Invitation to Tender
For
Ingleside Wastewater Treatment Plant Upgrades Phase 1

Invitation to Tender No.: **04-2025**

Issued: **March 20th, 2025**

Submission Deadline: **May 1st, 2025 @ 2:00pm local time**

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PART 1 - INVITATION AND SUBMISSION INSTRUCTIONS

1.1 INVITATION TO BIDDERS

This Invitation to Tender (the "TENDER") is an invitation by the Township of South Stormont (the "Township") to prospective bidders to submit bids for Ingleside Wastewater Treatment Plant Upgrade**,** as further described in Section A of the TENDER PARTICULARS (Appendix B) (the "Deliverables").

1.1.1 Scope of Work

The bidder, having carefully examined the site of the proposed work, and having read, understood and accepted the provisions, plans, specifications and conditions attached hereto, each and all of which forms part of this tender, hereby offer to furnish all machinery, tools, labour, apparatus, plant and other means of construction; all materials, except as otherwise stated in the Contract; and to complete the work in strict accordance with the provisions, plans, specifications and conditions hereto attached for the unit prices shown in Appendix B, which forms part of this tender.

The following is a general but not necessarily complete description of the works to be constructed under this contract:

- New headworks, including preselected redundant automated screens and vortex grit removal.
- Construction of a new UV disinfection system and building.
- New raw sewage forcemain extension to the Headworks
- Expansion of the existing biosolids storage facilities.
- Building Expansion to house the support systems: i.e., blowers, pumps, chemical feed systems, emergency power system, etc.

1.1.2 Prequalification (N/A)

1.1.3 Bidder must be Single Entity

The bidder must be a single legal entity that, if selected, intends to enter into the contract with the Township. If the bid is being submitted jointly by two (2) or more separate entities, the bid must identify only one of those entities as the "bidder". The bidder will be responsible for the performance of the Deliverables.

1.2 TENDER CONTACT

For the purposes of this procurement process, the "TENDER Contact" will be coordinated via Biddingo.

Bidders and their representatives are not permitted to contact any employees, officers, agents, elected or appointed officials, or other representatives of the Township, other than the TENDER Contact, concerning matters regarding this TENDER. Failure to adhere to this rule may result in the disqualification of the bidder and the rejection of the bidder's bid.

Questions or clarifications regarding this Tender will be received until the end of day **April 21st, 2025** and shall be submitted in writing via Biddingo. The Township reserves the right to distribute any and all questions (anonymously) and answers pertaining to this Tender by number addenda. The final addendum, if applicable, will be issued on **April 24th, 2025**.

Bidders must acknowledge receipt of all Addenda in Biddingo prior to submitting their bid.

1.3 CONTRACT FOR DELIVERABLES

1.3.1 Type of Contract

The selected bidder will be required to enter into an agreement with the Township for the provision of the Deliverables in the form attached as Appendix A to the TENDER (the "Agreement").

1.3.2 Term of Contract

It is anticipated that the commencement date will be within one week of award; However, the official start-date shall be mutually established by The Township of South Stormont and the Bidder upon award of the Contract. Substantial completion of the project shall be completed no later than **March 31st, 2027**.

If the time limits above specified are not sufficient to permit completion of the work by the Bidder working a normal number of hours each day or week on a single daylight shift basis, it is expected that additional and/or augmented daylight shifts will be required throughout the life of the contract to the extent deemed necessary by the Bidder to ensure that the work will be completed within the time limit specified. Any additional costs occasioned by compliance with these provisions will be considered to be included in the prices bid for the various items of work and no additional compensation will be allowed.

It is agreed by the Bidder that in case all the work called for under the Tender is not finished or completed within the date of completion specified aforementioned, damage will be sustained by the Township, and that it is and will be impractical and extremely difficult to ascertain and determine the actual damage which the Township will sustain in the event of and by reason of such delay and the parties hereto agree that the Bidder will pay to the Township the sum of **ONE THOUSAND DOLLARS ($1,000.00)** for liquidated damages for each and every working day delay in finishing the work beyond the dates of completion prescribed. It is agreed that this amount is an estimate of actual damage to the Township which will accrue during the period in excess of the prescribed date of completion. The Township reserves the right to recover actual damages in connection with the failure by the bidder to achieve Substantial Completion within the time specified within this Tender.

The Township may deduct any amount under the paragraph above from any monies that may be due or payable to the Contractor on any account whatsoever. The liquidated damages payable under this paragraph are in addition to and without prejudice to any other remedy, action or other alternative that may be available to the Township.

1.4 TENDER TIMETABLE

1.4.1 Key Dates

Issue Date of TENDER:	March 20th, 2025
Deadline for Questions:	April 21st, 2025; 11:59:59 PM local time
Deadline for Issuing Addenda:	April 24th, 2025; 11:59:59 PM local time
Submission Deadline:	May 1st, 2025 @ 2:00 PM local time
Public Opening:	May 1st, 2025 @ 3:00 PM local time
Anticipated Execution of Agreement:	May 14th, 2025
Irrevocability Period:	90 calendar days

The TENDER timetable is tentative only and may be changed by the Township at any time.

1.4.2 Site Visit / Pre-Bid Meeting

A mandatory job showing is scheduled for **Tuesday April 1st, 2025** @ **9:00 AM** at the site of the Ingleside WWTP located at 15005 Long Sault Parkway, Ingleside. The job showing is mandatory for all general contractors who are bidding on the project. Sub-contractors or suppliers may attend the job showing but it is not mandatory for them.

1.4.3 Public Opening (if applicable)

A public opening of the bids will be held at the Township of South Stormont office located at 2 Mille Roche Road, Long Sault Ontario at 3:00pm local time or posted on the Township of South Stormont's web page.

1.5 SUBMISSION OF BIDS

1.5.1 Bids to be Submitted at Prescribed Location

Bids must be submitted electronically no later than **May 1st, 2025 @ 2:00pm** local time through Biddingo.

1.5.2 Bids to be Submitted on Time

Bids must be submitted 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 electronically on or before the Submission Deadline. Bidders are advised to make submissions well before the deadline. Bidders making submissions near the deadline do so at their own risk.

1.5.3 Bids to be Submitted in Prescribed Format

Bidders must submit their Bid in the format presented in Biddingo.

1.5.4 Amendment of Bids

Bidders may amend their bids prior to the Submission Deadline. Any amendment should clearly indicate which part of the bid the amendment is intended to amend or replace.

1.5.5 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 TENDER Contact prior to the Submission Deadline and must be signed by an authorized representative of the bidder. The Township is under no obligation to return withdrawn bids.

1.5.6 Bids Irrevocable after Submission Deadline

Bids shall be irrevocable for a period of 90 days running from the moment that the Submission Deadline passes.

[END OF PART 1]

PART 2 - EVALUATION AND AWARD

2.1 STAGES OF EVALUATION

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

2.1.1 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 Township, be rejected. The Mandatory Submissions are as follows:

Bid Bond

An Agreement to Bond

A Schedule of Unit Prices and Statements B, and C.

2.1.2 No Amendment to Forms

Other than inserting the information requested on the mandatory submission forms set out in the TENDER, 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, may be disqualified.

2.2 STAGE II – MANDATORY TECHNICAL REQUIREMENTS (N/A)

2.3 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 set out in Section F of the TENDER Particulars (Appendix B). The evaluation of price will be undertaken after the evaluation of mandatory requirements has been completed.

In the event that a bidder's pricing appears to be abnormally low in relation to the Deliverables, the Township may require the bidder to provide a detailed explanation of the pricing information to account for the low level of price and confirm that all requirements in respect of the Deliverables have been taken into account. If the bidder is unable to satisfactorily account for the abnormally low pricing, the Township may reject the bid. The Township may also reject any bid that contains unbalanced pricing. Pricing may be considered unbalanced where nominal or significantly understated prices are proposed for some elements of the Deliverables and inflated prices are proposed for other elements of the Deliverables. Unbalanced pricing includes, but is not limited to, "front-loaded" pricing which contains inflated pricing for Deliverables to be provided or completed at the beginning of the contract, offset by understated pricing for Deliverables to be provided or completed later in the contract.

Extensions of unit prices and addition of extended unit prices, lump sums and allowances entered in the "Schedule of Unit Prices" in the Tender will be checked by the Township. The unit prices will be considered correct in the event that there is an arithmetical error between the unit price and extended price. The total amount bid shall be based on the arithmetically correct unit price extensions in the "Schedule of Unit Prices". The bidder will be bound to the corrected extended price.

2.4 SELECTION OF LOWEST COMPLIANT BIDDER

Subject to the Township's reserved rights, the compliant bidder with the lowest pricing will be selected to enter into the Agreement. In the event of a tie, the selected bidder will be determined by way of a coin toss.

2.5 NOTICE TO BIDDER AND EXECUTION OF AGREEMENT

Notice of selection by the Township to the selected bidder shall be in writing. The selected bidder shall execute the Agreement in the form attached as Appendix A to this TENDER and satisfy any other applicable conditions of this TENDER, including the pre-conditions of award listed in Section E of the TENDER Particulars (Appendix B), within fourteen (14) calendar days of notice of selection. This provision is solely for the benefit of the Township and may be waived by the Township.

2.6 FAILURE TO ENTER INTO AGREEMENT

If a selected bidder fails to execute the Agreement or satisfy any applicable conditions within fourteen (14) calendar days of notice of selection, the Township may, without incurring any liability, proceed with the selection of another bidder and pursue all other remedies available to the Township.

[END OF PART 2]

PART 3 - TERMS AND CONDITIONS OF THE TENDER PROCESS

3.1 GENERAL INFORMATION AND INSTRUCTIONS

The Ontario Provincial Standards (OPS) for Municipal Oriented General Conditions of Contract (OPSS.MUNI 100 2019) shall apply to this contract for its duration. The submission of a bid by the Contractor signifies that they have reviewed the appropriate OPS General Conditions and Supplementary Conditions which form part of this Tender.

