VOLTS", or with appropriate voltage in English.

.3 Arrange for installation of temporary doors for rooms containing electrical distribution equipment. Keep these doors locked except when under direct supervision of electrician.

1.10 RECORD DRAWINGS

.1 Obtain and pay for three sets of white prints. As the job progresses, mark these prints to accurately indicate installed work. Have the white prints available for inspection at the site at all times and present for scrutiny at each job meeting.

.2 Show on the record drawings the installed inverts of all services entering and leaving the building and the property. Dimension underground services at key points of every run in relation to the structure and building.

.3 Indicate exact location of all services for future work. Show and dimension all work embedded in the structure.

.4 Submit record drawings within 30 days prior to start of commissioning.

1.11 INSPECTION OF WORK

.1 The Owner will make periodic visits to the site during construction to ascertain reasonable conformity to plans and specifications but will not execute quality control. The Contractor shall be responsible for the execution of his work in conformity with the construction documents and with the requirements of the inspection authority.

1.12 SCHEDULING OF WORK

.1 Work shall be scheduled in phases as per other divisions of the architectural specifications.

.2 Become familiar with the phasing requirements for the work and comply with these conditions.

.3 No additional monies will be paid for contractor's requirement to comply with work phasing conditions.

1.13 FIRE RATING OF PENETRATIONS

.1 Maintain fire ratings around conduits passing through floors, ceilings and fire rated walls.

.2 Use 3M brand or equal fire barrier products at each penetration.

.3 Acceptable products for fire barrier products shall be 3M #CP25 fire barrier caulk, #303 putty, #FS 195 wrap and #CS195 sheet.

.4 Acceptable manufacturers: Nelson, Fire Stop Systems, 3M or approved equal. Material of same manufacturer to be used throughout project..

PART 2 PRODUCTS

2.1 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

.1 Supplier and installer responsibility is indicated in Motor, Control and Equipment Schedule on electrical drawings and related mechanical responsibility is indicated on Mechanical Equipment Schedule on mechanical drawings, where applicable.

.2 Control wiring and conduit is specified in Division 26 except for conduit, wiring and connections below 50 V which are related to control systems specified in Division 25 and shown on mechanical drawings. Division 25 – EMCS Controls Contractor is responsible for all conduit, wiring and connections below 50V which are related to control systems in Division 25 and shall comply with the requirements of Division 26 for standard of quality.

2.2 MATERIALS AND EQUIPMENT

.1 Provide materials and equipment in accordance with Section 01 61 00 - Common Product Requirements.

.2 Equipment and material to be CSA certified. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from Electrical Inspection Division.

.3 Factory assemble control panels and component assemblies.

2.3 WARNING SIGNS

.1 As specified and to meet requirements of Electrical Inspection Department and Owner's Representative.

.2 Porcelain enamel decal signs, minimum size 175 x 250 mm.

2.4 WIRING TERMINATIONS

.1 Lugs, terminals, screws used for termination of wiring to be suitable for either copper or aluminum conductors.

2.5 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with nameplates and labels as follows:

.1 Nameplates: Lamicoid 3 mm thick plastic engraving sheet, black white face, black white core, mechanically attached with self tapping screws.

.2 Sizes as follows:

NAMEPLATE SIZES

Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters

NAMEPLATE SIZES

Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters

.2 Labels:

.1 Embossed plastic labels with 6 mm high letters unless specified otherwise.

.3 Wording on nameplates and labels to be approved by Owner's Representative prior to manufacture.

.4 Allow for average of twenty-five (25) letters per nameplate and label.

.5 Identification to be English (and French where applicable).

.6 Nameplates for terminal cabinets and junction boxes to indicate system name and voltage characteristics.

.7 Disconnects, starters and contactors: indicate equipment being controlled and voltage.

.8 Terminal cabinets and pull boxes: indicate system name and voltage.

.9 Transformers: indicate capacity, primary and secondary voltages and transformer number.

.10 All new panel boards in the work area to be painted as follows. Provide new lamicoid labels and arc flash labels for all panel boards.

Equipment System	Color	Pantone
12500+ V Normal	Bright Yellow	12-0752 Buttercup
4160 V Essential	Dark Orange	17-1461 Orangeade
480 to 600 V Normal	Light Blue	13-5410 Iced Aqua
480 to 600 V Essential	Dark Blue	17-4530 Barrier Reef
120 to 240 V Normal	Light Green	14-0425 Beachnut
120 to 240 V Essential	Dark Green	18-0430 Avocado
Fire Alarm	Bright Red	-

2.6 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour code: to CSA C22.1, Canadian Electrical Code.

.4 Use colour coded wires in communication cables, matched throughout system.

2.7 CONDUIT AND CABLE IDENTIFICATION

.1 Colour code all new conduits, boxes and metallic sheathed cables using 25mm wide tape (minimum 2 full wraps)..

.2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.

.3 Colours:

Conduit System	Color	Pantone
12500+ V Normal	Bright Yellow	12-0752 Buttercup
4160 V Essential	Dark Orange	17-1461 Orangeade
480 to 600 V Normal	Light Blue	13-5410 Iced Aqua
277 to 600 V Essential	Dark Blue	17-4530 Barrier Reef
120 to 240 V Normal	Light Green	14-0425 Beachnut
120 to 240 V Essential	Dark Green	18-0430 Avocado
Fire Alarm	Bright Red	-

PART 3 EXECUTION

3.1 NAMEPLATES AND LABELS

.1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

3.2 LOCATION OF OUTLETS

.1 Locate outlets in accordance with Section 26 27 26 – Wiring Devices.

.2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.

.3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.

.4 Locate light switches on latch side of doors. Locate disconnect devices in mechanical and elevator machine rooms on latch side of door.

3.3 CONDUIT AND CABLE INSTALLATION

.1 Install conduit and sleeves prior to pouring of concrete. Sleeves through concrete: schedule 40 steel pipe, sized for free passage of conduit, and protruding 50 mm.

.2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.

.3 Install cables, conduits and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.

3.4 MOUNTING HEIGHTS

.1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.

.2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

.3 Install electrical at following heights unless indicated otherwise.

- .1 Local switches: 1200 mm.
- .2 Wall receptacles:
  - .1 General: 406 mm.
  - .2 Above top of continuous baseboard heater: 200mm.
  - .3 Above top of counters or counter splash backs: 175 mm.
  - .4 In mechanical rooms: 1400 mm.
- .3 Panelboards: as required by Code or as indicated.
- .4 Telephone and interphone outlets: 400 mm.
- .5 Wall mounted telephone and interphone outlets: 1400 mm.
- .6 Fire alarm stations: 1200 mm.
- .7 Fire alarm bells: 2400 mm.
- .8 Wall mounted speakers: 2400 mm.
- .9 Clocks: 2400 mm.
- .10 Door bell pushbuttons: 1200 mm.
- .11 Exit lights: 2400 mm.
- .12 Emergency lighting heads: 2400 mm.

3.5 CO-ORDINATION OF PROTECTIVE DEVICES

.1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

3.6 FIELD QUALITY CONTROL

.1 All electrical work to be carried out by qualified, licensed electricians or apprentices as per the conditions of the Provincial Act respecting manpower vocational training and qualification. Employees registered in a provincial apprentices program shall be permitted, under the direct supervision of a qualified licensed electrician, to perform specific tasks – the activities permitted shall be determined based on the level of training attained and the demonstration of ability to perform specific duties.

.2 The work of this division to be carried out by a contractor who holds a valid Code 1 Electrical Contractor License as issued by the Province.

.3 Perform tests in Accordance with this section as noted and Section 01 91 13 – Commissioning (Cx) Requirements.

.4 Load Balance:

.1 Measure phase current to panelboard with normal loads (lighting) operating at time of acceptance. Adjust branch circuit connections as required to obtain best balance of current between phases and record changes.

.2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.

.3 Submit, at completion of work, report listing phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load. State hour and date on which each load was measured, and voltage at time of test.

.5 Conduct and pay for following tests:

.1 Power generation and distribution system including phasing, voltage, grounding and load balancing.

.2 Circuits originating from branch distribution panels.

.3 Lighting and its control.

.4 Motors, heaters and associated control equipment including sequenced operations of systems where applicable.

.5 Systems: fire alarm system, communications.

.6 Furnish manufacturer's certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturer's instructions.

.7 Insulation resistance testing.

.1 Megger and record circuits, feeders and equipment up to 350 V with a 500 V instrument.

.2 Megger and record 350 – 600 V circuits, feeders and equipment with a 1000 V instrument.

.3 Check resistance to ground before energizing and record value.

.8 Carry out tests in presence of Owner's Representative.

.9 Provide instruments, meters, equipment and personnel required to conduct tests during and conclusion of project.

.10 Submit test results for Owner's Representative's review and include in Commissioning Manuals specified in Section 01 91 13 – Commissioning (Cx) Requirements.

3.7 CLEANING

.1 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

.2 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

.1 Materials and installation for wire and box connectors.

1.2 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results - Electrical.

1.3 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CAN/CSA-C22.2 No.18, Outlet Boxes, Conduit Boxes and Fittings.

.2 CAN/CSA-C22.2 No.65, Wire Connectors (Tri-National Standard with UL 486A-486B and NMX-J-543-ANCE-03).

.2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)

.1 EEMAC 1Y-2, Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).

.3 National Electrical Manufacturers Association (NEMA)

PART 2 PRODUCTS

2.1 MATERIALS

.1 Pressure type wire connectors to: CSA C22.2 No.65, with current carrying parts of copper sized to fit copper conductors as required.

.2 Fixture type splicing connectors to: CSA C22.2 No.65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.

.3 Bushing stud connectors: to EEMAC 1Y-2 to consist of:

.1 Connector body and stud clamp for stranded copper conductors.

.2 Clamp for copper bar.

.3 Stud clamp bolts.

.4 Bolts for copper bar.

.5 Sized for conductors and bars as indicated.

.4 Clamps or connectors for armoured cable, aluminum sheathed cable, mineral insulated cable, flexible conduit, non-metallic sheathed cable as required to: CAN/CSA-C22.2 No.18.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Remove insulation carefully from ends of conductors and:

.1 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2 No.65.

.2 Install fixture type connectors and tighten. Replace insulating cap.

.3 Install bushing stud connectors in accordance with EEMAC 1Y-2.

END OF SECTION

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 26 05 20 - Wire and Box Connectors - 0 - 1000 V.

.2 Refer to drawings for wiring type required under different applications.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CSA C22.2 No .0.3, Test Methods for Electrical Wires and Cables.
.2 CAN/CSA-C22.2 No. 131, Type TECK 90 Cable.

PART 2 PRODUCTS

2.1 BUILDING WIRES

.1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.

.2 Copper: size as indicated, with 600 V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE and RWU90 XLPE as indicated. Provide RWU90 XLPE rated cable for underground wiring. Related to new service entrance feeders and site lighting circuits. RWU90 XLPE not required under interior floor slabs.

.3 Copper conductors: size as indicated, with thermoplastic insulation type TWH rated at 600 V, typically used for insulated ground wires.

2.2 TECK Cable

.1 Cable: to CAN/CSA-C22.2 No. 131.

.2 Conductors:

.1 Grounding conductor: copper.
.2 Circuit conductors: copper, size as indicated.

.3 Insulation:

.1 Cross-linked polyethylene XLPE, rating – 600 V.

.4 Inner jacket: polyvinyl chloride material.

.5 Armour: interlocking aluminum, compliant to applicable Building Code classification for this project.

.6 Overall covering: thermoplastic polyvinyl chloride material.

.7 Fastenings:

.1 One hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.

.2 Channel type supports for two or more cables at 1500 mm centers.

.3 Threaded rods: 6 mm dia. to support suspended channels.

.8 Connectors:

.1 Watertight and/or type approved for TECK cable, as indicated.

2.3 MINERAL-INSULATED CABLES

.1 Conductors: solid bare soft-annealed copper, size as indicated.

.2 Insulation: compressed powdered magnesium oxide to form compact homogeneous mass throughout entire length of cable.

.3 Overall covering: annealed seamless copper sheath, Type M1 rated 600 V, 250°C.

.4 Overall jacket: PVC applied over the sheath and compliant to applicable Building Code classification for this project for direct buried and wet locations, as indicated.

.5 Two hour fire rating.

.6 Connectors: watertight, field installed, approved for MI cable.

.7 Termination kits: field installed approved for MI cable.

2.4 ARMOURED CABLES

.1 Conductors: insulated, copper, size as indicated.

.2 Type: AC90.

.3 Armour: interlocking type fabricated from aluminum strip.

.4 Connectors: standard as required, complete with double split rings.

2.5 CONTROL CABLES

.1 Type LVT: 2 soft annealed copper conductors, sized as indicated, with thermoplastic insulation, outer covering of thermoplastic jacket.Low energy 300 V control cable: stranded annealed copper conductors sized as indicated, with PVC insulation type TW -40° C polyethylene insulation with shielding of tape coated with paramagnetic material wire braid over each conductor and overall covering of PVC jacket.

PART 3 EXECUTION

3.1 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Perform tests using method appropriate to site conditions and to approval of Owner's Representative and local authority having jurisdiction over installation.

.3 Perform tests before energizing electrical system.

.4 No splices permitted in panel board feeders in new construction. Splices in re-work or renovation projects only with pre-approval by Owner's Representative.

3.2 GENERAL CABLE INSTALLATION

.1 Install cable in trenches in accordance with Section 33 71 73.02 - Underground Electrical Service.

.2 Lay cable in cable trays in accordance with Section 26 05 36 - Cable Trays for Electrical Systems.

.3 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - (0-1000 V).

.4 Cable Colour Coding: to Section 26 05 00 Common Work Results for Electrical.

.5 Conductor length for parallel feeders to be identical.

.6 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.

.7 Wiring in walls: typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls to be avoided unless indicated.

.8 Branch circuit wiring for surge suppression receptacles and permanently wired computer and electronic equipment to be 2-wire circuits only, i.e. common neutrals not permitted.

.9 Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend. Obtain wiring diagram for control wiring.

3.3 INSTALLATION OF BUILDING WIRES

.1 Install wiring as follows:

- .1 In conduit systems in accordance with Section 26 05 34- Conduits, Fastenings and Fittings.
- .2 In cable troughs in accordance with Section 26 05 33.01- Cable Trays for Electrical Systems.
- .3 In underground ducts in accordance with Section 26 05 43.01- Installation of Cables in Ducts.
- .4 In trenches in accordance with Section 26 05 43.01- Installation of Cables in Trenches.
- .5 In underfloor distribution system in accordance with Section 26 05 39- Underfloor Raceways for Electrical Systems
- .6 In cellular floor raceways in accordance with Section 26 05 38 – Cellular Metal Floor Raceway Fittings.
- .7 In surface and lighting fixture raceways in accordance with Section 26 50 00- Lighting.

.8 In wireways and auxiliary gutters in accordance with Section 26 05 37 – Wireways and Auxiliary Gutters.

.9 Overhead service conductors in accordance with Section 26 24 01 - Service Equipment.

3.4 INSTALLATION OF TECK CABLE 0 -1000 V

.1 Install cables.

.1 Group cables wherever possible on channels.

.2 Install cable concealed, securely supported by straps and hangers.

3.5 INSTALLATION OF MINERAL-INSULATED CABLES

.1 Run cable exposed, securely supported by straps.

.2 Support 2 h fire rated cables at 1m intervals.

.3 Make cable terminations by using factory-made kits.

.4 At cable terminations use thermoplastic sleeving over bare conductors.

.5 Where cables are buried in cast concrete or masonry, sleeve for entry and exit of cables.

.6 Do not splice cables.

3.6 INSTALLATION OF ARMOURED CABLES (AC-90)

.1 Group cables wherever possible.

.2 Use permitted only for work in movable partitions and vertical power supply drops to lighting fixtures.

3.7 INSTALLATION OF CONTROL CABLES

.1 Install control cables in conduit as indicated.

.2 Ground control cable shield.

END OF SECTION

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 91 13 – Commissioning (Cx) Requirements.

.2 Section 26 05 00 – Common Work Results - Electrical.

.3 Grounding conductors for all distribution grounding to be insulated copper, uninsulated where in contact with earth. Copper conductors shall, at a minimum, be used in the following areas: grounding of transformer neutrals, service entrance switch ground of neutral, padmount transformer grounding, ground rider conductors from main ground station to sub-closets, telephone and data system grounds and circuits rated less than 60 amps. Where type ACM conductors are used for circuits rated 60 amps or greater, type ACM bonding conductor is permitted.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE)

.1 ANSI/IEEE 837, Qualifying Permanent Connections Used in Substation Grounding.

.2 Canadian Standards Association, (CSA)

.1 CAN/CSA Z32, Electrical Safety and Essential Electrical Systems in Health Care Facilities, where applicable.

PART 2 PRODUCTS

2.1 EQUIPMENT

.1 Clamps for grounding of conductor: size as indicated to electrically conductive underground water pipe.

.2 Copper conductor: minimum 6 m long for each concrete encased electrode, bare, stranded, tinned, soft annealed, size as indicated.

.3 Rod electrodes: copper clad steel 19 mm dia by 3 m long.

.4 Plate electrodes: copper, surface area 0.2 m^2, 1.6 mm thick.

.5 Grounding conductors: bare stranded copper, soft annealed, size as indicated.

.6 Insulated grounding conductors: green, type TW.

.7 Ground bus: copper, size as indicated, complete with insulated supports, fastenings, connectors.

.8 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:

.1 Grounding and bonding bushings.

.2 Protective type clamps.

.3 Bolted type conductor connectors, as required by local authority having jurisdiction..

.4 Thermit welded type conductor connectors, as indicated.

.5 Bonding jumpers, straps.

.6 Pressure wire connectors.

PART 3 EXECUTION

3.1 INSTALLATION GENERAL

.1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories. Where EMT is used, run insulated copper ground wire in conduit.

.2 Install connectors in accordance with manufacturer's instructions.

.3 Protect exposed grounding conductors from mechanical injury.

.4 Make buried connections, and connections to conductive water main, electrodes, using copper welding by thermit process.

.5 Use mechanical connectors for grounding connections to equipment provided with lugs.

.6 Soldered joints not permitted.

.7 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.

.8 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.

.9 Install separate ground conductor to outdoor lighting standards.

.10 Connect building structural steel and metal siding to ground by welding copper to steel.

.11 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.

.12 Bond single conductor, metallic armoured cables to cabinet at supply end and load end.

.13 Ground secondary service pedestals.

3.2 MANHOLES

.1 Install conveniently located grounding electrode and size 3/0 stranded copper conductor in each manhole.

.2 Install ground rod in each manhole so that top projects through bottom of manhole. Provide with lug to which grounding connection can be made.

3.3 ELECTRODES

.1 Make ground connections to continuously conductive underground water pipe on street side of water meter.

.2 Install water meter shunt.

.3 Install concrete encased electrodes in building foundation footings, with terminal connected to grounding network.

.4 Install rod, plate electrodes and make grounding connections.

.5 Bond separate, multiple electrodes together.

.6 Use size 2/0, 3/0 or 4/0 AWG copper conductors for connections to electrodes as required by code.

.7 Make special provision for installing electrodes that will give acceptable resistance to ground value where rock or sand terrain prevails. Ground as indicated.

3.4 SYSTEM AND CIRCUIT GROUNDING

.1 Install system and circuit grounding connections to neutral of primary 600 V system, secondary 208 V system.

3.5 EQUIPMENT GROUNDING

.1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, building steel work, generators, elevators and escalators, distribution panels, outdoor lighting.

3.6 GROUNDING BUS

.1 Install copper grounding bus mounted on insulated supports on wall of electrical room.

.2 Ground items of electrical equipment in electrical room to ground bus with individual bare stranded copper connections size as required by code.

3.7 HOSPITALS

.1 Grounding in hospital operating rooms: to CAN/CSA Z32.

.2 Connect equipment to building ground system.

3. Install ground bus for conductive floor tile. Make connections from tile system to bus in accordance with tile manufacturer's instructions. Ground resistance to CAN/CSA Z32.

3.8 COMMUNICATION SYSTEMS

.1 Install grounding connections for telephone, sound, fire alarm, intercommunication systems as follows:

.1 Telephones: make telephone grounding system in accordance with telephone company's requirements.

.2 Sound, fire alarm, intercommunication systems as indicated.

3.9 PERMAFROST

.1 Bond non-current carrying metal parts together with size 3/0 AWG copper equipotential conductor. Run conductor from separate lug or service neutral bar to, but not necessarily limited to, following indoor systems and equipment:

.1 Hot water heating system.

.2 Main water pipe.

.3 Main building drain.

.4 Oil line.

.5 Telephone, radio/tv, emergency and fire alarm lead-in or service conduits, near panels.

.6 Make connections to pipes on building side of main valves and tanks. Connect jumpers across boilers to supply and return hot water heating pipes.

.2 Drive three -19 mm diam x 3 m copper clad ground rods at least 1.8 m apart in original undisturbed ground. If rods will not penetrate permafrost, drive at angle not more than 60° from vertical, and in same direction. Rods must be driven, not trenched.

.3 Install ground wire from service neutral bar to rods and where buried use bare copper not smaller than size 1AWG7- strand or size 4AWG solid, and at least 460 mm below ground. Bond ground conductor, or short tap from it, to outside metal sheathing of building close to power service conduit. Use lug or cast clamp, with bronze or plated bolt, nut and washers (not sheet metal screw or wood screw). Remove paint from sheathing for good contact. Conduit is required only on outside wall of building. Indoors, run bare and fasten as specified for equipotential bonding wire.

.4 Install electrode interconnections where metal parts, circuits or grounding conductors and/or electrodes are in proximity to lightning rod conductors.

3.10 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 – Common Work Results - Electrical and Section 01 19 13 – Commissioning (Cx) Requirements.

.2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Owner's Representative and local authority having jurisdiction over installation.

.3 Perform tests before energizing electrical system.

.4 Disconnect ground fault indicator during tests.

END OF SECTION

PART 1 GENERAL (NOT APPLICABLE)

PART 2 PRODUCTS

2.1 SUPPORT CHANNELS

.1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted suspended or set in poured concrete walls and ceilings as required.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Secure equipment to hollow or solid masonry, tile and plaster surfaces with lead anchors or nylon shields.

.2 Secure equipment to poured concrete with expandable inserts.

.3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.

.4 Secure surface mounted equipment with twist clip fasteners to inverted T bar ceilings. Ensure that T bars are adequately supported to carry weight of equipment specified before installation.

.5 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

.6 Fasten exposed conduit or cables to building construction or support system using straps.

- .1 One-hole steel straps to secure surface conduits and cables 50 mm and smaller.
- .2 Two-hole steel straps for conduits and cables larger than 50 mm.
- .3 Beam clamps to secure conduit to exposed steel work.
- .4 Strap AC-90 cable at box location plus every 900 mm.

.7 Suspended support systems.

- .1 Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.
- .2 Support 2 or more cables or conduits on channels supported by 6 mm dia threaded rod hangers where direct fastening to building construction is impractical.

.8 For surface mounting of two or more conduits use channels at 1.5 m on centre spacing.

.9 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.10 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

.11 Do not use wire lashing, wood blocking, plastic strap or perforated strap to support or secure raceways or cables.

.12 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Owner's Representative.

.13 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

END OF SECTION

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results – Electrical.

.2 Section 26 05 29 – Hangers and Supports for Electrical Systems.

.3 Section 26 05 34 – Conduits, Conduit Fastenings and Fittings.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CSA C22.1, Canadian Electrical Code, Part 1.

PART 2 PRODUCTS

2.1 OUTLET AND CONDUIT BOXES GENERAL

.1 Size boxes in accordance with CSA C22.1.

.2 102 mm square or larger outlet boxes as required for special devices.

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

.5 347 V outlet boxes for 347 V switching devices.

.6 Combination boxes with barriers where outlets for more than one system are grouped.

2.2 GALVANIZED STEEL OUTLET BOXES

.1 Electro-galvanized steel single and multi gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.

.2 Electro-galvanized steel utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.

.3 102 mm square or octagonal outlet boxes for lighting fixture outlets.

.4 102 mm square outlet boxes with extension and plaster rings for flush mounting devices in finished plaster walls.

2.3 MASONRY BOXES

.1 Electro-galvanized steel masonry single and multi gang boxes for devices flush mounted in exposed block walls.

2.4 CONCRETE BOXES

.1 Electro-glavanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

2.5 FLOOR BOXES

.1 Concrete tight electro-galvanized sheet steel floor boxes with adjustable finishing rings to suit floor finish with brass faceplate. Device mounting plate to accommodate short or long ear duplex receptacles. Minimum depth: 28 mm for receptacles; 73 mm for communication equipment.

.2 Adjustable, watertight, concrete tight, cast floor boxes with openings drilled and tapped for 12 mm and 19 mm conduit. Minimum size: 73 mm deep.

2.6 CONDUIT BOXES

.1 Cast FS or FD aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacle.

2.7 FITTINGS - GENERAL

.1 Bushing and connectors with nylon insulated throats.

.2 Knock-out fillers to prevent entry of debris.

.3 Conduit outlet bodies for conduit up to 32 mm and pull boxes for larger conduits.

.4 Double locknuts and insulated bushings on sheet metal boxes.

.5 Double split rings for AC-90 terminations.

2.8 SERVICE FITTINGS

.1 'High tension' receptacle fitting made of 2 piece die-cast aluminum with brushed aluminum housing finish for 1 duplex receptacles. Bottom plate with two knockouts for centered or offset installation.

.2 Pedestal type 'low tension' fitting made of 2 piece die cast aluminum with brushed aluminum housing finish to accommodate two amphenol jack connectors.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Support boxes independently of connecting conduits.

.2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.

.3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.

.4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.

.5 Vacuum clean interior of outlet boxes before installation of wiring devices.

.6 Identify systems for outlet boxes as required.

END OF SECTION

PART 1 GENERAL

1.1 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CAN/CSA C22.2 No. 18, Outlet Boxes, Conduit Boxes, and Fittings and Associated Hardware, a National Standard of Canada.

.2 CSA C22.2 No. 45, Rigid Metal Conduit.

.3 CSA C22.2 No. 56, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.

.4 CSA C22.2 No. 83, Electrical Metallic Tubing.

.5 CSA C22.2 No. 211.2, Rigid PVC (Unplasticized) Conduit.

.6 CAN/CSA C22.2 No. 227.3, Nonmetallic Mechanical Protection Tubing (NMPT), a National Standard of Canada.

1.2 SUBMITTALS

.1 Product data: submit manufacturer's printed product literature, specifications and datasheets.

.1 Submit cable manufacturing data.

.2 Quality assurance submittals:

.1 Test reports: submit certified test reports.

.2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.3 Instructions: submit manufacturer's installation instructions.

PART 2 PRODUCTS

2.1 CONDUITS

.1 Rigid metal conduit: to CSA C22.2 No. 45, hot dipped galvanized steel threaded.

.2 Epoxy coated conduit: to CSA C22.2 No. 45, with zinc coating and corrosion resistant epoxy finish inside and outside.

.3 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.

.4 Rigid PVC conduit: to CSA C22.2 No. 211.2.