3.1.1 TENDER Incorporated into Bid

All of the provisions of this TENDER 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 inconsistent with the terms set out in this TENDER, including the terms of the Agreement in Appendix A, either as part of its bid or after receiving notice of selection, may be disqualified. If a bidder is not disqualified despite such changes or qualifications, the provisions of this TENDER, including the Agreement set out in Appendix A, will prevail over any such changes or qualifications in the bid.

3.1.2 Bidders to Follow Instructions

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

3.1.3 Bids in English

All bids are to be in English only.

3.1.4 Performance and Payment Bonds

The Bidder, together with a surety company shall, unless otherwise directed, furnish to the Township a Performance Bond and a separate Labour and Material Payment Bond each in the amount of one hundred percent (100%) of the total tender price. The bonds shall be those issued by a bonding agency licensed to operate in the Province of Ontario and in a form satisfactory to the Township.

The Bidder shall include with their Bid Submission the Agreement to Bond executed under its corporate seal by the surety company from which they propose to obtain the required bonds. The Bidder will be required to furnish the Performance Bond and the Labour and Material Payment Bond in triplicate as required within Fourteen (14) calendar days after notification of award by the Township. One copy of the said bonds shall be bound into each of the three (3) executed sets of the Contract.

3.1.5 No Incorporation by Reference

The entire content of the bidder's bid should be submitted in a fixed format, and 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.

3.1.6 Past Performance (N/A)

3.1.7 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.

3.1.8 Bid to be Retained by the Township

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

3.1.9 No Guarantee of Volume of Work or Exclusivity of Contract

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

3.2 COMMUNICATION AFTER ISSUANCE OF TENDER

3.2.1 Bidders to Review TENDER

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

(a) shall report any errors, omissions or ambiguities; and

(b) may direct questions or seek additional information

in writing by email to the TENDER Contact on or before the Deadline for Questions. No such communications are to be sent or initiated through any other means. The Township is under no obligation to provide additional information, and the Township is not responsible for any information provided by or obtained from any source other than the TENDER Contact. It is the responsibility of the bidder to seek clarification on any matter it considers to be unclear. The Township shall not be responsible for any misunderstanding on the part of the bidder concerning this TENDER or its process.

3.2.2 All New Information to Bidders by Way of Addenda

This TENDER may be amended only by addendum in accordance with this section. If the Township, for any reason, determines that it is necessary to provide additional information relating to this TENDER, such information will be communicated to all bidders by addenda. Each addendum forms an integral part of this TENDER and may contain important information, including significant changes to this TENDER. Bidders are responsible for obtaining all addenda issued by the Township.

3.2.3 Post-Deadline Addenda and Extension of Submission Deadline

If the Township determines that it is necessary to issue an addendum after the Deadline for Issuing Addenda, the Township may extend the Submission Deadline for a reasonable period of time.

3.2.4 Verify and Clarify

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

3.3 HEALTH AND SAFETY

3.3.1 Protection of Public

The Bidder shall provide adequate warning signage, devices, barricades, guards, flagmen, or other necessary precautions shall be taken by the Bidder to give advice and reasonable protection, safety and warning to pedestrian and vehicular traffic in all area(s) affected by the Contract.

3.3.2 Health and Safety Policy

The Bidder shall provide the Township, within Fourteen (14) calendar days after notification of award by the Township a written copy of the Health and Safety Policy for their firm along with Health and Safety procedure(s) relevant to the Work to be performed where applicable. If the firm does not have written procedures relevant to the Work, then the firm shall be expected to abide by the Township's safety procedures in addition to the Occupational Health and Safety Act.

3.3.3 The Occupational Health and Safety Act

The Contractor, for purposes of the Ontario Occupational Health and Safety Act (the "OHSA"), shall be designated as the Constructor for this project and shall assume all of the responsibilities of the "Constructor" as set out in the OHSA and its regulations. The foregoing shall apply notwithstanding that the Contractor has been referred to as the "Contractor" in this and any other related document.

a. The Contractor acknowledges that they have read and understood the Occupational Health and Safety Act (RSO 1990, as amended).
b. The Contractor shall be solely responsible for construction safety at the Place of Work and for compliance with the rules, regulations and practices required by the applicable construction health and safety legislation and shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of the Work. The Contractor acknowledges that it is a "constructor" within the meaning of the Occupational Health and Safety Act (Ontario).
c. The Contractor covenants and agrees to observe strictly and faithfully the provisions of the said Occupational Health and Safety Act and all regulations and rules promulgated thereunder, and, in particular (without limiting the generality of the foregoing) the provisions regarding the obligations and responsibilities of the "Constructor".
d. The Contractor agrees to indemnify and save harmless the Township, its agents, officers, directors, employees, consultants, successors, and assigns from and against the consequences of any and all safety infractions committed by the Contractor or Subcontractors under the Occupational Health and Safety Act, including but not limited to the legal fees incurred by the Township.
e. The Contractor agrees to assume full responsibility for the enforcement of the said Occupational Health and Safety Act to ensure compliance therewith. The Contractor agrees to ensure full responsibility that the Contractor's own forces, Subcontractors, Suppliers and invitees follow all rules, directives, policies and regulations of the Owner regarding health and safety applicable to the Place of the Work including, but not limited to, the Owner's Health & Safety Policy.
f. The Contractor further acknowledges and agrees that any breach or breaches of the Occupational Health and Safety Act whether by the Contractor or any of its subcontractors, may result in the immediate termination of the Contract.
g. The Contractor shall allow access to the Work site on demand to representatives of the Township to review work sites to ensure compliance with the Occupational Health and Safety Act, but no such review shall relieve the Contractor from its responsibilities as Constructor.
h. The Contractor agrees that any damages or fines that may be assessed against the Township by reason of a breach or breaches of the Occupational Health and Safety Act by the Contractor or any of its subcontractors shall entitle the Township to set-off the damages so assessed against any monies that the Township may from time to time owe the Contractor under the Contract or under any other Contract whatsoever.

i. The Township reserves the right to terminate the Contract without obligation for non-compliance with the terms set out herein, health and safety regulations, the Environmental Protection Act, associated regulations or other applicable legislation.
j. The Contractor shall perform the Work so as to cause the public the least inconvenience possible. In particular, the Contractor shall not obstruct any street, thoroughfare, or footwalk longer or to a greater extent than necessary.
k. The Contractor shall take all reasonable precaution necessary to ensure the safety of the workers and the general public, particularly children who may play in the area of Work.
l. The Contractor shall provide a list of all controlled hazardous materials or products containing hazardous materials, all physical agents or devices or equipment producing or emitting physical agents and any substance, compound, product or physical agent that is deemed to be or contains a designated substance in accordance with the Workplace Hazardous Materials Information System (WHMIS) as defined under the Ontario Occupational Health and Safety Act and shall provide appropriate Safety Data Sheets for these substances used for the performance of the required Work, all prior to the performance of the Work.
m. When hazardous materials, physical agents and/or designated substances are used in the performance of the required Work, the selected Contractor shall ensure that the requirements of the Ontario Occupational Health and Safety Act and associated regulations are complied with.
n. Prior to the commencement of the Work, the Contractor shall submit to the Owner:
    i. A current Workplace Safety and Insurance Board (WSIB) clearance certificate;
    ii. Documentation of the Contractor's in-house safety-related programs; and
    iii. A copy of the Notice of Project filed with the Ministry of Labour naming itself as "constructor" under the Occupational Health and Safety Act (OHSA).

3.3.4 Workplace Safety and Insurance Board

Within Fourteen (14) calendar days after notification of award by the Township the successful Bidder shall provide to the Township a Certificate of Clearance from the Workplace Safety and Insurance Board. The successful Bidder shall maintain its good standing and shall provide to the Township current Certificates of Clearance throughout the duration of the Contract.

3.3.5 Accessibility Standards for Customer Service, Disabilities Act.

It is the Proponent's responsibility to ensure that they and all sub-contractors hired under this contract are in full compliance with all accessibility regulations including Section 7 of Ontario Regulation 191/11, Accessibility Standards for Customer Service made under the Accessibility for Ontarians with Disabilities Act, 2005 as may be amended from time to time

3.4 NOTIFICATION AND DEBRIEFING

3.4.1 Notification to Other Bidders

Once the Agreement is executed by the Township and a bidder, the other bidders may be notified directly in writing and shall be notified by public posting of the outcome of the procurement process.

3.4.2 Debriefing (N/A)

3.4.3 Procurement Protest Procedure

Any bidder with concerns about the TENDER process is required to attend a debriefing prior to proceeding with a protest.

If, after attending a debriefing, the bidder wishes to challenge the TENDER process, it should provide written notice to the TENDER Contact in accordance with applicable procurement protest procedures. The written notice must contain:

(a) a clear statement as to which procurement the bidder wishes to challenge;

(b) a clear explanation of the bidder's concerns with the procurement, including specifics as to why it disagrees with the procurement process or its outcome; and

(c) the bidder's contact details, including name, telephone number and email address.

The Township will send an initial response to acknowledge receipt of the bidder's notice and indicate the date by which the Township will provide the bidder with a formal response.

3.5 CONFLICT OF INTEREST AND PROHIBITED CONDUCT

3.5.1 Conflict of Interest

For the purposes of this TENDER, the term "Conflict of Interest" includes, but is not limited to, any situation or circumstance where:

(a) in relation to the TENDER 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 Township in the preparation of its bid that is not available to other bidders;

  (ii) having been involved in the development of the TENDER, including having provided advice or assistance in the development of the TENDER;

  (iii) receiving advice or assistance in the preparation of its response from any individual or entity that was involved in the development of the TENDER;

  (iv) communicating with any person with a view to influencing preferred treatment in the TENDER process (including but not limited to the lobbying of decision makers involved in the TENDER process); or

  (v) engaging in conduct that compromises, or could be seen to compromise, the integrity of the open and competitive TENDER process or render that process non-competitive or unfair;

(b) in relation to the performance of its contractual obligations under a contract for the Deliverables, the bidder's other commitments, relationships, or financial interests:

  (i) could, or could be seen to, exercise an improper influence over the objective, unbiased, and impartial exercise of its independent judgement; or

  (ii) could, or could be seen to, compromise, impair, or be incompatible with the effective performance of its contractual obligations.