.5 Flexible metal conduit: to CSA C22.2 No. 56, aluminum liquid-tight flexible metal.

.6 FRE conduit: to CSA C22.2.

.7 Flexible PVC conduit: to CAN/CSA-C22.2 No. 227.3,

2.2 CONDUIT FASTENINGS

.1 One hole steel straps to secure surface conduits 50 mm and smaller. Two hole steel straps for conduits larger than 50 mm.

.2 Beam clamps to secure conduits to exposed steel work.

.3 Channel type supports for two or more conduits at 1.5 m oc.

.4 Threaded rods, 6 mm dia., to support suspended channels.

2.3 CONDUIT FITTINGS

.1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.

.2 Factory "ells" where 90°, 45 ° or 22.5 ° bends are required for 25 mm and larger conduits.

.3 Ensure conduit bends other than factory “ells” are made with an approved bender. Making offsets and other bends by cutting and rejoining 90 degree bends are not permitted.

.4 Connectors and couplings for EMT. Steel set-screw type, size as required.

2.4 EXPANSION FITTINGS FOR RIGID CONDUIT

.1 Weatherproof expansion fittings with internal bonding assembly suitable for 100 mm linear expansion.

.2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection in all directions.

.3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.5 FISH CORD

.1 Polypropylene.

PART 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install all conduit, conduit fittings and accessories in accordance with the latest edition of the Canadian Electrical Code in a manner that does not alter, change or violate any part of the installed system components or the CSA/UL certification of these components.

.2 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.3 Conceal conduits except in mechanical and electrical service rooms and in unfinished areas.

.4 Surface mount conduits except in finished areas or as indicated.

.5 Use rigid hot dipped galvanized steel threaded conduit for exposed work below 2.4 m above finished floor.

.6 Use epoxy coated conduit underground in corrosive areas and where exposed to exterior elements. (ie: pole mounted service entrance conduits)

.7 Use electrical metallic tubing (EMT) except in cast concrete and above 2.4 m not subject to mechanical injury, as well as concealed work in masonry construction.

.8 Use rigid PVC conduit underground and buried in or under concrete slab on grade.

.9 Use FRE conduit for encasement in concrete duct bank for service entrance feeders.

.10 Use flexible metal conduit for connection to motors in dry areas connection to recessed incandescent fixtures without a prewired outlet box connection to surface or recessed fluorescent fixtures work in movable metal partitions.

.11 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.

.12 Use AC-90 for vertical power supply drops to light fixtures.

.13 Use explosion proof flexible connection for connection to explosion proof motors.

.14 Install conduit sealing fittings in hazardous areas. Fill with compound.

.15 Minimum conduit size for lighting and power circuits: 19 mm. 12 mm conduit is acceptable for switch leg drops only where one two-wire circuit and ground is required.

.16 Install EMT conduit from computer room branch circuit panel to outlet boxes located in sub floor.

.17 Install EMT conduit from computer room branch circuit panel to junction box in sub-floor immediately below panel. Run flexible conduit from junction box to outlet boxes for each computer in sub-floor.

.18 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.19 Mechanically bend steel conduit over 19 mm dia.

.20 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.21 Install fish cord in empty conduits.

.22 Run 2 - 25 mm spare conduits up to ceiling space and 2 - 25 mm spare conduits down to ceiling space from each flush panel. Terminate these conduits in 152 x 152 x 102 mm junction boxes in ceiling space or in case of an exposed concrete slab, terminate each conduit in flush concrete type box.

.23 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.

.24 Dry conduits out before installing wire.

3.3 SURFACE CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.

.3 Run conduits in flanged portion of structural steel.

.4 Group conduits wherever possible on suspended channels.

.5 Do not pass conduits through structural members except as indicated.

.6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.4 CONCEALED CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Do not install horizontal runs in masonry walls.

.3 Do not install conduits in terrazzo or concrete toppings.

3.5 CONDUITS IN CAST-IN-PLACE CONCRETE

.1 Locate to suit reinforcing steel. Install in centre one third of slab. Use rigid PVC conduit.

.2 Protect conduits from damage where they stub out of concrete. Use rigid steel conduit for stub-up and adapt to in floor rigid PVC conduit.

.3 Install sleeves where conduits pass through slab or wall.

.4 Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed. Use cold mastic between sleeve and conduit.

.5 Do not place conduits is slabs in which slab thickness is less than 4 times conduit diameter.

.6 Encase conduits completely in concrete with minimum 25 mm concrete cover.

.7 Organize conduits in slab to minimize cross-overs.

3.6 CONDUITS IN CAST-IN-PLACE SLABS ON GRADE

.1 Run conduits 25 mm and larger below slab and encased in 75 mm concrete envelope. Provide 50 mm of sand over concrete envelope below floor slab.

3.7 CONDUITS UNDERGROUND

.1 Slope conduits to provide drainage.

.2 Waterproof joints (PVC excepted) with heavy coat of bituminous paint.

3.8 CLEANING

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

.2 On Completion and verification of performance of installation, remove surplus materials, excess materials rubbish, tools and equipment.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

.1 Materials and installation for standard and custom breaker type panelboards.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 91 13 – General Commissioning (Cx) Requirements.

.3 Section 06 10 00 - Rough Carpentry.

.4 Section 26 05 00 – Common Work Results - Electrical.

.5 Section 26 28 16.02 - Moulded Case Circuit Breakers.

1.3 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CSA C22.2 No.29, Panelboards and enclosed Panelboards.

1.4 SUBMITTALS

.1 Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

PART 2 PRODUCTS

2.1 PANELBOARDS

.1 Panelboards: to CSA C22.2 No.29 and product of one manufacturer.

.1 Install circuit breakers in panelboards before shipment.

.2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.

.2 250 and 600 V panelboards: bus and breakers rated for 10,000 and 18,000 A (symmetrical) minimum interrupting capacity respectively or as indicated on electrical drawings.

.3 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.

.4 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.

.5 Two keys for each panelboard and key panelboards alike.

.6 Tin plated aluminum bus with neutral of same ampere rating as mains.

.7 Mains: suitable for bolt-on breakers.

.8 Trim with concealed front bolts and hinges.

.9 Any ventilation openings are to be sprinkler proof design.

.10 Trim and door finis in baked enamel in accordance with Section 26 05 00 – Common Work Results – Electrical.

2.2 CUSTOM BUILT PANELBOARD ASSEMBLIES

.1 125 mm relay section on one or both sides of panels as indicated for installation of low voltage remote control switching components.

.2 Double stack panels as indicated.

.3 Contactors in mains as indicated.

.4 Feed through lugs as indicated.

2.3 BREAKERS

.1 Breakers: to Section 26 28 16.02 - Moulded Case Circuit Breakers.

.2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.

.3 Main breaker: separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.

.4 Lock-on devices for 10% of 15 to 30 A breakers installed as indicated. Turn over unused lock-on devices to Departmental Representative.

.5 Lock-on devices for receptacles, fire alarm clock outlet, emergency, door supervisory, intercom, stairway, exit and night light circuits as indicated.

2.4 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results - Electrical.

.2 Nameplate for each panelboard size 4 engraved as indicated.

.3 Nameplate for each circuit in distribution panelboards size 2 engraved as indicated.

.4 Complete circuit directory with typewritten legend showing location and load of each circuit.

.5 Arc flash and PPE requirement label with specific information for individual panel instllation.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.

.2 Install surface mounted panelboards on plywood backboards in accordance with Section 06 10 00 - Rough Carpentry. Where practical, group panelboards on common backboard.

.3 Mount panelboards to height specified in Section 26 05 00 – Common Work Results - Electrical or as indicated.

.4 Connect loads to circuits.

.5 Connect neutral conductors to common neutral bus with respective neutral identified.

END OF SECTION

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 91 13 – General Commissioning (Cx) Requirements.

.3 Section 26 05 00 – Common Work Results - Electrical.

PART 2 PRODUCTS

2.1 DISCONNECT SWITCHES

.1 Fusible and non-fusible, disconnect switch in required CSA Enclosure type as required, size as indicated.

.2 Provision for padlocking in on-off switch position by three locks.

.3 Mechanically interlocked door to prevent opening when handle in ON position.

.4 Fuses: size as indicated, to Section 26 28 13.01 - Fuses - Low Voltage.

.5 Fuseholders: suitable without adaptors, for type and size of fuse indicated.

.6 Quick-make, quick-break action.

.7 ON-OFF switch position indication on switch enclosure cover.

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results - Electrical.

.2 Indicate name of load controlled on size 4 nameplate.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install disconnect switches complete with fuses as indicated.

END OF SECTION

PART 1 GENERAL

1.1 SCOPE OF WORK

.1 Testing and commissioning are called for throughout the individual specifications. This does not relieve this trade from providing all testing and commissioning necessary to ensure that systems and equipment operate as required and that they interface with other systems and equipment as required.

1.2 SECTION INCLUDES

.1 Commissioning of all building electrical systems and component including:

.1 Testing and adjustment.
.2 Demonstrations and Training.
.3 Instructions of all procedures for Owner's personnel.
.4 Updating as-built data.
.5 Co-ordination of Operation and Maintenance material.

1.3 RELATED SECTION

.1 Section 01 77 00 – Closeout Procedures.

.2 Section 01 91 13 – General Commissioning (Cx) Requirements.

.3 Section 26 05 00 – Common Work Results - Electrical.

1.4 REFERENCES

.1 CSA (Canadian Standards Association).

.2 Underwriters Laboratories of Canada.

1.5 QUALITY ASSURANCE

.1 Provide qualified trades persons, certified testing agencies, factory trained and approved by the Commissioning Team Leader.

.2 Submit the names of all personnel to be used during the Commissioning activities for Owner Approval.

1.6 COMMISSIONING

.1 The purpose of the commissioning process is to fully test all building systems including architectural, mechanical and electrical components and operating procedures by challenging these systems to realistic operation conditions.

.2 The Commissioning activities shall be co-ordinated by the General Contractor.

.3 Commissioning activities for the electrical systems must have available up to date as-built drawing information and accurate Operations and Maintenance Manuals. These documents shall be a major part of this activity.

.4 Contractor shall be responsible to update all documentation with information and any changes duly noted during the Commissioning exercise.

.5 Contractor shall arrange for all outside suppliers, equipment manufacturers, test agencies and others as identified in the commissioning sections of this specification. The cost associated with this requirement shall be included as part of the tender price.

1.7 SUBMITTALS

.1 A commissioning document shall be prepared by the Owner's Representative prior to conducting these activities for use by the Commissioning Team.

.2 The electrical sub-contractor shall be responsible for ensuring all activities are properly documented in this manual and co-ordinated through the General Contractor.

.3 As-built drawings and data books must be available two weeks prior to commissioning for review and use by the consultant and Commissioning Team prior to the start of the commissioning activities.

1.8 PREPARATION

.1 Provide test instruments required for all activities as defined in the commissioning documents.

.2 Verify all systems are in compliance with the requirements of the commissioning documents prior to the precommissioning check out operation.

.3 Confirm all scheduled activities have identified personnel available.

.4 Where systems or equipment do not operate as required, make the necessary corrections or modifications, re-test and re-commission.

1.9 SYSTEM DESCRIPTION

.1 Perform all start up operations, control adjustment, trouble shooting, servicing and maintenance of each item of equipment as defined in the commissioning documentation.

.2 Owner will provide list of personnel to receive instructions and will co-ordinate their attendance at agreed upon times.

.3 Prepare and insert additional data in the operations and maintenance manuals and update as-built drawings when need for additional data becomes apparent during the commissioning exercise.

.4 Where instruction is specified in the commissioning manual, instruct personnel in all phases of operation and maintenance using operation and maintenance manuals as the basis of instruction.

.5 Conduct presentation on Owner's premises. Owner will provide space.

1.10 FINAL REPORT

.1 This trade shall assemble all testing data and commissioning reports and submit them to the Owner.

.2 Each form shall bear signature of recorder, and that of supervisor of reporting organizer.

1.11 SCHEDULE OF ACTIVITIES

.1 Commissioning activities shall be conducted based on pre-established schedule with all members of the commissioning team, refer to Section 01 91 13 – General Commissioning (Cx) Requirements.

.2 In addition, there will be two meetings held through the contract duration to introduce the parties of the commissioning team, establish the schedules and deadlines for the various activities and review the Commissioning Manual.

.3 Adhering to the established schedule is very important as the co-ordination and scheduling of the participants will be difficult to alter once this is established. Close co-ordination of this schedule is important.

.4 In the event project cannot be commissioned in the allotted time slot, the contractor shall pay for all costs associated with assembling the Commissioning Team at a later date. If the contractor has not performed his duties to reach commissioning stage as outlined earlier, he will incur all expenses of other trades and the Commissioning Team due to his non-compliance.