3.5.2 Disqualification for Conflict of Interest

The Township may disqualify a bidder for any conduct, situation, or circumstances, determined by the Township, in its sole and absolute discretion, to constitute a Conflict of Interest as defined above.

An existing supplier of the Township may be precluded from participating in the TENDER process in instances where the Township has determined that the supplier has a competitive advantage

that cannot be adequately addressed to mitigate against unfair advantage. This may include, without limitation, situations in which an existing supplier is in a position to create unnecessary barriers to competition through the manner in which it performs its existing contracts, or situations where the incumbent fails to provide the information within its control or otherwise engages in conduct obstructive to a fair competitive process.

3.5.3 Disqualification for Prohibited Conduct

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

3.5.4 Prohibited Bidder Communications

Bidders must not engage in any communications that could constitute a Conflict of Interest and should take note of the Conflict of Interest declaration set out in the Submission Form (Appendix C).

3.5.5 Bidder Not to Communicate with Media

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

3.5.6 No Lobbying

Bidders must not, in relation to this TENDER 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).

3.5.7 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 Township; 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 TENDER.

3.5.8 Supplier Suspension

A Bidder shall be excluded from eligibility to submit, or a submitted Bid will be summarily rejected, where the Chief Administrative Officer, and the applicable Executive Leadership Team Member agree, in their absolute sole discretion that one of the following circumstances has occurred:

(a) the Bidder is currently or, has within the last 5 years, been involved in litigation with the Township of South Stormont, its elected officials, officers or employees.

(b) the Bidder has failed to pay any amount owed to the Township when due,

(c) there is documented evidence of poor performance and/or non-performance,

(d) the Bidder within the last 2 years has withdrawn its bid after bids have been opened by the Township,

(e) the Bidder is in breach of the Township Purchasing By-law,

(f) the Bidder has been convicted of a criminal offence including but not limited to fraud or theft,

(g) the Bidder has been convicted of a criminal offence pursuant to the Occupational Health and Safety Act, as amended, where the circumstances of that conviction demonstrate a disregard on the part of the Bidder for the health and safety of its workers, Township employees or the public,

(h) the Bidder is bankrupt or insolvent,

(i) the Bidder has made a false declaration(s) and/or has committed acts or omissions that adversely reflect on the integrity of their bid.

3.6 CONFIDENTIAL INFORMATION

3.6.1 Confidential Information of the Township

All information provided by or obtained from the Township in any form in connection with this TENDER either before or after the issuance of this TENDER

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

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

(c) must not be disclosed without prior submitted authorization from the Township; and

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

3.6.2 Application of Municipal Freedom of Information and Protection of Privacy Act

By submitting a Bid, the Bidder agrees that any and all information contained in its Bid will be treated in accordance with the relevant provisions of the Municipal Freedom of Information and Protection of Privacy Act (MFIPPA). Section 10 of MFIPPA extends protection in certain circumstances to records which reveal a trade secret or scientific, commercial, financial or labour relations information. The Information and Privacy Commissioner (IPC) has held that unit pricing, quantities and extended prices arising out of competitive procurement are records that a municipality may not refuse to disclose pursuant to section 10 of MFIPPA. Accordingly, the Township reserves the right to disclose pricing information, including quantities and unit, extended and total pricing, and the Bidder, in submitting its Bid, hereby consents to such disclosure.

3.7 RESERVED RIGHTS AND LIMITATION OF LIABILITY

3.7.1 Reserved Rights of the Township

The Township reserves the right to

(a) make public the names of any or all bidders;

(b) make changes, including substantial changes, to this TENDER provided that those changes are issued by way of addendum in the manner set out in this TENDER;

(c) request written verification or clarification from any bidder and incorporate a bidder's response to that request for clarification into the bidder's bid;

(d) 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 TENDER, consider any other relevant information that arises during this TENDER process;

(e) reject a bid that contains abnormally low or unbalanced pricing;

(f) waive formalities and accept bids that substantially comply with the requirements of this TENDER;

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

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

(i) 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;

(j) select a bidder other than the bidder whose bid reflects the lowest cost to the Township;

(k) cancel this TENDER process at any stage;

(l) cancel this TENDER process at any stage and issue a new TENDER for the same or similar deliverables;

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

(n) reject any or all bids;

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

3.7.2 Limitation of Liability

By submitting a bid, each bidder agrees that

(a) neither the Township nor any of its employees, officers, agents, elected or appointed officials, advisors, or representatives will be liable, under any circumstances, for any claim arising out of this TENDER 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 Township's decision to not accept the bid summitted by the bidder, 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.

3.8 WARRANTY/FIT FOR INTENDED USE

The Bidder warrants that the Work, goods, materials, equipment and/or services supplied by the Bidder to the Township will be in full conformity with the Tender Documents, and any samples provided. The Bidder further warrants that the goods, materials and/or equipment are of merchantable quality, and fit for the intended use and will perform according to the requirements set out by the Township as well as in accordance with all published performance specifications contained in any of the Bidder's product manuals. For greater certainty, equipment and materials shall be new, the latest model, and shall be complete with all necessary accessories for operation. The overall warranty period for the work included in this Tender is one year from the date of

Substantial Performance of the Work. The Contractor shall be responsible to correct at his/her own expense all defects or deficiencies in the Work which appears during the two-year warranty period

3.9 GOVERNING LAW AND INTERPRETATION

These Terms and Conditions of the TENDER Process (Part 3)

(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 Township; and

(c) are to be governed by and construed in accordance with the laws of the province of Ontario and the federal laws of Canada applicable therein.

3.10 INSURANCE

(a) The successful bidder shall at their own expense within 10 days of notification of acceptance and prior to the commencement of work, obtain and maintain until the termination of the contract or otherwise stated.

(b) General liability insurance shall be with limits of not less than $10,000,000 per occurrence, an aggregate limit of not less than $10,000,000 within any policy year with respect to completed operations, and a deductible not exceeding $10,000. The insurance coverage shall not be less than the insurance provided by IBC Form 2100 (including an extension for a standard provincial and territorial form of non-owned automobile liability policy) and IBC Form 2320. To achieve the desired limit, umbrella or excess liability insurance may be used. Subject to satisfactory proof of financial capability by the *Contractor,* the *Owner* may agree to increase the deductible amounts.

(c) Automobile liability insurance in respect of vehicles that are required by law to be insured under a contact by a Motor Vehicle Liability Policy, shall have limits not less than $10,000,000 inclusive per occurrence for bodily injury, death and damage to property, covering all vehicles owned or leased by the *Contractor*. Where the policy has been issued pursuant to a government-operated automobile insurance system, the *Contractor* shall provide the *Owner* with confirmation of automobile insurance coverage for all automobiles registered in the name of the *Contractor*.

(d) Manned Aircraft and watercraft liability insurance with respect to owner or non-owned aircraft and watercraft (if used directly or indirectly in the performance of the *Work*), including additional premises, shall have limits of not less than $10,000,000 inclusive per occurrence for bodily injury, death and damage to property including loss of use thereof and limits of not less than $10,000,000 for aircraft passenger hazard. Such insurance shall be in a form acceptable to the *Owner*.

(e) Unmanned aerial vehicle liability insurance with respect to owned or non-owned aircraft (if used directly or indirectly in the performance of the *Work*), shall have limits of not less than $5,000,000 per occurrence or accident for bodily injury, death and damage to property or such amounts as required by any applicable law or regulation.

(f) "Broad form" property insurance shall have limits of not less than the sum of 1.1 times the *Contract Price* and the full value, as stated in the *Contract*, of the *Products* and design services that are specified to be provided by the *Owner* for incorporation into the *Work*, with a deductible not exceeding $10,000. The insurance coverage shall not be less than the insurance provided by IBC Forms 4042 and 4047 or their equivalent replacement. Subject to satisfactory proof of financial capability by the *Contractor*, the *Owner* may agree to increase the deductible amounts.

(g) Boiler and machinery insurance shall have limits of not less than the replacement value of the permanent or temporary boilers and pressure vessels, and other insurable objects forming part of the *Work*. The insurance coverage shall not be less than the insurance provided by a comprehensive boiler and machinery policy including hot testing and commissioning.

(h) Contractors' equipment insurance coverage written on an "all risks" basis covering *Construction Equipment* used by the *Contractor* for the performance of the *Work*, shall be in a form acceptable to the *Owner* and shall not allow subrogation claims by the insurer against the *Owner*. Subject to satisfactory proof of financial capability by the *Contractor* for self-insurance, the *Owner* may agree to waive the equipment insurance requirement.

(i) Contractors' Pollution and Environmental Impairment liability insurance shall have limits of not less than $5,000,000 per occurrence for bodily injury, death and damage to property. Coverage shall include Third Party Bodily Injury and Property Damage including on-site and off-site clean-up. The Policies shown above shall not be cancelled unless the Insurer notifies the Corporation in writing at least thirty (30) days prior to the effective date of the cancellation. The insurance policy will be a form and with a company which are, in all respects, acceptable to the Township.

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

(k) The insurance shall also include as Unnamed Insureds other consultants of the Owner and sub consultants of the Consultant.

The Contractors insurance shall be primary coverage and not additional to and shall not seek contribution for any other insurance policies available to the Township.

3.11 PAYMENT TO SUPPLIERS OF PRE-SELECTED EQUIPMENT

Preselected equipment (see "Schedule of Preselected Equipment", in the Appendix C) which the Contractor is required to furnish under the Contract shall be ordered and paid for either by the Contractor or by an authorized and approved subcontractor.

The purchaser of pre-selected equipment, whether such purchaser is the Contractor or a subcontractor, shall make payments and shall release holdback to suppliers of pre-selected equipment in accordance with the terms of payment set out in the quotation documents prepared by the Owner's Consulting Engineer and upon which quotations for pre-selected equipment were based. (See documents attached to in Appendix H).

The itemized statement which the Contractor submits monthly to the Contract Administrator in accordance with GC 8.02.04.01 of OPSS.MUNI 100 2019 shall include items and amounts in respect of pre-selected equipment in accordance with the said terms of payment. Similarly, if

release of holdback becomes due to a supplier of pre-selected equipment during the period of maintenance of the Contract, the Contractor shall submit to the Contract Administrator, an itemized statement or invoice showing the amount to be released and when it is due.

Provided that the Contract Administrator is satisfied that the supplier of an item of pre-selected equipment and the Contractor (and subcontractor, if any) have fulfilled their obligations, the Contract Administrator shall approve payment or release of holdback in respect of the said preselected equipment to the Contractor in accordance with the said terms of payment.

If requested by the Contract Administrator, the Contractor shall furnish to the Contract Administrator photostat copies of any or all invoices issued by equipment suppliers to the Contractor or to subcontractors in relation to the Contract.

[END OF PART 3]

APPENDIX A – FORM OF AGREEMENT

TOWNSHIP OF SOUTH STORMONT
CONTRACT 04-2025

THIS AGREEMENT made this_____day of_____, 2025

BETWEEN: **THE CORPORATION OF THE TOWNSHIP OF SOUTH STORMONT**

(hereinafter called the "Township")

Of the First Part

- and -

_____

(hereinafter called the "Contractor")

Of the Second Part

WHEREAS the Township issued a request for Bid for **Ingleside Wastewater Treatment Plant Upgrades Phase 1** (the "TENDER");

AND WHEREAS the Contractor submitted a response to the TENDER dated the _____ day of _____(the "Bid");

AND WHEREAS the Township has agreed to accept the submitted Bid of the Contractor and enter into the contract for the completion of the work called for under the TENDER under terms and conditions hereinafter set out;

NOW THEREFORE THIS AGREEMENT WITNESSETH that in consideration of the mutual covenants contained hereafter, the parties agree as follows:

1. **Interpretation.** Capitalized words and phrases shall have the meanings given to them herein and any capitalized words and phrases not defined herein shall have the meaning given to them in the TENDER.

2. **Project.** The work to be completed by the Contractor (the "Work") includes all of the labour and materials and products required for the project as defined in the TENDER.

3. **Schedule.** The Contractor agrees to commence the Work immediately and to complete the Work and the Project by no later than the **31st** day of **March 2027**.

4. **Contract Documents.** The provisions herein and following are the contract documents that form part of the agreement between the Township and the Contractor in respect of the Project and Work and collectively are referred to as the "Agreement":
   (a) the TENDER, including any Addendums thereto;
   (b) the Ontario Provincial Standards for Roads and Public Works OPSS MUNI 100,2019 or other Ontario Provincial Standards referred to in the TENDER (the "OPSS Standards")
   (c) this Agreement; and
   (d) the Bid.
   (e) The Contract Drawings.

   In the event of a conflict between the terms herein and the TENDER, the OPSS Standards and the Proposal, the priority for interpretation shall be as per OPSS GC 2.02.

5. **Contract Price.** The contract price shall be the sum of _____ **($**_____) **Dollars**,(Exclusive of HST) which price is all-inclusive (the "Contract Price"). Payment terms shall be as set out on the TENDER and if not, as set out in the OPSS Standards.

6. **Turnkey.** The Contractor acknowledges and agrees that the Project is a turnkey Project and that the Contract Price shall include the cost of labour, materials and equipment and all other costs associated with the engineering, design, construction and installation of the Project. There shall be no claim for extras or additional costs, including costs due to unknown or undisclosed conditions and all risks with respect to additional costs, including extras, shall be with the Contractor.

7. **Supervision.** The Contract Administrator identified in the TENDER, if any, shall provide all necessary supervision and be at the place of the Work while the Work is being performed. The Contract Administrator shall not be changed without the approval of the Township.

8. **Subcontractors.** The Contractor shall: enter into contracts or written agreements with its subcontractors, including those identified in the list submitted by the Contractor to the Township pursuant to the TENDER; incorporate the terms and conditions of this Agreement into all contracts or written agreements with such subcontractors or suppliers; be fully responsible to the Township for the acts and omissions of the subcontractors, suppliers and of persons directly or indirectly employed by them or contracted by them as well as for the acts and omissions of persons directly employed by the Company; and, obtain the Township's written approval of any changes to the subcontractors or suppliers in accordance with the TENDER.

9. **Damage.** The Contractor acknowledges the Contractor will be responsible for any damage caused during the installation to the existing facilities.

10. **Defective Work.** The Contractor shall promptly remove and replace and re-execute any defective Work that has been rejected by the Township as failing to comply with the terms of this contract, whether defective Work is due to poor workmanship, use of defective products or damage due to carelessness, other act or omission of the Contractor or its subcontractors or suppliers.

11. **Labour and Products.** The Contractor shall provide and pay for labour, products, tools, construction machinery and equipment and all other equipment, parts and supplies, water, heat, light, power, transportation or other facilities and services, including design services necessary for the performance of the Work.

12. **New Equipment.** All equipment shall be new, and no equipment shall be substituted for that contained in the Proposal without the prior written consent of the Township.

13. **Drawings.** The Contractor shall provide design drawings, shop drawings, engineering reports, including stamped engineering reports called for under the TENDER and Proposal, as the Township may from time-to-time request.

13.1 The Contractor agrees that items such as plans, drawings, photos, designs, studies, specifications, computer programs, schedules, technical reports, or other work products which is/are specified to be delivered under this Agreement, the Township may use, duplicate and disclose such items in whole or in part, in any manner and for whatever purpose, and to have others do so and the Contractor hereby grants the Township a royalty-free, non-exclusive and irrevocable license to do so. If an item produced by the Contractor is copyrightable, the Contractor may copyright it, subject to the rights of the Township.

14. **Clean-up.** The Contractor shall maintain the place of work in a tidy condition and free from the accumulation of waste products and debris. The Contractor shall remove waste products and debris and leave the place of work clean and suitable for occupancy by the Township before the completion of the contract.

15. **Changes of Work.** In the event that there shall be any change in Work agreed to between the parties, then prior to the performance of such Work, the Contractor shall provide a notice in writing describing the proposed change in the Work to the Township, including a fixed price cost for such changes in Work. The changes in Work shall only proceed if agreed to by the Township and only at the fixed price therein.

16. **Delays.** The Contractor shall only be entitled to be excused from completion of this contract due to delays which are the result of a deliberate act or omission or negligence of the Township or its employees, in which case the contract shall be extended for the reasonable time as agreed to between the Township and the Contractor based on such delays.

17. **Default and Termination**.

17.1 If the Contractor is adjudged, bankrupt, or makes a general assignment for the benefit of creditors because of the Contractor's insolvency, or if a receiver is appointed because of the Contractor's insolvency, the Township may, without prejudice to any other right or remedy the Township may have, terminate the Agreement, by giving the Contractor or receiver or trustee in bankruptcy Notice in Writing to that effect.

17.2 If the Contractor neglects to prosecute the Work properly or otherwise fails to comply with the requirements of the Agreement to a substantial degree and if the Township has given a written statement to the Contractor that sufficient cause exists to justify such action, the Township may, without prejudice to any other right or remedy the Township may have, give the Contractor Notice in Writing that the Contractor is in default of the Contractor's contractual obligations and instruct the Contractor to correct the default in the five (5) business days immediately following the receipt of such Notice in Writing.

17.3 If the default cannot be corrected within the five (5) business days or in such other time period as may be subsequently agreed in writing by the parties, the Contractor shall be compliant with the Township 's instructions if the Contractor:

(a) commences the correction of the default within the specified time,
(b) provides the Township with an acceptable schedule for such correction, and
(c) corrects the default in accordance with the terms of this Agreement and with such schedule.

17.4 If the Contractor fails to correct the default in the time specified or in such other time period as may be subsequently agreed in writing by the parties, without prejudice to any other right or remedy the Township may have, the Township may:

(a) correct such default and deduct the cost thereof from any payment then or thereafter due the Contractor, or
(b) terminate the Contractor's right to continue with the Work in whole or in part or terminate the Agreement.

17.5 If the Township is entitled to terminate the Agreement under the provisions herein, the

Township shall be entitled to take possession of the Work and the equipment, utilize any documents provided construction machinery and equipment and finish the Work by whatever reason or method the Township may consider expedient and charge the Contractor for the cost of completion of the Work and any losses suffered by the Township as a result thereof.

17.6 If the Township terminates the Agreement, the Township may: withhold any further payments to the Contractor until its liability to the Township is ascertained; recover from the Contractor any loss, damage and expense incurred by the Township by reason of the Contractor's default (which may be deducted from any monies due or becoming due to the Contractor); and, set off any amounts owing to the Contractor the amount of any loss, damage and expense incurred by the Township by reason of the Contractor's default.

17.7 Any termination of the Agreement by the Township, as aforesaid, shall be without prejudice to any other rights or remedies the Township may have.

17.8 The Township shall not be responsible to the Contractor for loss of anticipated profit on the cancelled portion or portions of the Project or the Work.

18. **Laws.** The Contractor shall be required to comply with all laws, ordinances, rules, regulations or codes, including the *Ontario Building Code*, *Occupational Health and Safety Act,* applicable to the Work and the Project.

19. **Permits.** The Contractor shall obtain and pay for all building permits and other permits, licenses and certificates necessary for the performance of the Work.

20. **Insurance.** The Contractor agrees to maintain the insurance required under the terms of this contract, including specifically the TENDER and as provided under the Proposal for the entire term of the contract. The Township and EVB Engineering shall be named as an additional insured throughout the period of the contract. A certificate of such insurance will be provided prior to the Commencement of the Work.

21. **Bonding.** Prior to the commencement of the Work, the Contractor shall provide to the Township the surety bonds and other security required under the terms of the contract, including the TENDER, the OPSS Standards and Proposal which shall be maintained throughout the term of the contract in good standing.

22. **Environmental.** The Contractor shall be responsible for compliance with all environmental rules, laws, ordinances and regulations, shall take all reasonable steps to ensure that no person suffers injury, sickness or death and that property is not injured or damaged or destroyed as a result of exposure to or the presence of toxins or hazardous materials or substances, including all requirements relating to the storage disposal and rendering harmless of toxins or hazardous substances or materials. The Contractor shall indemnify and hold harmless the Township, its agents, servants and employees from and against all claims, demands, losses, costs, damages, actions, suits or proceedings, including penalties and fines arising out of or resulting from exposure to or the presence of toxins or hazardous substances or materials during the performance of the Work and construction of the Project.