END OF SECTION

Memorial University of Newfoundland

Engineering Building, Server Room Cooling

ST. JOHN'S CAMPUS

FEBRUARY 25, 2025

ISSUED FOR TENDER

LIST OF DRAWINGS

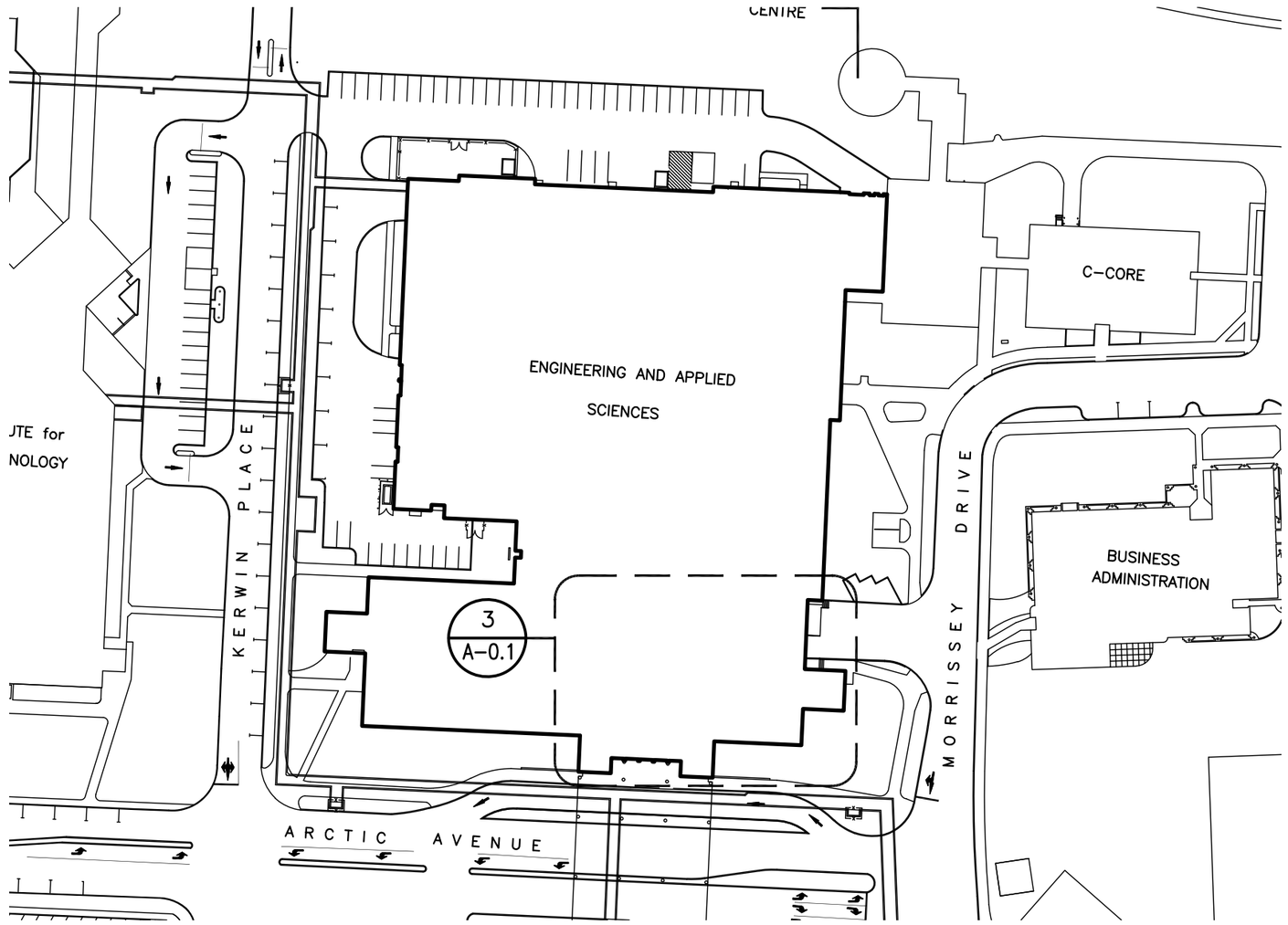
EN-178-21 ISSUED FOR TENDER

This University was raised by the people of Newfoundland as a memorial to the fallen in the great wars, 1914-1918, 1939-1945, that in freedom of learning, their cause and sacrifice might not be forgotten.

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

MEMORIAL UNIVERSITY

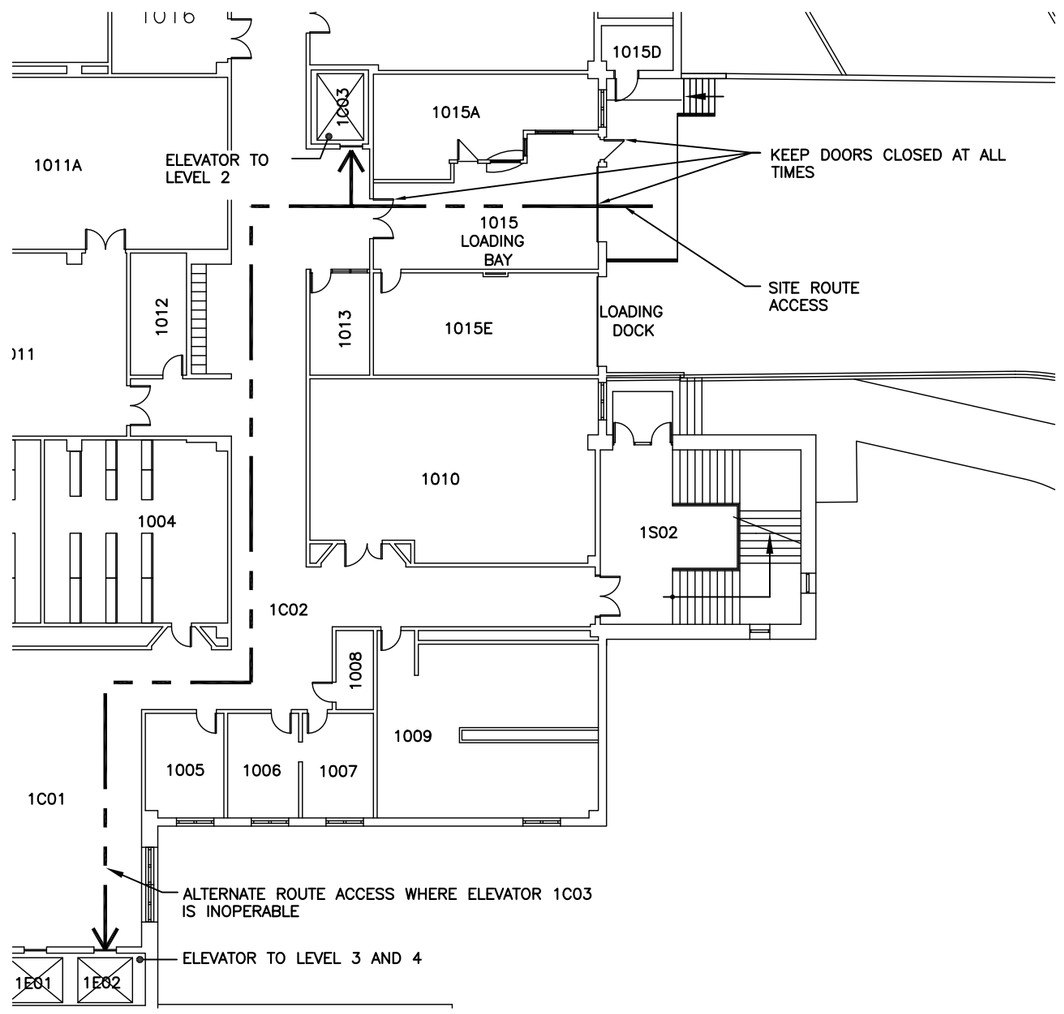
FACILITIES MANAGEMENT



SITE / BUILDING LOCATION PLAN

SCALE: N.T.S.

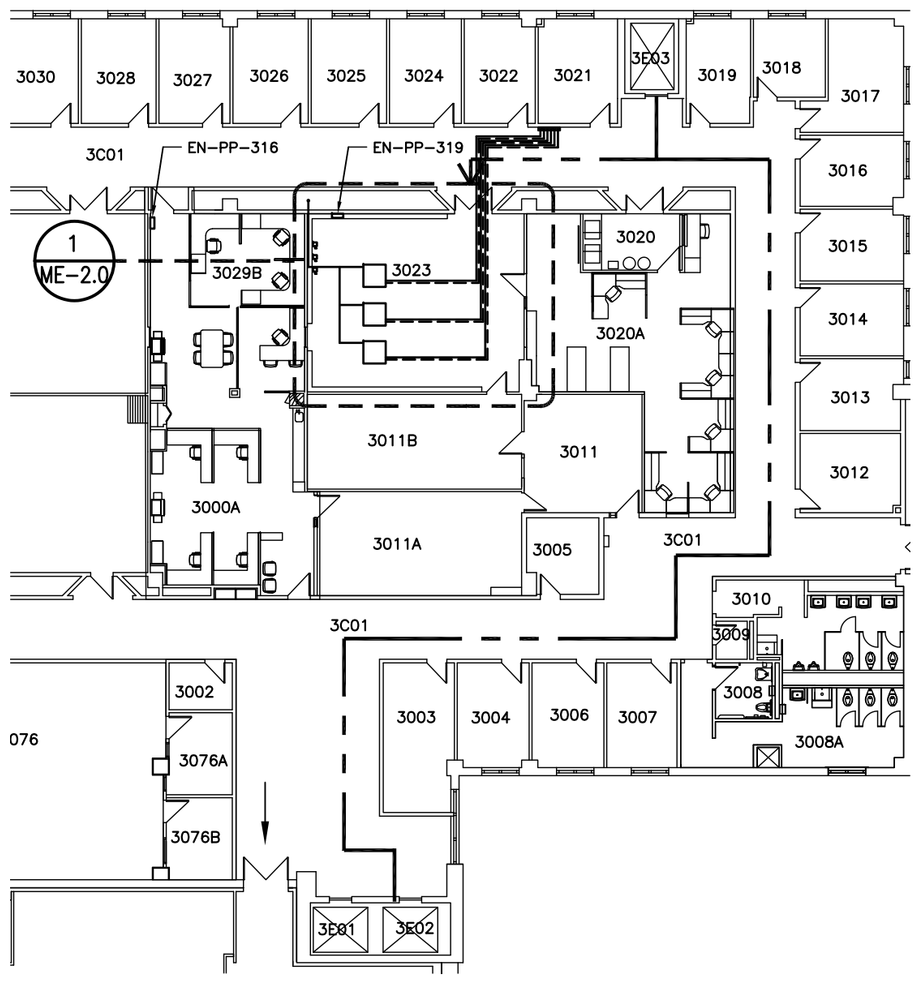
1
A-0.1



SITE ACCESS LEVEL 1 – LOCATION PLAN

SCALE: N.T.S.

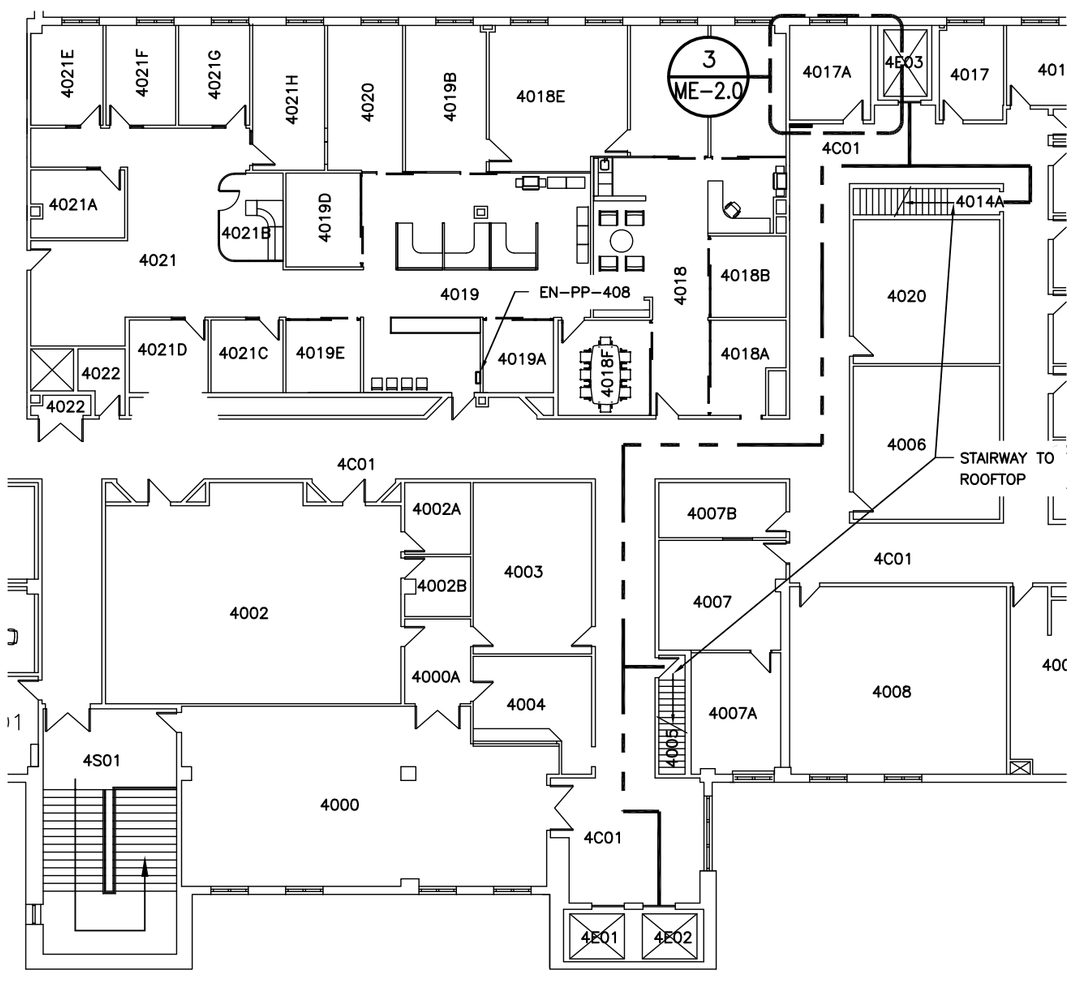
2
A-0.1



SITE ACCESS LEVEL 3 – LOCATION PLAN

SCALE: N.T.S.