23. **Consequential Damages.** Under no circumstances shall the Township be exposed to, nor shall the Contractor make any claim against the Township for consequential damages or indirect damages, including loss or damage to profit, reputation or revenue.

24. **Warranties.** The Contractor is to supply all warranties required under the terms of the TENDER and OPSS Standards to the extent not set out in the TENDER:
    (a) If none set out in the TENDER or OPSS Standards, there shall be warranty all Work as from defects in workmanship, design and materials and shall be fit for the purpose intended and

meet the specifications for a period of twenty-four (24) months from final completion.

25. **Replacement Personnel.** None of the key personnel identified in the Proposal or any subcontractors or other Contractors identified in the Proposal may be substituted without the prior written consent of the Township not to be unreasonably withheld.

26. **Notices.** Any notices required or desired may be sent by email, personal deliver or registered post addressed to the parties as follows:

    (a) To the Township at: 2 Mille Roches Road, Long Sault, ON K0C 1P0

    (b) To Contractor at: _____

    Any notice sent by prepaid registered post shall be deemed to be received on the second business day following the posting thereof.

27. **Confidentiality of Information.** Except as required by the Municipal Freedom of Information and Protection of Privacy Act, the Township and the Contractor shall keep confidential all matters respecting technical, commercial and legal issues relating to or arising out of the Work or the performance of this Agreement and shall not, without the prior written consent of the other, disclose any such matters, except in strict confidence, to its directors, officers, employees, agents, subcontractors and professional advisors on a need to know basis**.** The foregoing restriction does not apply to any information which is or becomes generally available to the public or which is known to such person prior to its receipt of the information from the other Party or which was obtained from any third party who obtained the information lawfully, and under no obligation of secrecy.

    27.1 The foregoing restriction does not apply to the extent disclosure is required by law. To the extent that any information about identifiable individuals is obtained by the Contractor, the Contractor agrees to treat such information in accordance with the standards of the Personal Information Protection and Electronic Documents Act c.5, Statutes of Canada 2000.

    27.2 All public communications and advertising of the Project are subject to the prior written approval of the Township.

28. OPSS Standards

It is intended that many of the provisions herein may already be covered by the TENDER or the OPSS Standards and in greater detail. To the extent that any matter contained in this Agreement is dealt with in greater detail in the TENDER or the OPSS Standards or there shall be a conflict between the terms of this Agreement and the TENDER or the OPSS Standards, the terms of the of the Order of Precedence as defined in OPSS Muni 100 GC 2.02 will govern.

29. General

29.1 Survival*.* Upon delivery of a notice of termination, this Agreement shall thereupon be terminated and all rights and obligations of the parties under this Agreement shall cease, subject to any obligations outstanding as of the date of such termination. Notwithstanding the foregoing, all obligations of the parties which, by their nature, require performance or fulfilment following the expiry or sooner termination of this Agreement, shall survive the expiry or sooner termination of this Agreement.

29.2 Relationship. The relationship of the parties shall be that of independent contractors. Neither party nor its agents will have authority to make any agreement or incur any liability on behalf of the other party, except as set forth in this Agreement.

29.3 Successors and Assigns. This Agreement shall inure to the benefit of and be binding upon the parties hereto and their respective successors and assigns, provided that the Contractor may not assign the Contract in whole or in part without the written approval of the Township which

the Township may withhold in its discretion.

29.4 Governing Law. This Agreement shall be governed by and construed in accordance with the laws of the Province of Ontario.

29.5 Waiver. No waiver of any breach of any term or provision of this Agreement shall be effective or binding unless made in writing and signed by the party purporting to give the same and, unless otherwise provided, shall be limited to the specific breach waived.

29.6 Severability. If any term of this Agreement is held by a court of competent jurisdiction to be invalid or unenforceable, then this Agreement, including all of the remaining terms, will remain in full force and effect as if such invalid or unenforceable term had never been included.

29.7 Entire Agreement. This Agreement, along with the Contract Documents referred to in Section 4 represent the entire agreement between the parties and may not be amended except by further agreement in writing.

This Agreement dated this _____day of_____2025.

Signed, Sealed and Delivered)
In the presence of:)
) THE CORPORATION OF THE TOWNSHIP
OF SOUTH STORMONT

)
) Per: _____
) Mayor
)
)
) Per: _____
) Clerk
)
)
) Per: _____
) Authorized Signing Officer

) **CONTRACTOR COMPANY NAME**
)
)
)
) Per: _____
) Title
)
)
) Per: _____
) Title

APPENDIX B – TENDER PARTICULARS

A. THE DELIVERABLES

1. New headworks, including preselected redundant automated screens and vortex grit removal.
2. Construction of a new UV disinfection system and building.
3. New raw sewage forcemain extension to the Headworks
4. Expansion of the existing biosolids storage facilities.
5. Building Expansion to house the support systems: i.e., blowers, pumps, chemical feed systems, emergency power system, etc.

B. MATERIAL DISCLOSURES

1. See Appendix D – General Conditions
2. See Appendix G – Construction Specifications

C. MANDATORY SUBMISSION REQUIREMENTS

1. Submission Form (Appendix C)

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

2. Pricing

Each bid must include pricing information that complies with the instructions set out in Appendix C. Schedule of Unit Prices and Statements B, and C.

3. Bid Security

3.1. Tender Deposit

Bidders shall submit a Tender Deposit in the form of a Bid Bond issued by a surety company authorized to transact the business of suretyship in the Province of Ontario (Surety Company) in an amount no less than ten percent (10%) of the Bidder's Contract Price, exclusive of HST, as per Appendix B, Schedule of Unit Prices.

The Tender Deposits of all but the two (2) lowest Bidders will be returned within ten (10) days after the date of opening tenders. The Tender Deposits of the two (2) lowest Bidders will be retained until a Tender has been accepted by the Township and the Performance Bond, the Labour and Material Payment Bond and the other documents required herein have been furnished to the satisfaction of the Township. After the execution of the Contract and the receipt by the Township of the Performance Bond and the Labour and Material Payment Bonds, the Tender Deposits will be returned.

If either of the above-mentioned two (2) Bidders have not been notified within 90 days after the date of opening tenders that their tender has been recommended to the Township for acceptance, they may apply to the Township for the return of their tender deposit in this Section.

3.2. Agreement to Bond

Bidders shall submit an Agreement to Bond in the form provided by a Surety Company authorized to transact the business of suretyship in the Province of Ontario (Surety Company) for the required surety bonds (i.e. performance, labour/material) indicated in Section 3.1.4, (Terms and conditions of the tender process) to the satisfaction of the Township.

4. Other Requirements
4.1. Subcontractors

The tenderer shall provide the name and address of each proposed subcontractor used in making their tender. Only one subcontractor shall be named for each part of the work to be sublet.

If the successful tenderer wishes to substitute a subcontractor other than the one named in the Form of Tender for a specific item of work, they shall submit documentation to the Contract Administrator pertaining to the proposed subcontractor's experience and competence to carry out the work. Employment of the proposed subcontractor on the works is subject to the written approval of the Contract Administrator.

The term "subcontractor" shall not include suppliers of preselected equipment unless otherwise specifically stated in these documents or directed.

D. OTHER TECHNICAL REQUIREMENTS

1. Lump Sum for Mobilization/Demobilization

The first item in the Schedule of Items and Prices or, in the case of a lump sum type contract, in the Breakdown Schedule, is to cover the Contractor's cost of mobilization at the beginning of the construction period and demobilization at the close of the construction period. The price entered for this item shall be consistent with the costs involved but shall not, in any event, exceed ten percent (10%) of the total tender price.

If the tenderer has entered against this item in his tender a price in excess of ten percent (10%) of the total tender price, the Owner shall, in preparing contract documents based upon the tender, reduce the price for the said item to an amount not exceeding ten percent (10%) of the total tender price and shall add the amount of the reduction to the price for the "Lump Sum for Other Requirements" item so that the total tender price shall not be affected.

Sixty percent (60%) of the price for the Mobilization and Demobilization item shall be considered as relating to mobilization and the balance to demobilization.

The payment for mobilization shall be included in the first payment certificate issued for the Contract subject to the Contract Administrator being satisfied that full mobilization has been carried out. If the Contract Administrator is not so satisfied, he shall allow a payment which, in his opinion, reflects the degree of mobilization effected to date.

The payment for demobilization shall become due following Substantial Performance of the works and subject to the Contract Administrator being satisfied that full demobilization has been carried out. The Contract Administrator may, in his discretion, allow partial payment for demobilization before full demobilization has been affected.

2. Lump Sum for Other Requirements

In this item of the Schedule of Items and Prices, or in the case of a lump sum type contract, in the Breakdown Schedule, the tenderer shall enter his tender price for providing items such as watchmen, permits and approvals (other than those to be paid by the Owner), items required by the Drawings or Specifications but which have been omitted from the Schedule and other items required by the Contract but not specifically covered by or related to the other items in the Schedule.

E. PRE-CONDITIONS OF AWARD (N/A)

F. PRICE EVALUATION METHOD

Tender documents will be evaluated based on the tender submission and a recommendation to the Township Council will be made.

Instructions on How to Provide Pricing

(a) Bidders should submit their pricing information by completing the attached pricing form and including it in their bids.

(b) Rates must be provided in Canadian funds, inclusive of all applicable duties and taxes except for HST, which should be itemized separately.

(c) Unless otherwise indicated in the requested pricing information, rates quoted by the bidder must be all-inclusive and must include all labour and material costs, all travel and carriage costs, all insurance costs, all costs of delivery, 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.

Required Pricing Information

See Appendix “C” Schedule of Item & Pricing & Statements B & C

APPENDIX C – SUBMISSION FORM

1. Bidder Information

Please fill out the following form, naming one person to be the bidder's contact for the TENDER 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:	
Company Website (if any):	
Bidder Contact Name and Title:	
Bidder Contact Phone:	
Bidder Contact Email:	

2. Offer

The bidder has carefully examined the TENDER documents and has a clear and comprehensive knowledge of the Deliverables required under the TENDER. By submitting a bid, the bidder agrees and consents to the terms, conditions, and provisions of the TENDER, including the Form of Agreement, and offers to provide the Deliverables in accordance therewith at the rates set out in its bid.

3. Rates

The bidder has submitted its rates in accordance with the instructions in the TENDER. 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

The bidder is deemed to have read and accepted all addenda issued by the Township prior to the Deadline for Issuing Addenda. The onus is on bidders to make any necessary amendments to their bids based on the addenda.

5. Communication with Competitors

For the purposes of this TENDER, the word "competitor" includes any individual or organization, other than the bidder, whether or not related to or affiliated with the bidder, who could potentially submit a response to this TENDER.

Unless specifically disclosed below under Disclosure of Communications with Competitors, the bidder declares that:

(a) it has prepared its bid independently from, and without consultation, communication, agreement or arrangement with any competitor, including, but not limited to, consultation, communication, agreement or arrangement regarding:

    (i) prices;

(ii) methods, factors or formulas used to calculate prices;

(iii) the quality, quantity, specifications or delivery particulars of the Deliverables;

(iv) the intention or decision to submit, or not to submit, a bid; or

(v) the submission of a bid which does not meet the mandatory technical requirements or specifications of the TENDER; and

(b) it has not disclosed details of its bid to any competitor and it will not disclose details of its bid to any competitor prior to the notification of the outcome of the procurement process.

Disclosure of Communications with Competitors

If the bidder has communicated or intends to communicate with one or more competitors about this TENDER or its bid, the bidder discloses below the names of those competitors and the nature of, and reasons for, such communications:

_____

_____

_____

_____

_____

_____

6. No Prohibited Conduct

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

7. Conflict of Interest

The bidder must declare all potential Conflicts of Interest, as defined in section 3.4.1 of the TENDER. This includes disclosing the names and all pertinent details of all individuals (employees, advisers, or individuals acting in any other capacity) who (a) participated in the preparation of the bid; **AND** (b) were employees of the Township within twelve (12) months prior to the Submission Deadline.

If the box below is left blank, the bidder will be deemed to declare that (a) there was no Conflict of Interest in preparing its bid; and (b) there is no foreseeable Conflict of Interest in performing the contractual obligations contemplated in the TENDER.

Otherwise, if the statement below applies, check the box.

❑ The bidder declares that there is an actual or potential Conflict of Interest relating to the preparation of its bid, and/or the bidder foresees an actual or potential Conflict of Interest in performing the contractual obligations contemplated in the TENDER.

If the bidder declares an actual or potential Conflict of Interest by marking the box above, the bidder must set out below details of the actual or potential Conflict of Interest:

_____

_____

_____

_____

8. 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 Township to the advisers retained by the Township to advise or assist with the TENDER process, including with respect to the evaluation of this bid.

9. Bid Irrevocable

The bidder agrees that its tender shall be irrevocable for the Irrevocability Period specified in the TENDER, running from the moment the Submission Deadline has passed.

10. Execution of Agreement

The bidder agrees that in the event its bid is selected by the Township, in whole or in part, it will finalize and execute the Agreement in the form set out in Appendix A to this TENDER in accordance with the terms of this TENDER.

Signature of Bidder Representative

Name of Bidder Representative

Title of Bidder Representative

Date

I have the authority to bind the bidder.

This Tender is submitted by:

Tenderer's Business Name: _____

Tenderer Signature: _____
Tenderer's Signature
I/We are authorized to bind the Company/Corporation

_____
Print Name

Witness Signature: _____
Witness Signature

_____
Print Name

Dated at _____ this_____ day of _____, 20_____.

Note: If the Tender is submitted by or on behalf of a corporation, it must be signed in the name of such corporation by the duly authorized officers or agent thereof who shall also subscribe their own name and office. The seal of the Corporation shall also be affixed.

If the Tender is submitted by or on behalf of an individual or partnership, a seal must be affixed opposite the signature of the individual or each partner and each signature shall be witnessed.

Schedule of Items and Prices

ITEM #	DESCRIPTION	UNIT	TENDER AMOUNT
1	Construction of Phase 1 of the Ingleside WWTP upgrades and all related items, appurtenances, and cash allowances	LS	
2	Total Price of Provisional Items	N/A	
3	Total Price of Preselected Items	N/A	
4	Contingency Allowance	LS	$500,000
	TOTAL TENDERED AMOUNT (excl. HST)		

Schedule of Provisional Items

Provide a lump sum price for each of the provisional items listed in the schedule below and further described in Section 00 11 00 – Provisional Items. All items must be priced. The sum of the provisional items shall be entered as Item 2 in the Schedule of Items and Prices and included in the total tendered amount.

If the items priced in the following Schedule are deemed, in the Owner's sole and absolute discretion, to be unrealistic, abnormally low or not representative of the fair market value, the Owner reserves the right to request substantiation for the pricing submitted. If the Owner determines the pricing for any or all Provisional items to be unrealistic, abnormal or unbalanced in anyway, in the Owner's sole and absolute discretion, they reserve the right to reject the bid.

PROVISIONAL ITEM	DESCRIPTION	UNIT	TENDER QUANTITY	UNIT PRICE	TENDER AMOUNT
P1	Biosolids Storage Tanks	LS	1		
P2	Outfall Sewer	LS	1		
P3	Basement Pump for Solids Transfer to Storage	LS	1		
	TOTAL VALUE OF PROVISIONAL ITEMS (To be inserted into Item no. 2 of Schedule of Items and Prices)				$

Schedule of Preselected Equipment

The Tenderer is required to enter herein the actual prices quoted to him/her by the suppliers for the items listed. The supplier's price shall be in accordance with their quotation documents included in Appendix G and shall include any amendments made through the associated special provision sections. Payments to the Contractor will be made in accordance with the items in the Schedule of Items and Prices, but the quotations for the following items are required for the purpose of checking against quotations already received by the Owner.

Specifications for pre-selected equipment are presented in Appendix G. Addenda for Pre-selected Equipment quotations are included in Section 44 of the Specifications.

FOR THIS SCHEDULE, ALL PRICES SHALL BE EXCLUSIVE OF HST, F.O.B. JOBSITE.

SYSTEM NO.	DESCRIPTION	SUPPLIER'S PRICE	DELIVERY PERIOD FROM ISSUE OF P.O. (WEEKS)
1	Screening Equipment – Claro		
2	Vortex Grit Removal Units – Claro		
5	Ultra-Violet Disinfection - Trojan		

Itemized Lump Sum Breakdown

Within two (2) working days of the tender closing, the two lowest Tenderers shall complete and submit the following itemized breakdown of the total tendered amount. If the itemized breakdown is deemed by the Owner or Contract Administrator, at their sole and absolute direction, to be inaccurate, poorly distributed or unbalanced in anyway, they reserve the right to request for additional information or documentation to substantiate the itemized pricing. If after reviewing the additional documentation provided by the Contractor, the Owner or Contract Administrator, at their sole and absolute discretion, determined the funds are still not distributed accurately, they reserve the right to adjust the lump sum breakdown to more accurately distribute the funds.

Itemized Breakdown Schedule of Lump Sum Price (Item 1 of Schedule of Items and Prices)

Prior to the preparation of the first progress payment, the successful Tenderer shall provide a more detailed breakdown to the contract administrator, which further itemizes the work by specification section. This breakdown will form the basis of the progress payment template and will be used to evaluate the work completed by the contractor on a monthly basis.

Item	Description	Amount
1	Mobilization and demobilization (Refer to Clause D.1 of the Tender Particulars)	$
2	Division 1 – General Requirements	$
3	Division 2 – Existing Conditions	$
4	Division 3 – Concrete	$
5	Division 4 - Masonry	$
6	Division 5 – Metals	$
7	Division 6 – Wood and Plastic	$
8	Division 7 – Thermal and Moisture Protection	$
9	Division 8 – Openings	$
10	Division 9 – Finishes	$
11	Division 10 – Miscellaneous Specialties	$
12	Division 11 – Laboratory Specialities	$
13	Division 14 – Conveying Systems	$
14	Division 20 to 23 - Mechanical	$
15	Division 25 – Instrumentation and Controls	$
16	Division 26 to 28 – Electrical	$
17	Division 31 to 33 – Site Works and Infrastructure Works	$
18	Division 44 – Process Mechanical	$
19	Lump Sum for Other Requirements (Refer to Clause D.2 of the Tender Particulars)	$
20	Cost of 100% Performance and 100% Labour and Material Payment Bond (Refer to Clause 1.3.4 of Invitation and Submission Instructions)	$
21	Project Insurance (Refer to Clause 3.1 of Terms and Conditions of the Tender Process)	$
22	Allowances (As per Specification 01 21 00)	$
Total Item 1 Cost (must match Item 1 of Schedule of Items and Prices)		**$**

Upon award of the contract, the contractor will be required to submit a more detailed breakdown of the lump sum price, further division the Division groupings described above into specification sections, Labour and Material values for each specification section.

STATEMENT "B" – TENDERER'S SENIOR SUPERVISORY STAFF

All Contractors must complete Statements B and C – failure to complete and submit these three Statements may result in the rejection of their bid submissions.

Complete the following table identifying Key Field Staff that the Tenderer is planning to use for the project. Resumes shall be included and should cross reference the projects listed in the Proof of ability Statement 1 - Work Experience, if applicable.

At a minimum, the Tenderer must identify the proposed:

a. Project Manager,
b. Construction Superintendent (In-charge of day-to-day operation, full-time presence on construction site.)
c. Project Foreman

CONSTRUCTION KEY STAFF			
NAME	**ROLE**	**TWO LATEST PROJECT MANAGED OR IN CHARGED FOR MENTIONED ROLE**	**YEARS OF EXPERIENCE**

STATEMENT "C" – LIST OF SUB-CONTRACTORS

All Contractors must complete Statements B and C – failure to complete and submit these three Statements may result in the rejection of their bid submissions.