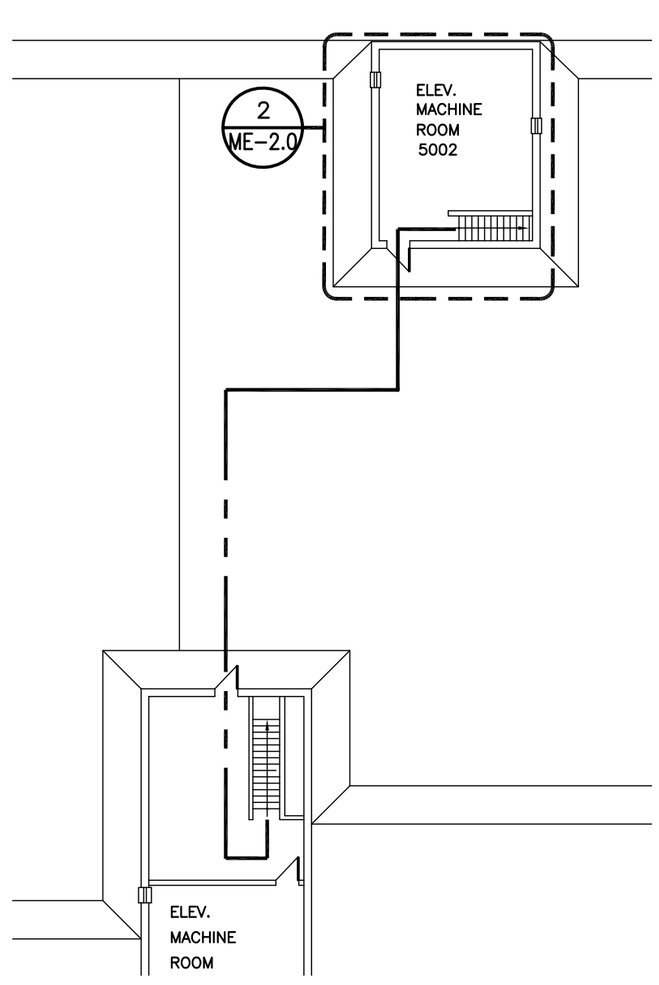
3
A-0.1



SITE ACCESS LEVEL 4 – LOCATION PLAN

SCALE: N.T.S.

4
A-0.1



SITE ACCESS ROOFTOP – LOCATION PLAN

SCALE: N.T.S.

5
A-0.1

No.	REVISION	DATE
R0	ISSUED FOR TENDER	FEBRUARY, 25, 2025

GENERAL NOTES

1. DRAWINGS TO BE READ AS A SET.
2. DO NOT SCALE FROM DRAWINGS.
3. THE CONTRACTOR IS TO VERIFY ALL DIMENSIONS AND SITE CONDITIONS. PRIOR TO SUBMISSION OF TENDERS.
4. ALL DISCREPANCIES FOUND IN THESE DRAWINGS TO BE BROUGHT TO THE ATTENTION OF FACILITIES MANAGEMENT PRIOR TO SUBMISSION OF TENDERS.

NORTH

MEMORIAL UNIVERSITY

FACILITIES MANAGEMENT

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

PROJECT NAME:

SERVER COOLING SYSTEM REPLACEMENT EN-3023
Project #: EN-178-21

DRAWING TITLE:

SITE ACCESS, LOCATION PLANS & ELECTRICAL PANELS - LEVEL 1, 3, 4 & ROOFTOP

REVIEWED:	DRAWN:
MF	JY
SCALE: N.T.S.	DATE: FEBRUARY, 2025
MUN PROJECT No. **EN-178-21**	DRAWING No. **A-0.1**

GENERAL MECHANICAL NOTES:

1. ALLOW FOR EXTRA PIPE, OFFSETS, FITTINGS, ETC. AS REQUIRED TO AVOID ANY INTERFERENCE AND COMPLETE INSTALLATION.
2. CONTRACTOR TO PROVIDE P–TRAPS, WASTE, S.S. BRAIDED WATER LINES, VALVES, CARRIERS, ETC. FOR ALL PLUMBING FIXTURES AS REQUIRED.
3. PROVIDE ACCESS DOORS AT ALL CONCEALED VALVES AND CLEANOUTS. ACCESS DOORS TO BE MAINTAIN FIRE RATING OF ASSEMBLES IN WHICH THEY ARE INSTALLED. MIFAB UA SERIES UNIVERSAL ACCESS DOOR OR APPROVED ALTERNATE.
4. ALL CUTTING AND PATCHING SHALL BE COORDINATED WITH THE GENERAL CONTRACTOR.
5. COORDINATE ROUTING OF ALL NEW PIPING TO AVOID INTERFERENCE WITH EQUIPMENT PRIOR TO INSTALLATION. IF INTERFERENCE FOUND RELOCATE PIPING TO SUIT.
6. THE COMPLETE MECHANICAL SYSTEM SHALL CONFORM TO THE LATEST EDITION OF THE NATIONAL BUILDING CODE, CANADIAN PLUMBING CODE, NFPA, ASHRAE AND SMACNA STANDARDS, THE DEPT. OF FACILITIES MANAGEMENT STANDARDS AND LOCAL BY–LAWS CURRENTLY IN FORCE IN THE PROVINCE AND MUNICIPALITY.
7. BEFORE COMMENCING ANY DEMOLITION OR NEW WORK, THE CONTRACTOR SHALL THOROUGHLY INSPECT THE SITE SO AS TO BECOME FAMILIAR WITH ALL EXISTING CONDITIONS. THE CONTRACTOR IS ADVISED THAT ALTHOUGH SOME EXISTING DEVICES, EQUIPMENT ANO SYSTEMS HAVE BEEN SHOWN SO AS TO AID THE CONTRACTOR IN THEIR WORK, THEY MAY NOT NECESSARILY BE INSTALLED EXACTLY AS SHOWN. CONTRACTOR IS RESPONSIBLE FOR CONFIRMING ON SITE THE ACTUAL SIZE, LOCATION, AND ROUTING OF ALL EXISTING DEVICES, EQUIPMENT AND SYSTEMS.
8. WHERE THE ACTUAL SIZE, LOCATION, OR ROUTING OF EXISTING DEVICES, EQUIPMENT, OR SYSTEMS IS FOUND TO DIFFER FROM THAT SHOWN, THE CONTRACTOR SHALL NOTIFY THE OWNER AND/OR ENGINEER. WHERE SUCH DIFFERENCES DO NOT AFFECT THE WORK, THE CONTRACTOR SHALL NOTE AND RECORD THE DIFFERENCES FOR RECORD DOCUMENT PURPOSES. WHERE, IN THE OPINION OF THE CONTRACTOR, SUCH DIFFERENCES DO AFFECT THE WORK, THEN THE CONTRACTOR SHALL BRING THESE AFFECTS TO THE ATTENTION OF THE OWNER AND OBTAIN WRITTEN DIRECTION BEFORE PROCEEDING FURTHER. FAILURE TO DO SO SHALL NOT BE USED AS A BASIS FOR ADDITIONAL COSTS AT A LATER TIME.
9. THE CONTRACTOR IS ADVISED THAT THE WORK REQUIRES THE INSTALLATION OF MULTIPLE SYSTEMS AND EQUIPMENT WITHIN EXISTING SPACES, WHICH WILL REQUIRE COORDINATION AND EFFICIENT USE OF SPACE. THIS CONTRACTOR WILL REVIEW ALL DRAWINGS AND COORDINATE WITH OTHER TRADES. SHOULD DEVIATIONS BE REQUIRED FROM THE EQUIPMENT LAYOUTS AND ROUTING SHOWN, THE CONTRACTOR SHALL ADVISE THE OWNER PRIOR TO IMPLEMENTING ANY SUCH CHANGES, MINOR CHANGES SHALL (WITHIN REASON) BE MADE AT NO ADDITIONAL COST TO THE OWNER. DO NOT PREFABRICATE SYSTEMS OR EQUIPMENT.
10. TRACE OUT ALL LINES AND SYSTEMS BEFORE INITIATING WORK. CONTRACTOR SHALL VISUALLY CONFIRM THE ACTUAL SIZE, CONDITION, AND ROUTING OF ALL SYSTEMS TO BE SHUT DOWN OR AFFECTED BY THE WORK, AND IDENTIFY ALL BRANCH CONNECTIONS AND AREAS SERVED, SO AS TO DETERMINE THE EQUIPMENT AND AREAS WHICH COULD BE POTENTIALLY AFFECTED BY A SHUT DOWN. COORDINATE SYSTEM SHUTDOWNS AND SERVICE INTERRUPTIONS WITH OWNER, AND PROVIDE WRITTEN DESCRIPTION OF WORK FOR REVIEW BY OWNER. WHERE A TEMPORARY SHUTDOWN IS TO BE ACHIEVED USING EXISTING ISOLATION VALVES, DEVELOP A CONTINGENCY PLAN FOR VALVES WHICH COULD FAIL TO CLOSE AND/OR RE–OPEN. THE OWNER RESERVES THE RIGHT TO CHANGE SCHEDULES TO PROTECT ONGOING OPERATIONS.
11. MAINTAIN FIRE RATINGS AROUND PIPING PASSING THROUGH FLOORS AND CEILINGS, AND FIRE SEPARATIONS.
12. HANGERS & SUPPORTS: TO SMACNA, ASHRAE & NPC RECOMMENDATIONS, STANDARDS & CODES.

GENERAL VENTILATION NOTES:

1. THE COMPLETE VENTILATION SYSTEM SHALL CONFORM TO THE LATEST EDITION OF THE NATIONAL BUILDING CODE, CANADIAN PLUMBING CODE, NFPA, ASHRAE AND SMACNA STANDARDS, THE DEPT. OF FACILITIES MANAGEMENT STANDARDS AND LOCAL BY–LAWS CURRENTLY IN FORCE IN THE PROVINCE AND MUNICIPALITY.
2. BEFORE COMMENCING ANY DEMOLITION OR NEW WORK, THE CONTRACTOR SHALL THOROUGHLY INSPECT THE SITE SO AS TO BECOME FAMILIAR WITH ALL EXISTING CONDITIONS. CONTRACTOR IS RESPONSIBLE FOR CONFIRMING ON SITE THE ACTUAL SIZE, LOCATION, AND ROUTING OF ALL EXISTING DEVICES, EQUIPMENT AND SYSTEMS.
3. TRACE OUT ALL LINES AND SYSTEMS BEFORE INITIATING WORK. COORDINATE SHUTDOWNS AND SERVICE INTERRUPTIONS WITH THE PROJECT COORDINATOR, AND PROVIDE WRITTEN DESCRIPTION OF WORK FOR REVIEW BY OWNER. THE OWNER RESERVES THE RIGHT TO CHANGE SCHEDULES TO PROTECT ONGOING OPERATIONS.
4. MAKE GOOD ANY DAMAGE AS A RESULT OF THE CONSTRUCTION WORK.
5. DUCTWORK: NEW GALVANIZED STEEL OF LOCK FORMING QUALITY TO ASTM 525 M–80 ZINC COATING WITH GAUGES AND FABRICATION DETAILS TO SMACNA STANDARDS.
6. HANGERS & SUPPORTS: TO SMACNA & ASHRAE RECOMMENDATIONS & STANDARDS.
7. SEAMS, JOINTS & CONNECTIONS TO BE MADE AIRTIGHT WITH SEALING COMPOUND & TAPE.
8. DUCT SEALER: OIL RESISTANT, POLYMER TYPE FLAME RESISTANT HIGH VELOCITY DUCT SEALING COMPOUND.
9. NEW REGISTERS TO BE CENTERED IN CEILING TILES.

SYMBOL LEGEND:

- DOMESTIC COLD WATER SUPPLY PIPING
- SAN — SANITARY DRAIN PIPING
- CD — CONDENSATE DRAIN PIPING
- REFRIGERANT SUPPLY PIPING
- REFRIGERANT RETURN PIPING
- PIPE RISER UP
- PIPE RISER DOWN
- BALL VALVE
- CHECK VALVE
- PRESSURE REDUCING VALVE
- P — PRESSURE GAUGE
- DIRECT CONNECTION TO ELECTRICAL SWITCH
- DISCONNECT SWITCH (DSW)

GENERAL ELECTRICAL NOTES:

1. ALL CIRCUIT BREAKER/PANEL SHUTDOWNS WILL REQUIRE MUN ELECTRICIAN PRESENT TO PROVIDE LOCK OUT/TAG OUT. CONTRACTOR SHALL CONTACT PROJECT COORDINATOR 24hrs IN ADVANCE TO SCHEDULE MUN ELECTRICIAN. LIVE ELECTRICAL WORK IS NOT PERMITTED. CONTRACTOR TO VERIFY ELECTRICAL CIRCUITS PRIOR TO THE START OF WORK.
2. ALL DATA DROPS NOTED TO BE REMOVED SHALL BE DISCONNECTED BY MUN FORCES PRIOR TO DEMOLITION WORK BY ELECTRICAL SUB–TRADE. CONTRACTOR SHALL CONTACT PROJECT COORDINATOR 48hrs IN ADVANCE TO NOTIFY / SCHEDULE DATA DROP DISCONNECTION. DO NOT CUT OR DISCONNECT DATA CABLES.
3. REMOVE ALL WIRING AND CONDUIT BACK TO NEAREST JUNCTION BOXES FOR RECEPTACLES, SWITCHES, ETC. THAT ARE INDICATED TO BE REMOVED OR RELOCATED.
4. ELECTRICAL CONTRACTOR RESPONSIBLE TO VERIFY INDICATED CIRCUITS AND TRACE OUT ANY UNKNOWN POWER AND LIGHTING CIRCUITS PRIOR TO ANY WORK TAKING PLACE.
5. REUSE EXISTING LIGHTING POWER CIRCUITS AS INDICATED. RE–ROUTE, EXTEND, OR MODIFY POWER FEEDS AS REQUIRED TO FACILITATE ALL NEW LOCATIONS OF LIGHT FIXTURES, ILLUMINATED EXIT SIGNS, LINE VOLTAGE DIMMER SWITCHES, AND LOW VOLTAGE SWITCHES.