The Contractor shall identify in the table below the Sub-Contractor(s) to be employed in this contract for each sub-trade. Where the Contractor proposes to complete the work specified, the contractor must indicate "By Own Forces" in the space provided. Failure to fully disclose all information requested may result in rejection of the Contractor's bid.

SUB-TRADE	PROPOSED SUBCONTRACTOR

Add sub-trades as required.

APPENDIX D – GENERAL CONDITIONS

APPENDIX D - AMENDMENTS TO GENERAL CONDITIONS

Insert the following sections to the General Conditions

GC 6.03 Contractor's Insurance

GC 6.03.01 General

Replace .01 with the following:

Without restricting the generality of subsection GC 6.02, Indemnification, the Contractor shall provide, maintain, and pay for the insurance coverages listed under clauses GC 6.03.02, GC 6.03.03 and GC 6.03.05.01. Insurance coverage in clauses GC6.03.04, GC 6.03.05.02, and GC 6.03.06 shall only apply when so specified in the Contract Documents.

GC 6.03.05.01 Property Insurance

.01 To remain as is.

Add .02

The Contractor shall insure and shall maintain insurance for, in the joint names of the Contractor and of the Owner, and in an insurance company satisfactory to the Owner, the work and all the material, plant, fuel, machinery, tools and equipment acquired, possessed or provided by the Contractor for incorporation into the work, whether or not such material, plant, fuel, machinery, tools and equipment are brought to or upon the work or upon lands of the Agency or of the Corporation, in an amount not less than 90% of the total value of such work and material, plant, fuel, machinery, tools and equipment and such additional amount, not exceeding the contract price, as may be directed by the Owner, against all risk, so that any loss under such insurance shall be payable to the Owner and the Contractor as their respective interests may appear. The Contractor shall deposit with the Owner, a Certificate of Insurance as evidence of the insurance required to be maintained in accordance with these provisions. Delivery to, examination by or acceptance by the Owner of any Certificate of Insurance or other evidence of insurance shall in no way relieve the Contractor of any of its obligations pursuant to the provisions of the Contract and shall in no way operate as a wavier by the Owner of its rights or the Contractor's obligations. The Contractor shall pay all insurance premiums as they become due; provided that the Owner may pay the premiums and deduct the amount thereof from monies due the Contractor. Any loss or damage which may occur shall not affect the rights and obligations of the Contractor or of the Owner under this Contract except that in such event the Engineer may in writing extend the time for completion for such period as he thinks reasonable. If the Engineer does not extend the time for completion, then the work must be completed within the time fixed in the Contract. Monies paid to the Contractor under such insurance shall be used for the purpose of replacing, rebuilding, repairing and completing the work, and all such material, plant, fuel, machinery, tools and equipment which have been damaged or destroyed. Such replacing, rebuilding, repairing and completion shall be carried out in every way subject to the terms and conditions of the Contract.

GC 7.19 Payment to Suppliers of Pre-Selected Equipment

Add the following section GC 7.19

.01 Following the execution of the General Contract and the issuance of the Contract Administrator's written order to commence work, the Contractor or an authorized Subcontractor will novate the contract purchase order with the Township of South Stormont ("Assignor") and multiple vendors ("Vendor") and assume the management of the Vendor's responsibility for the supply and installation of the pre-selected package they were selected to supply (refer to Appendix H of tender document for scope of work).

GC 8.02.03.13 Maintenance Security

.01 As referenced in 8.02.03.05.02 (d), the contract shall provide to the Owner for the duration of the Warranty Period, a Maintenance Security, the value of which shall be derived from the following table:

CONTRACT PRICE		VALUE OF MAINTENANCE SECURITY ($)
FROM ($)	TO ($)	
Less than 0.1M		4% of Final Contract Price
0.1M	< 0.5M	4,000 on first 0.1M + 3.0% on next 0.4M
0.5M	< 1.0M	16,000 on first 0.5M + 2.4% on next 0.5M
1.0M	<2.0M	28,000 on first 1.0M + 2.2% on next 1.0M
2.0M	<4.0M	50,000 on first 2.0M + 2.0% on next 2.0M
4.0M	<6.0M	90,000 on first 4.0M + 1.8% on next 2.0M
6.0M	10.0M	126,000 on first 6.0M + 1.5% on next 4.M
Greater than 10.0M		186,000 on first 10.0M + 1.0% on balance

The maintenance security, which is at no time a part of the statutory holdback, shall be retained by the Owner in increments from monies that would otherwise be payable to the Contractor, commencing during the latter part of the period of construction, so that by the date of substantial performance of the contract the full value of the required maintenance security has been retained.

Except as otherwise provided hereunder, the maintenance security, less any deductions made therefrom as provided for in the Contract, shall be paid to the Contractor following the issuance by the Contract Administrator of the Final Acceptance Certificate at the end of the Warranty Period.

The Contractor may apply in writing to the Contract Administrator at the time of substantial performance to substitute for the monies retained as the maintenance security an alternative maintenance security of equivalent or greater value comprising:

1. one or more irrevocable letters of credit or
2. Another readily negotiable security.

Acceptance of any such alternative shall be at the discretion of the Contract Administrator and the Solicitor for the Owner.

Following receipt and acceptance of any such alternative, the Contract Administrator shall release to the Contractor the monies previously retained for maintenance security purposes.

The Contract Administrator may, in their discretion, allow the total maintenance security to be made up in part of monies retained under the Contract and in part of an alternative maintenance security as indicated in (a) and (b) above provided that the total value of such parts, as determined by the Contract Administrator, shall be not less than the required value as derived from the table set out above.

Such alternative maintenance security or the monies derived therefrom, less any deductions made as provided for in the Contract, shall be released to the Contractor following the issuance by the Contract Administrator of the Final Acceptance Certificate at the end of the period of maintenance.

Where the Contract Administrator proposes to release the statutory holdback to a Subcontractor through the Contractor as provided for herein, the Contract Administrator shall arrange for "the required maintenance security in respect of the said Subcontract", to be provided by a retention from monies that would otherwise be payable to the Contractor. The value of the required maintenance security shall be determined by applying to the value of the Subcontract work the same effective percentage retention, derived from the foregoing table, as applies to the Contract as a whole.

The Contractor may apply in writing to the Contract Administrator to substitute for the maintenance security referred to in the preceding paragraph an irrevocable letter of credit in the name of the Contractor.

Following the substantial performance of the Contract, the Contract Administrator may require the Contractor to consolidate all letters of credit provided pursuant to the foregoing into one or two letters of credit covering the Contract as a whole.

The Contractor shall allow his Subcontractors to provide letters of credit to the Contractor in conformity with the foregoing procedures. The Contractor shall provide the Contract Administrator with copies of any or all such letters of credit on request.

GC 8.02.04 Payment on a Time and Material Basis

Replace Sections GC 8.02.04.04, GC 8.02.04.05, GC 8.02.04.06, GC 8.02.04.07, GC 8.02.04.08 with the following:

If the methods of evaluating extras described in GC 3.10 .01.03 are clearly inapplicable, and an agreeable value cannot be determined by GC 8.02.04.10, as modified herein, then the Engineer may direct that extra work shall be done by the Contractor on a Time and Material basis providing for payment as follows:

1. The actual cost of all labour plus a documented mark-up (not exceeding 60% of actual wage rates) to cover allowance for holiday pay, unemployment insurance, levy by Workers' compensation Board, and other contributions made by the employer to an employee as required by law, required directly for the performance of extra work and the

actual cost of all materials including transportation charges required directly in the extra work.

2. A rental rate based on 70% of the published OPSS 127 rates for machinery and heavy equipment, such as tractors, bulldozers, ditching machines, air compressors, concrete mixers and graders, for the actual time required in operation for the performance of the extra work, to which no percentage shall be added.
3. The value established in items 1. and 2. Above may be increased by the following overhead and profit mark-up:
    a. 15% of the same when the total value of the work described in items 1. and 2. prior to markup is less than $10,000.
    b. 7.5% of the same when the total value of the work described in items 1. and 2. prior to markup is in excess of $10,000.

If the Contractor is directed to carry out extra or additional work on a Time and Material basis and he proposes to have such work or a part thereof carried out by a Subcontractor or a Sub-subcontractor, he shall notify the Engineer to that effect before commencing the said work. Provided that the Contractor's proposal and all Sub-contractors and Sub-subcontractors involved have first been approved by the Engineer, the Contractor may claim payment from the Owner for such work as follows:

4. In respect of work carried out by the Contractor's own forces, an amount equal to the sum of the amounts provided for under 1., 2. and 3. above.
5. In respect of work carried out by a Subcontractor's forces, an amount equal to the sum of the amounts provided for under 1. and 2. above plus 10% of such sum.

The compensation provided for above shall be payment in full for all charges including superintendence, overhead, the use of small tools and profit.

No compensation for extra work or material shall be allowed unless such work or material is ordered in writing by the Engineer. Whenever any extra work is being performed in accordance on a Time and Material basis as described herein the Contractor shall, each working day, report to the Engineer, in writing, in full detail, the amount and cost of the labour and materials supplied and used in carrying out each order for extra work on the preceding working day, and no claim for compensation for extra work or materials will be considered or allowed unless such report shall have been made. The Engineer will not allow any compensation for the cost of repairs to equipment of any kind or for damage to anything used in performing any such extra work or making any such alterations.

GC 8.02.04.10 Payment Other Than on a Time and Material Basis

Add the follow section GC 8.02.04.10.02

.02 The Engineer shall determine the amount, if any, to be added to, or deducted from, the sum named in the Tender, in respect of any extra or additional work done, or work omitted by his order. All such work shall be valued at the price as set out in the Schedule of Items and Prices or the Schedule of Additional Unit Prices if, in the opinion of the Engineer, the same shall be applicable.