No.	REVISION	DATE
R0	ISSUED FOR TENDER	FEBRUARY, 25, 2025

GENERAL NOTES

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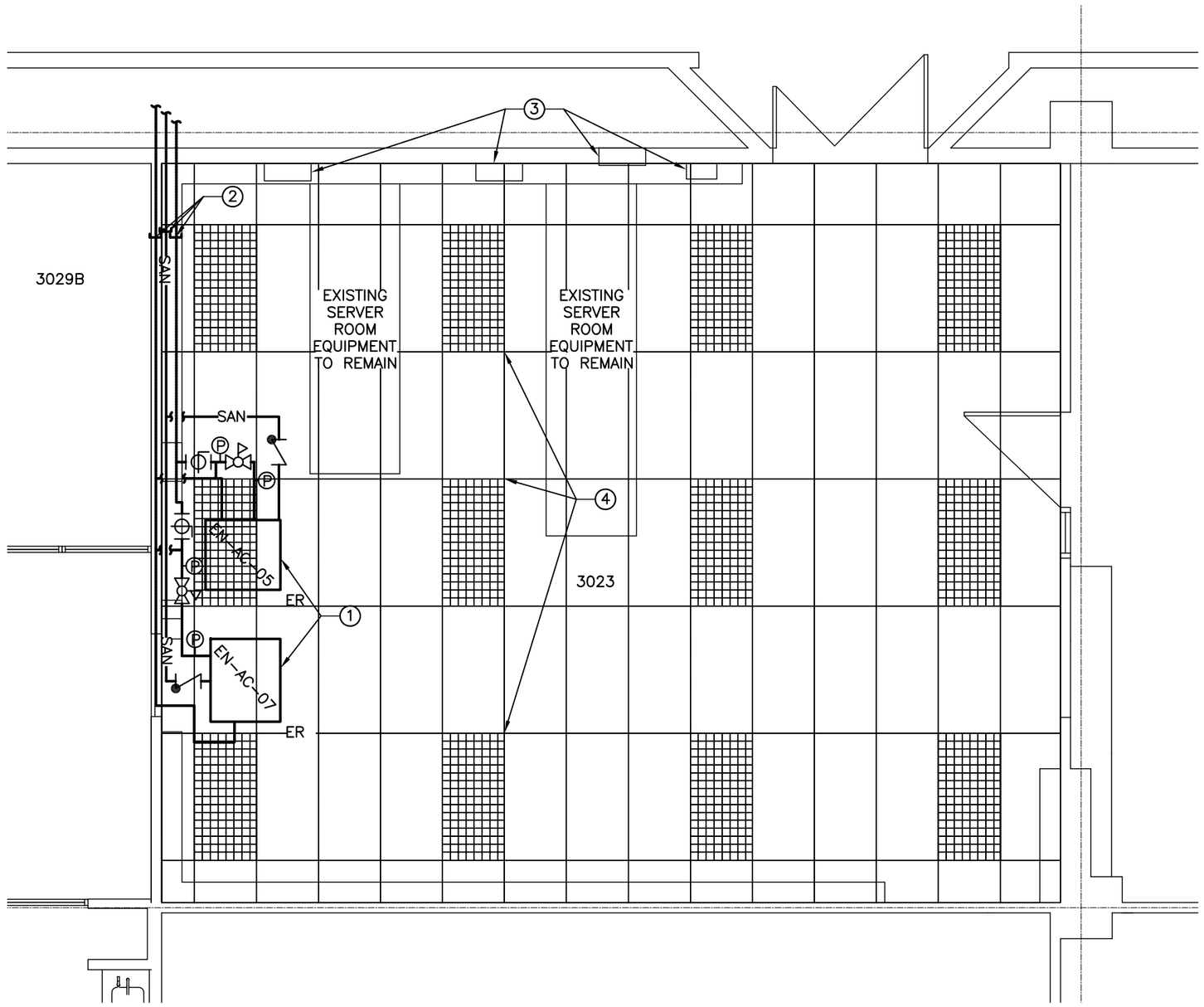
PROJECT NAME:

SERVER COOLING SYSTEM REPLACEMENT EN-3023
Project #: EN-178-21

DRAWING TITLE:

GENERAL NOTES & SYMBOL LEGEND

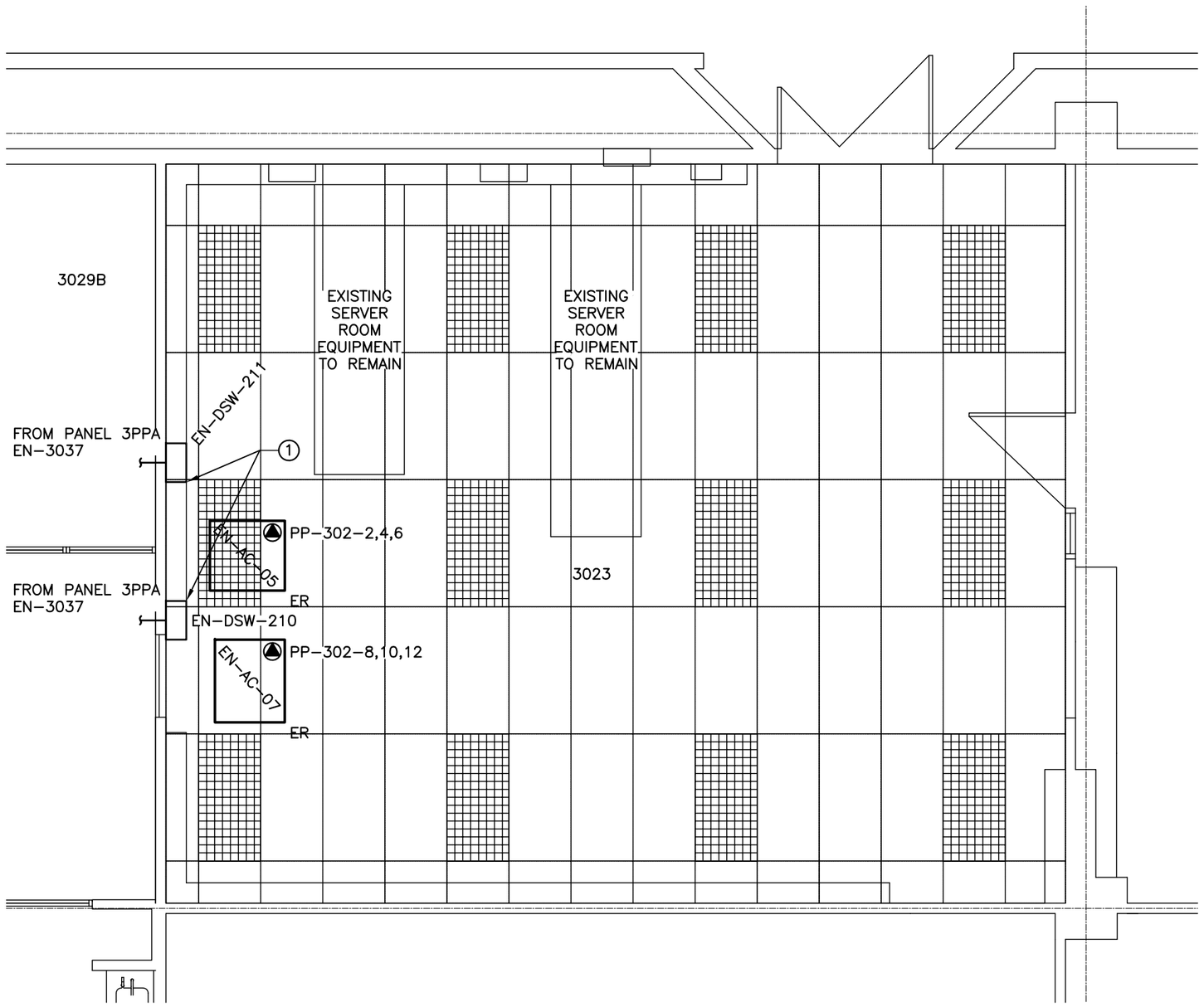
REVIEWED:	DRAWN:
MF	JY
SCALE:	DATE:
NTS	FEBRUARY, 2025
MUN PROJECT No.	DRAWING No.
EN-178-21	**ME-0.0**



COOLING LAYOUT DEMOLITION – LEVEL 3

SCALE: 1:50

1 ME-1.0



ELECTRICAL LAYOUT DEMOLITION – LEVEL 3

SCALE: 1:50

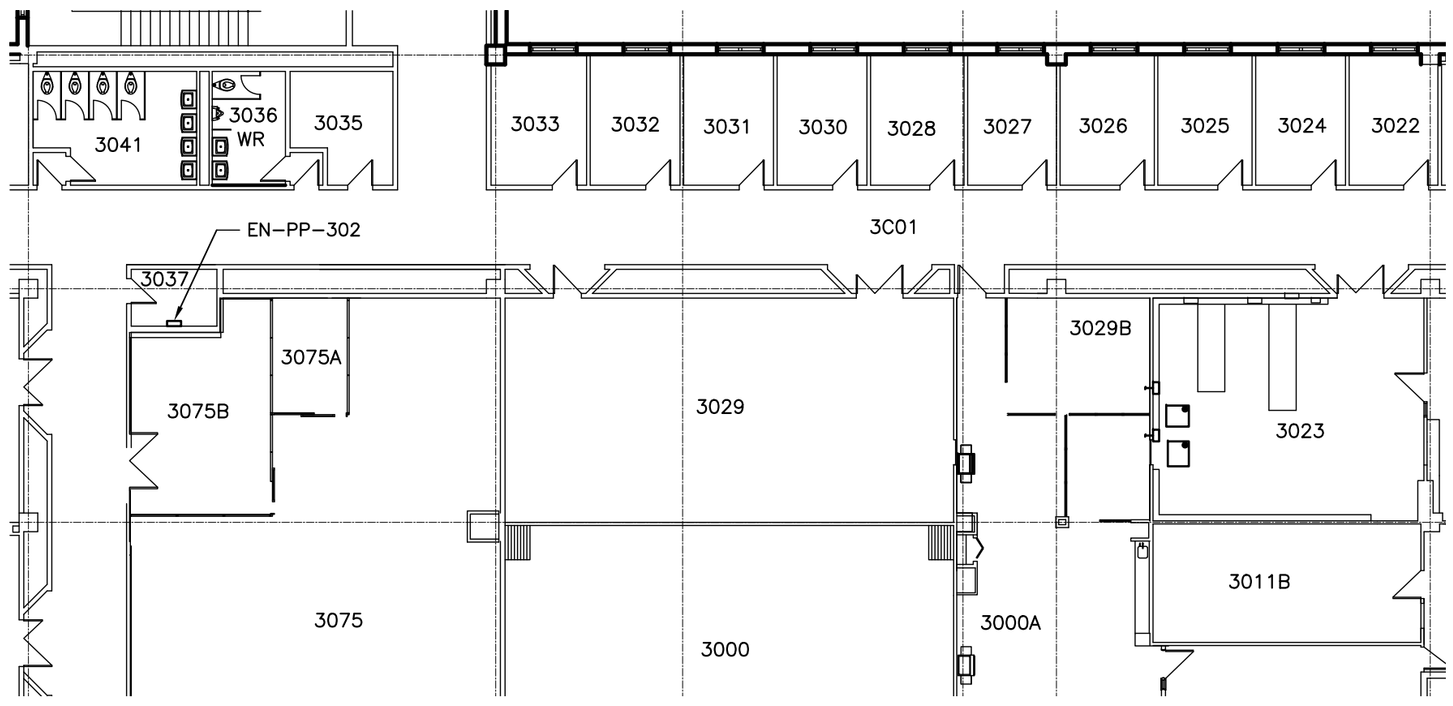
2 ME-1.0

COOLING DEMOLITION NOTES: (#)

1. EXISTING WATER COOLED AC UNITS, AND ASSOCIATED PIPING AND FITTINGS TO BE REMOVED. COORDINATE SHUTDOWNS WITH FACILITIES MANAGEMENT.
2. DOMESTIC COLD WATER SUPPLY PIPING, SANITARY DRAIN PIPING, AND CONDENSATE DRAIN LINES TO BE REMOVED AND CAPPED WITH A VALVE IN THIS LOCATION INSIDE OF THE SERVER ROOM. CONDENSATE DRAIN LINES TO BE USED AS CONDENSATE DRAIN FOR NEW SPLIT SYSTEM.
3. EXISTING MILLWORK TO REMAIN TO CONCEAL NEW CONDENSATE DRAIN LINES. MILLWORK WILL BE MODIFIED AND, IF NECESSARY, REMOVED BY THE CONTRACTOR TO ACCOMMODATE.
4. EXISTING CEILING PANEL LIGHTS TO BE MOVED AS REQUIRED BY THE CONTRACTOR TO ACCOMMODATE NEW EQUIPMENT.

ELECTRICAL DEMOLITION NOTES: (#)

1. EXISTING AC UNIT BREAKERS TO BE REMOVED, AND ELECTRICAL TIE INS FOR EXISTING AC UNIT FEEDS TO BE REMOVED FROM POWER PANELS IN ELECTRICAL ROOM EN–3037.
2. REMOVE ALL WIRING AND CONDUIT BACK TO NEAREST JUNCTION BOXES FOR RECEPTACLES, SWITCHES, ETC. THAT ARE INDICATED TO BE REMOVED OR RELOCATED.



ELECTRICAL PANEL LOCATION EN3037 – LEVEL 3

SCALE: 1:200

3 ME-1.0

No.	REVISION	DATE
R0	ISSUED FOR TENDER	FEBRUARY, 25, 2025

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5. EXISTING EQUIPMENT TAGS TO BE REMOVED FROM TMA BY WORK CONTROL.

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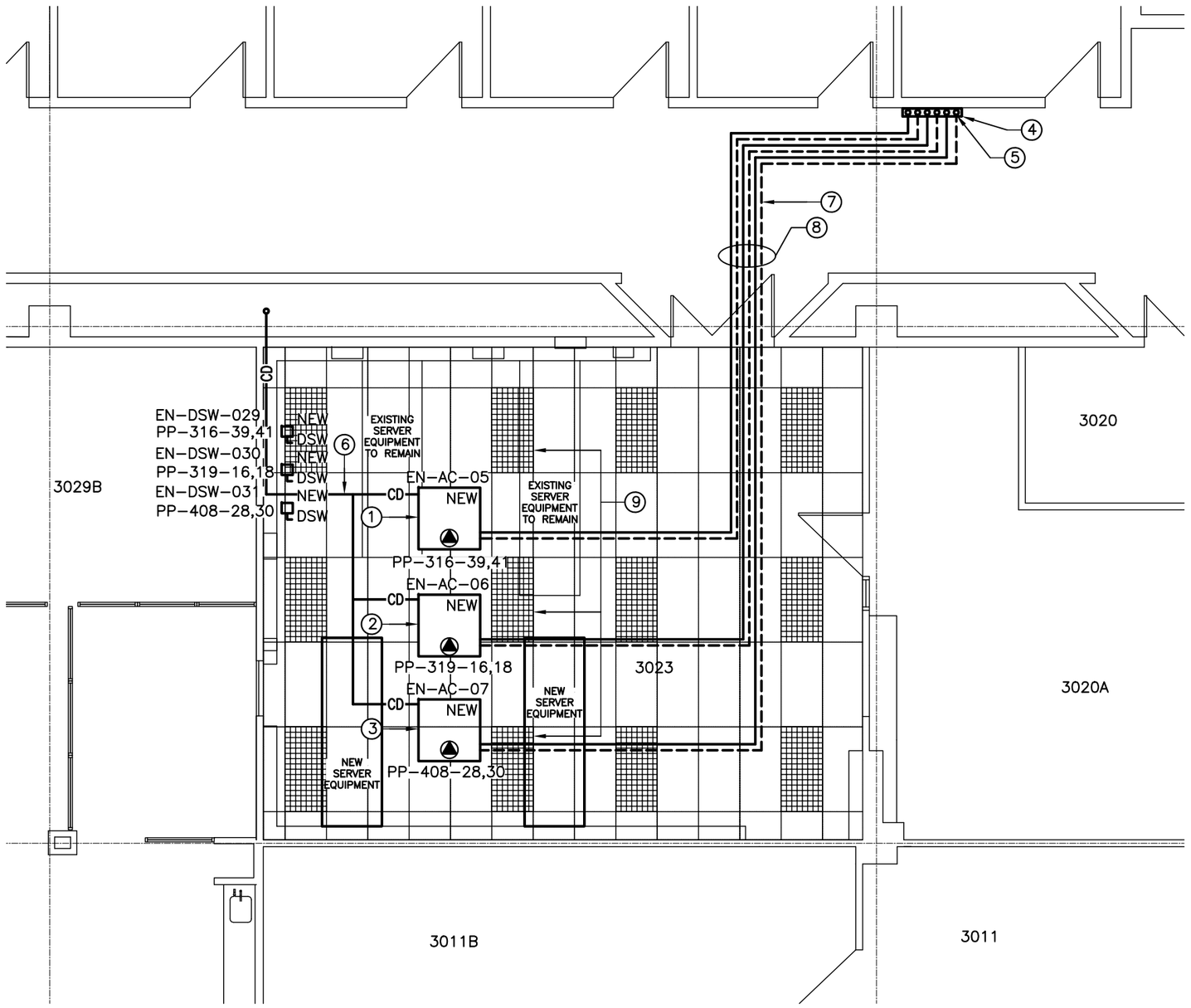
PROJECT NAME:

SERVER COOLING SYSTEM REPLACEMENT EN-3023
Project #: EN-178-21

DRAWING TITLE:

SERVER ROOM DEMOLITION

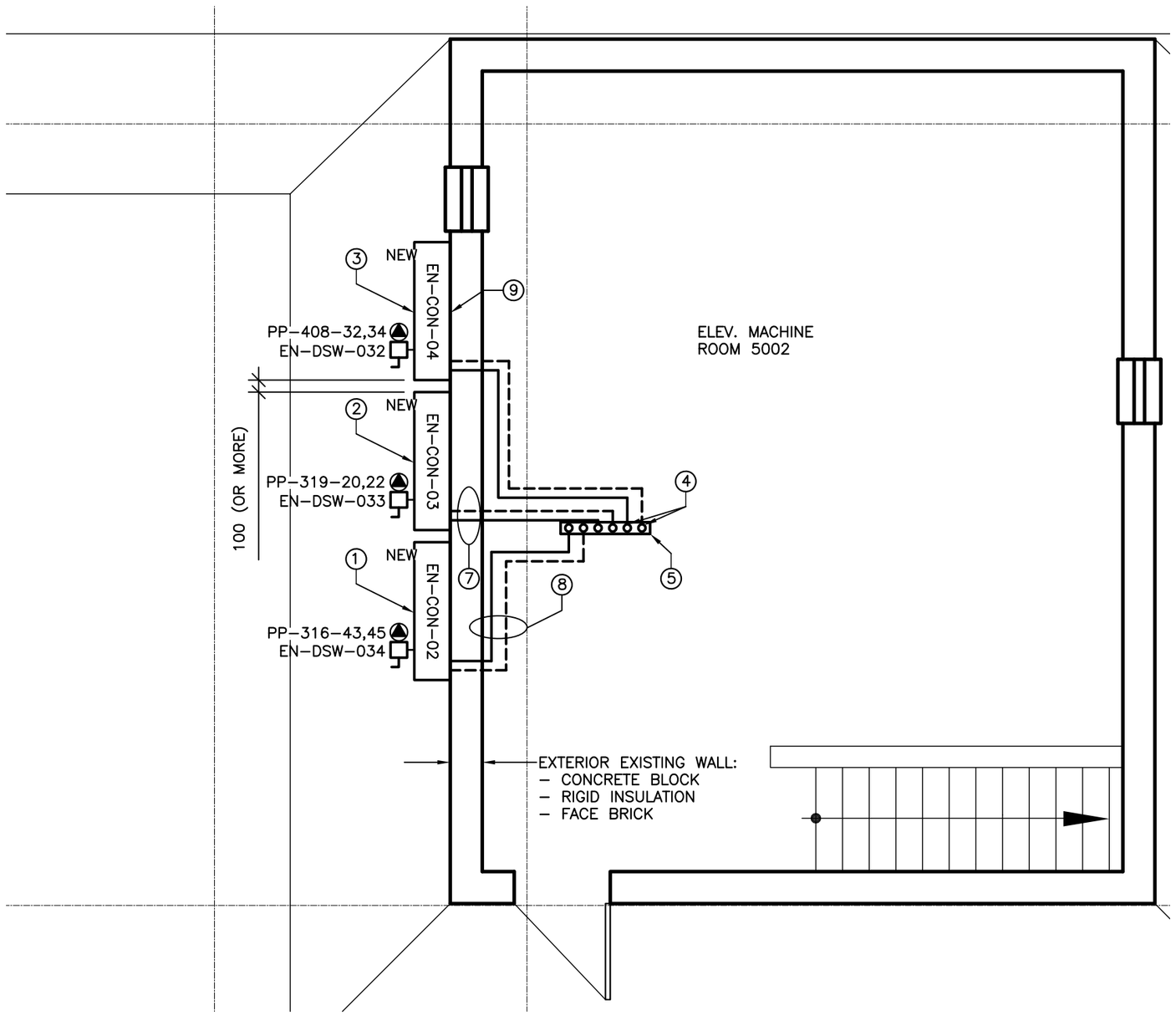
REVIEWED:	DRAWN:
MF	JY
SCALE: AS SHOWN	DATE: FEBRUARY, 2025
MUN PROJECT No. **EN-178-21**	DRAWING No. **ME-1.0**



NEW CEILING CASSETTE & ELECTRICAL LAYOUT – LEVEL 3

SCALE: 1:75

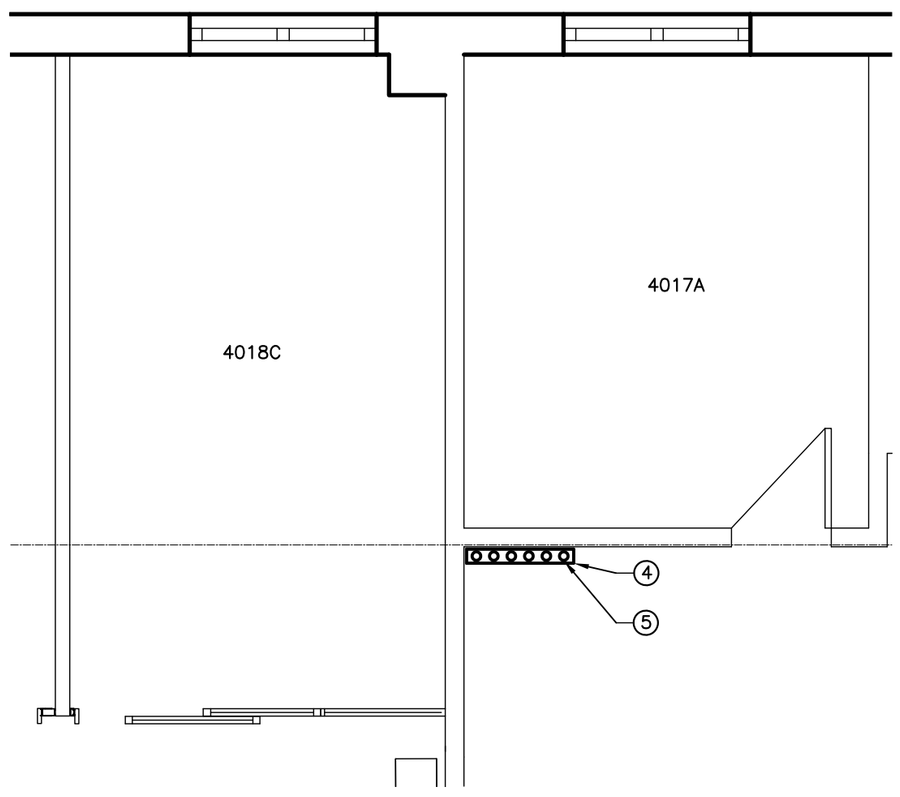
1 ME-2.0



ROOFTOP CONDENSER & ELECTRICAL LAYOUT

SCALE: 1:50

2 ME-2.0



PIPE CHASE TO ROOFTOP – LEVEL 4

SCALE: 1:50

3 ME-2.0

NEW CEILING CASSETTE NOTES: (#)

1. NEW CEILING CASSETTE TYPE EVAPORATOR FOR SPLIT SYSTEM 1. DAIKIN MODEL NO. FCQ48AAVJU OR OWNER APPROVED ALTERNATE. EVAPORATORS TO BE IN LINE WITH SERVER RACKS FOR RACK BASED COOLING.
2. NEW CEILING CASSETTE TYPE EVAPORATOR FOR SPLIT SYSTEM 2. DAIKIN MODEL NO. FCQ48AAVJU OR OWNER APPROVED ALTERNATE. EVAPORATORS TO BE IN LINE WITH SERVER RACKS FOR RACK BASED COOLING.
3. NEW CEILING CASSETTE TYPE EVAPORATOR FOR SPLIT SYSTEM 3. DAIKIN MODEL NO. FCQ48AAVJU OR OWNER APPROVED ALTERNATE. EVAPORATORS TO BE IN LINE WITH SERVER RACKS FOR RACK BASED COOLING.
4. APPROXIMATE LOCATION OF LEVEL 4 PIPE CHASE ABOVE. FIRE STOPPING REQUIRED IN ALL FLOOR SLABS.
5. NEW REFRIGERANT 15.9mm GAS AND 9.5mm LIQUID LINES, AND NEW ELECTRICAL FEEDS FOR ROOFTOP CONDENSERS UP TO LEVEL 4 THROUGH EXISTING CHASE.
   - 64mm STEEL STUD @406mm O.C.
   - 15.9mm TYPEX GYPSUM BOARD TO U/S OF EXISTING CEILING.
   - 1 COAT PRIMER, 2 COATS FINISH PAINT.
6. CONDENSATE DRAIN LINES FROM ALL EVAPORATORS TO BE USED AS CONDENSATE DRAIN OF NEW SPLIT SYSTEM, AND TIED INTO DRAIN FROM EXISTING.
7. ALL PIPE/CONDUIT ROUTING TO BE ABOVE CEILING SPACE ON LEVEL 3.
8. ROUTING FOR NEW SPLIT SYSTEM GAS AND LIQUID LINES. CONTRACTOR TO VERIFY EXACT ROUTING ON SITE.
9. CEILING PANEL LIGHTS TO BE SHIFTED 1 PANEL SPACE TO ACCOMMODATE NEW CEILING CASSETTE TYPE EVAPORATORS.

NEW ELECTRICAL NOTES:

1. TIE IN FOR NEW ELECTRICAL FEEDS FROM PANEL EN–PP–316 IN EN3000B FOR SPLIT SYSTEM 1. SUPPLY AND INSTALL NEW DOUBLE POLE 15A CIRCUIT FOR INTERIOR CASSETTE TYPE EVAPORATOR. SUPPLY AND INSTALL NEW DOUBLE POLE 35A CIRCUIT FOR ROOFTOP CONDENSING UNIT. COORDINATE SHUTDOWNS WITH MUN FACILITIES MANAGEMENT. EXACT ROUTING LOCATION TO BE DETERMINED ON SITE. ENSURE MANUFACTURER RECOMMENDED FEEDS AND BREAKER SIZE.
2. TIE IN FOR NEW ELECTRICAL FEEDS FROM PANEL EN–PP–319 IN EN3023 FOR SPLIT SYSTEM 2. SUPPLY AND INSTALL NEW DOUBLE POLE 15A CIRCUIT FOR INTERIOR CASSETTE TYPE EVAPORATOR. SUPPLY AND INSTALL NEW DOUBLE POLE 35A CIRCUIT FOR ROOFTOP CONDENSING UNIT. COORDINATE SHUTDOWNS WITH MUN FACILITIES MANAGEMENT. EXACT ROUTING LOCATION TO BE DETERMINED ON SITE. ENSURE MANUFACTURER RECOMMENDED FEEDS AND BREAKER SIZE.
3. TIE IN FOR NEW ELECTRICAL FEEDS FROM PANEL EN–PP–408 IN EN4019 FOR SPLIT SYSTEM 3. SUPPLY AND INSTALL NEW DOUBLE POLE 15A CIRCUIT FOR INTERIOR CASSETTE TYPE EVAPORATOR. SUPPLY AND INSTALL NEW DOUBLE POLE 35A CIRCUIT FOR ROOFTOP CONDENSING UNIT. COORDINATE SHUTDOWNS WITH MUN FACILITIES MANAGEMENT. EXACT ROUTING LOCATION TO BE DETERMINED ON SITE. ENSURE MANUFACTURER RECOMMENDED FEEDS AND BREAKER SIZE.
4. REUSE EXISTING LIGHTING POWER CIRCUITS AS INDICATED. RE–ROUTE, EXTEND, OR MODIFY POWER FEEDS AS REQUIRED TO FACILITATE ALL NEW LOCATIONS OF LIGHT FIXTURES, ILLUMINATED EXIT SIGNS, LINE VOLTAGE DIMMER SWITCHES, AND LOW VOLTAGE SWITCHES.
5. NEW DISCONNECT SWITCHES TO BE SUPPLIED AND INSTALLED BY CONTRACTOR. DISCONNECT SWITCHES TO BE RATED FOR OUTDOOR APPLICATION AS PER MANUFACTURER REQUIREMENTS.

NEW ROOFTOP CONDENSER NOTES: (#)

1. WALL MOUNTED CONDENSING UNIT FOR SPLIT SYSTEM 1. DAIKIN MODEL NO. RZR48TBVJUB OR OWNER APPROVED ALTERNATE. CONTRACTOR RESPONSIBLE FOR CURB AND ASSOCIATED ROOF WORK.
2. WALL MOUNTED CONDENSING UNIT FOR SPLIT SYSTEM 2. DAIKIN MODEL NO. RZR48TBVJUB OR OWNER APPROVED ALTERNATE.
3. WALL MOUNTED CONDENSING UNIT FOR SPLIT SYSTEM 3. DAIKIN MODEL NO. RZR48TBVJUB OR OWNER APPROVED ALTERNATE.
4. REFRIGERANT GAS AND LIQUID LINES, AND NEW ELECTRICAL FEEDS FOR CONDENSING UNITS DOWN THROUGH LEVEL 4 TO LEVEL 3 THROUGH EXISTING CHASE. EXACT ROUTING TO BE DETERMINED ON SITE. SEE 1/ME–3.0 FOR LEVEL 3 CONTINUATION. CONTROL WIRING NOT SHOWN. CONTRACTOR TO CORE HOLES THROUGH FACE BRICK/CONCRETE BLOCK WALL. HOLE TO BE SEALED WITH A WEATHER RESISTANT SEALANT.
5. FIRE STOPPING REQUIRED ON ALL FLOOR SLABS.
6. ROUTING FOR NEW SPLIT SYSTEM 15.9mm GAS AND 9.5mm LIQUID LINES, AND NEW 35A FEED FROM PANEL EN–PP–316 IN EN3000B TO CONDENSER 1 FOR SPLIT SYSTEM 1. REFRIGERANT LIES TO BE INSULATED BY CONTRACTOR. DETERMINE EXACT ROUTING ON SITE.
7. ROUTING FOR NEW SPLIT SYSTEM 15.9mm GAS AND 9.5mm LIQUID LINES, AND NEW 35A FEED FROM PANEL EN–PP–319 IN EN3023 TO CONDENSER 2 FOR SPLIT SYSTEM 2. REFRIGERANT LINES TO BE INSULATED BY CONTRACTOR. DETERMINE EXACT ROUTING ON SITE. CORE HOLES TO SUIT FEEDER SIZES AND SEAL WITH AN APPROVED EXTERIOR GRADE SEALANT.
8. ROUTING FOR NEW SPLIT SYSTEM 15.9mm GAS AND 9.5mm LIQUID LINES, AND NEW 35A FEED FROM PANEL EN–PP–408 IN EN4019 TO CONDENSER 3 FOR SPLIT SYSTEM 3. REFRIGERANT LINES TO BE INSULATED BY CONTRACTOR. DETERMINE EXACT ROUTING ON SITE.
9. CONDENSERS TO BE MOUNTED ON WALL MOUNTED BRACKETS, MINIMUM 610mm FROM THE TOP OF THE ROOF.

No.	REVISION	DATE
R0	ISSUED FOR TENDER	FEBRUARY, 25, 2025

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5. NEW EQUIPMENT TAGS TO BE ADDED TO TMA BY WORK CONTROL.

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PROJECT NAME:

SERVER COOLING SYSTEM REPLACEMENT EN-3023
Project #: EN-178-21

DRAWING TITLE:

NEW SERVER ROOM COOLING LAYOUT

REVIEWED:	DRAWN:
MF	JY
SCALE: AS SHOWN	DATE: FEBRUARY, 2025
MUN PROJECT No. **EN-178-21**	DRAWING No. **ME-2.0**

PANEL SCHEDULE

PANEL EN-PP-316 LOCATION EN3000B
TYPE CIRCUIT BREAKER
RATING 120/208V, 3ø, 4W, 225A
MANUFACTURER EATON
MINIMUM INTERRUPTING CAPACITY 10kA

CIRCUIT DESCRIPTION	BRKR. SIZE	CIRCUIT NO.		BRKR. SIZE	CIRCUIT DESCRIPTION
SPLIT REC 3029B	15	1	2	15	REFRIGERATOR COFFEE STATION
SPLIT REC 3029B	15	3	4	20	COUNTER REC. COFFEE STATION
SPLIT REC 3029B	15	5	6	20	COUNTER REC. COFFEE STATION
SPLIT REC 3029B	15	7	8	20	PHOTOCOPIER 3029B
SPLIT REC 3029B	15	9	10	15	COUNTER REC. 3029B
SPLIT REC 3029B	15	11	12	15	GENERAL REC. 3029B
SPLIT REC 3029B	15	13	14	15	GENERAL REC. 3029B
SPLIT REC 3029B	15	15	16	15	GENERAL REC. 3000A
SPLIT REC 3000A	15	17	18	15	GENERAL REC. 3000A
SPLIT REC 3000A	15	19	20	20	REC. MEETING RM
SPLIT REC 3000A	15	21	22	20	REC. MEETING RM
SPLIT REC 3000A	15	23	24	15	LTS RM 3000A&3029B
SPLIT REC 3000A	15	25	26	15	LTS RM 3000A&3029B
SPLIT REC 3000A	15	27	28	15	POTS LTS RM 3000A
SPARE	15	29	30	15	REC. BY PANEL
SPARE		31	32	15	POTS LTS COFFEE STATION
COUNTER REC. COFFEE STATION	20	33	34	15	REC. NEAR PANEL
SPLIT REC. RM 3000A	15	35	36	15	PHOTOCOPIER 3000A
SPLIT REC. RM 3000A	15	37	38	15	
CASSETTE TYPE EVAPORATOR 1 FOR SERVER RM EN3023 SPLIT SYSTEM 1	15	39	40	30	
		41	42	20	
ROOFTOP CONDENSER UNIT 1 FOR SERVER RM EN3023 SPLIT SYSTEM 1	35	43	44	15	
		45	46	20	DESK REC. RM 3029
		47	48	20	DESK SECURITY 3029
		49	50	20	DESK REC. RM 3029
		51	52	20	DESK REC. RM 3000
		53	54	15	SPARE IN DESK 3000
		55	56	20	DESK REC. RM 3000
		57	58		
		59	60		

PANEL SCHEDULE

PANEL EN-PP-319 LOCATION EN3023
TYPE CIRCUIT BREAKER
RATING 120/240V, 3ø, 4W, 225A
MANUFACTURER SIEMENS
MINIMUM INTERRUPTING CAPACITY 10kA

CIRCUIT DESCRIPTION	BRKR. SIZE	CIRCUIT NO.		BRKR. SIZE	CIRCUIT DESCRIPTION
30A DROP REC.	30	1	2	60	60A TWISTLOCK A
30A DROP REC.	30	3	4	60	60A TWISTLOCK B
30A REC. ON OPPOSITE WALL	30	5	6	60	60A TWISTLOCK C
30A REC. ON OPPOSITE WALL	30	7	8	60	60A TWISTLOCK
30A DROP REC.	30	9	10	20	20A DROP REC.
30A DROP REC.	30	11	12	20	20A DROP REC.
20A DROP REC.	20	13	14	15	CAMERA
20A DROP REC.	20	15	16	15	CASSETTE TYPE EVAPORATOR 2 FOR SERVER RM EN3023 SPLIT SYSTEM 2
		17	18		
		19	20	35	ROOFTOP CONDENSER UNIT 2 FOR SERVER RM EN3023 SPLIT SYSTEM 2
		21	22		
		23	24		
		25	26		
		27	28		
		29	30		
		31	32		
		33	34		
		35	36		
		37	38		
		39	40		
		41	42		

PANEL SCHEDULE

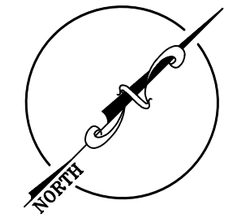
PANEL EN-PP-408 LOCATION EN4019
TYPE CIRCUIT BREAKER
RATING 120/208V, 3ø, 4W, 225A
MANUFACTURER SQUARE D
MINIMUM INTERRUPTING CAPACITY 10kA

CIRCUIT DESCRIPTION	BRKR. SIZE	CIRCUIT NO.		BRKR. SIZE	CIRCUIT DESCRIPTION
REC. RM 4019	15	1	2	15	REC. RM 4019
LHP REC. RM 4019 EXTRA DESK	15	3	4	15	REC. RM 4019
SPARE	30	5	6	15	REC. MEETING 4017
SPARE	15	7	8	15	REC. COMM. RM 4019
REC. DEV. RM 4019	30	9	10	15	REC. SAO RM 4019
REC. COFFEE 4019	15	11	12	15	REC. COFFEE 4019
REC. FRIDGE RM 4019	15	13	14		REC. LIAISON 4019
REC. RM 4019	15	15	16	30	REC. COPIER RM 4019
REC. COPIER RM 4019	15	17	18		FLOOR REC. MEETING ROOM
TV REC. MEETING ROOM	15	19	20		REC. 4019 APA DESK
REC. SHARED ASSIST RM 4019	15	21	22	30	SPARE
SPARE	15	23	24		REC. 4019 DEAN OFF.
LTS WAITING AREA	15	25	26	15	REC. 4019 DEAN OFF.
VAV BOX	15	27	28	15	CASSETTE TYPE EVAPORATOR 3 FOR SERVER RM EN3023 SPLIT SYSTEM 3
SECURITY PANEL	15	29	30		
REC. RECEPTION DESK	20	31	32	35	ROOFTOP CONDENSER UNIT 3 FOR SERVER RM EN3023 SPLIT SYSTEM 3
SPARE	20	33	34		
SPARE	20	35	36		SPARE
SPARE	20	37	38		SPARE
SPARE	20	39	40		SPARE
SPARE	20	41	42		SPARE

No.	REVISION	DATE
R0	ISSUED FOR TENDER	FEBRUARY, 25, 2025

GENERAL NOTES

1. DRAWINGS TO BE READ AS A SET.
2. DO NOT SCALE FROM DRAWINGS.
3. THE CONTRACTOR IS TO VERIFY ALL DIMENSIONS AND SITE CONDITIONS. PRIOR TO SUBMISSION OF TENDERS.
4. ALL DISCREPANCIES FOUND IN THESE DRAWINGS TO BE BROUGHT TO THE ATTENTION OF FACILITIES MANAGEMENT PRIOR TO SUBMISSION OF TENDERS.



MEMORIAL UNIVERSITY
FACILITIES MANAGEMENT

This University was raised by the people of Newfoundland as a memorial to the fallen in the great wars, 1914-1918, 1939-1945, that in freedom of learning, their cause and sacrifice might not be forgotten.

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

PROJECT NAME:

SERVER COOLING SYSTEM REPLACEMENT EN-3023
Project #: EN-178-21

DRAWING TITLE:

ELECTRICAL PANEL SCHEDULES FOR TIE-INS

REVIEWED:	DRAWN:
MF	JY
SCALE:	DATE:
AS SHOWN	FEBRUARY, 2025
MUN PROJECT No.	DRAWING No.
EN-178-21	**E-1.0**