1. If the Contract does not contain any prices applicable to the extra, additional, or omitted work, then the Engineer may issue a Contemplated Change Order (CCO) detailing the additional work done or work to be omitted. Within a reasonable amount of time, not exceeding 14 days, the Contractor shall provide, in an acceptable form to the Engineer, an estimate to complete the work defined in the CCO. The quotation shall be firm for a period of not less than sixty (60) calendar days from the date of receipt of the quotation by the Engineer. The determination of the estimate, by the Contractor, shall be based on a Lump Sum basis.
2. If the estimate submitted by the Contractor is in the form of a lump sum amount, the estimate must provide sufficient detail for the Engineer to determine the fairness of the valuation. The Contractor's submission shall include an itemized list of costs and values including but not limited to:
    1. Labour (staff, hourly wage, time required)
    2. Materials (itemized list of all materials required and their cost)
    3. Equipment costs (rental equipment, transportation, etc.)
    4. A maximum charge of 15% covering overhead and profit for work done by the Contractor's own forces.
    5. A maximum charge of 10% covering overhead and profit for work done by Sub-contractors. Subcontractors shall be permitted a maximum of 15% covering over-head and profit for work done by the Subcontractor's own forces.

The rates enumerated in paragraphs 2.4 and 2.5 above shall apply to charges resulting in addition to or deductions from the Contract not exceeding $10,000. The portion of charges which involve additions to or deletions from the Contract Price in excess of $10,000 shall carry an overhead and profit percentage of half those called for above.

The percentage of overhead and profit shall also cover financing, project management, estimating, and all site and off-site overheads such as superintendence, site facilities, safety, clean-up and items of small plant, equipment and tools and the like.

If a change in the Work results in a decrease in the Contract Price, the amount of the credit shall be the net cost, without deduction for overhead or profit. When both additions and deletions covering related work or substitutions are involved in a change in the Work, the allowance for overhead and profit shall be calculated on the basis of the net increase, if any, with respect to that change in the Work.

OPSS MUNI GENERAL CONDITIONS OF CONTRACT

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SECTION GC 1.0 - INTERPRETATION

GC 1.01 Captions

.01 The captions appearing in these General Conditions have been inserted as a matter of convenience and for ease of reference only and in no way define, limit, or enlarge the scope or meaning of the General Conditions or any provision hereof.

GC 1.02 Abbreviations

.01 The abbreviations on the left below are commonly found in the Contract Documents and represent the organizations and phrases listed on the right:

"AASHTO"	-	American Association of State Highway Transportation Officials
“ACI”	-	American Concrete Institute
"ANSI"	-	American National Standards Institute
"ASTM"	-	ASTM International
"AWG"	-	American Wire Gauge
"AWWA"	-	American Water Works Association
“CCIL”	-	Canadian Council of Independent Laboratories
"CGSB"	-	Canadian General Standards Board
"CSA"	-	CSA Group - formerly Canadian Standards Association
"CWB"	-	Canadian Welding Bureau
"GC"	-	General Conditions
“ISO”	-	International Organization for Standardization
"MECP"	-	Ontario Ministry of the Environment, Conservation and Parks
"MTO"	-	Ontario Ministry of Transportation
"MUTCD"	-	Manual of Uniform Traffic Control Devices, published by MTO
“OHSA”	-	Ontario Occupational Health and Safety Act
“OLS”	-	Ontario Land Surveyor
"OPS"	-	Ontario Provincial Standard
"OPSD"	-	Ontario Provincial Standard Drawing
"OPSS"	-	Ontario Provincial Standard Specification
“OTM”	-	Ontario Traffic Manual
"PEO"	-	Professional Engineers Ontario
"SAE"	-	SAE International
“SCC”	-	Standards Council of Canada
"SSPC"	-	The Society for Protective Coatings
"UL"	-	Underwriters Laboratories
"ULC"	-	Underwriters Laboratories Canada
“WHMIS”	-	Workplace Hazardous Materials Information System
“WSIB”	-	Workplace Safety & Insurance Board

GC 1.03 Gender and Singular References

.01 References to the masculine or singular throughout the Contract Documents shall be considered to include the feminine and the plural and vice versa, as the context requires.

GC 1.04 Definitions

.01 For the purposes of the Contract Documents the following definitions shall apply:

Abnormal Weather means an extreme climatic condition characterized by wind speed, air temperature, precipitation, or snow fall depth, that is less than or greater than 1-1/2 standard deviations from the mean determined from the weather records of the 25-year period immediately preceding the tender opening date.

Actual Measurement means the field measurement of that quantity within the approved limits of the Work.

Addenda means any additions or change in the Tender documents issued by the Owner prior to Tender closing.

Additional Work means work not provided for in the Contract Documents and not considered by the Contract Administrator to be essential to the satisfactory completion of the Contract within its intended scope.

Agreement means the agreement between the Owner and the Contractor for the performance of the Work that is included in the Contract Documents.

Base means a layer of Material of specified type and thickness placed immediately below the pavement, driving surface, finished grade, curb and gutter, or sidewalk.

Business Day means any Day except Saturdays, Sundays, and statutory holidays.

Certificate of Subcontract Completion means the certificate issued by the Contract Administrator in accordance with clause GC 8.02.04.02, Certification of Subcontract Completion.

Certificate of Substantial Performance means the certificate issued by the Contract Administrator at Substantial Performance.

Change Directive means any written instruction signed by the Owner, or by the Contract Administrator where so authorized, directing that a Change in the Work or Extra Work be performed.

Change in the Work means the deletion, extension, increase, decrease, or alteration of lines; grades; dimensions; quantities; methods; drawings; substantial changes in geotechnical, subsurface, surface, or other conditions; changes in the character of the Work to be done; or Materials of the Work or part thereof, within the intended scope of the Contract.

Change Order means a written amendment to the Contract signed by the Contractor and the Owner, or the Contract Administrator where so authorized, covering contingencies, a Change in the Work, Extra Work, Additional Work; and establishing the basis for payment and the time allowed for the adjustment of the Contract Time.

Completion means contract completion as set out in the Construction Act.

Completion Certificate means the certificate issued by the Contract Administrator at Completion.

Completion Payment means the payment described more particularly in clause GC 8.02.04.07.

Construction Act means as set out in the Construction Act, R.S.O. 1990, c. C.30**,** as amended.

Constructor means, for the purposes of, and within the meaning of the Occupational Health and Safety Act, R.S.O. 1990, c.O.1, as amended and amendments thereto, the Contractor who executes the Contract.

Contract means the undertaking by the Owner and the Contractor to perform their respective duties, responsibilities, and obligations as prescribed in the Contract Documents.

Contract Administrator means the person, partnership, or corporation designated by the Owner to be the Owner's representative for the purposes of the Contract.

Contract Documents mean the executed Agreement between the Owner and the Contractor, Tender, General Conditions of Contract, Supplemental General Conditions of Contract, Standard Specifications, Special Provisions, Contract Drawings, Addenda incorporated in a Contract Document before the execution of the Agreement, such other documents as may be listed in the Agreement, and subsequent amendments to the Contract Documents made pursuant to the provisions of the Agreement.

Contract Drawings or **Contract Plans** mean drawings or plans, any Geotechnical Report, any Subsurface Report, and any other reports and information provided by the Owner for the Work, and without limiting the generality thereof, may include soil profiles, foundation investigation reports, reinforcing steel schedules, aggregate sources list, Quantity Sheets, and cross-sections.

Contract Time means the time stipulated in the Contract Documents for Substantial Performance or Completion of the Work, including any extension of time made pursuant to the Contract Documents.

Contractor means the person, partnership, or corporation undertaking the Work as identified in the Agreement.

Control Monument means any horizontal or vertical (benchmark) monument that is used to lay out the Work.

Controlling Operation means any component of the Work that, if delayed, may delay the completion of the Work.

Cut-Off Date means the date up to which payment shall be made for Work performed.

Daily Work Records mean daily Records detailing the number and categories of workers and hours worked or on standby, types and quantities of Equipment and number of hours in use or on standby, and description and quantities of Material utilized.

Day means a calendar day.

Drawings or **Plans** mean any Contract Drawings or Contract Plans, or any Working Drawings or Working Plans, or any reproductions of drawings or plans pertaining to the Work.

End Result Specification means specifications that require the Contractor to be responsible for supplying a product or part of the Work. The Owner accepts or rejects the final product or applies a price adjustment that is commensurate with the degree of compliance with the specification.

Engineer means a professional engineer licenced by the Professional Engineers of Ontario to practice in the Province of Ontario.

Equipment means all machinery and equipment used for preparing, fabricating, conveying or erecting the Work and normally referred to as construction machinery and equipment.

Estimate means a calculation of the quantity or cost of the Work or part of it depending on the context.

Extra Work means work not provided for in the Contract as awarded but considered by the Contract Administrator to be essential to the satisfactory completion of the Contract within its intended scope, including unanticipated Work required to comply with legislation and regulations that affect the Work.

Final Acceptance means the date on which the Contract Administrator determines that the Work has passed all inspection and testing requirements and the Contract Administrator is satisfied that the Contractor has rectified all imperfect Work and has discharged all of the Contractor's obligations under the Contract Documents.

Final Acceptance Certificate means the certificate issued by the Contract Administrator at Final Acceptance of the Work.

Final Detailed Statement means a complete evaluation prepared by the Contract Administrator showing the quantities, unit prices, and final dollar amounts of all items of Work completed under the Contract, including variations in tender items and Extra Work, all as set out in the same general form as the monthly Estimates.

Geotechnical Report means a report or other information identifying soil, rock, and ground water conditions in the area of any proposed Work.

Grade means the required elevation of that part of the Work.

Hand Tools means tools that are commonly called tools or implements of the trade and include small power tools.

Highway means a common and public highway any part of which is intended for or used by the general public for the passage of vehicles and includes the area between the lateral property lines thereof.

Inclement Weather means weather conditions or conditions resulting directly from weather conditions that prevent the Contractor from proceeding with a Controlling Operation**.**

Lot means a specific quantity of Material or a specific amount of construction normally from a single source and produced by the same process.

Lump Sum Item means a tender item indicating a portion of the Work for which payment will be made at a single tendered price. Payment is not based on a measured quantity, although a quantity may be given in the Contract Documents.

Major Item means any tender item that has a value, calculated based on its actual or estimated tender quantity, whichever is the larger, multiplied by its tender unit price, which is equal to or greater than the lesser of,

a) $100,000, or

b) 5% of the total tender value calculated based on the total of all the estimated tender quantities and the tender unit prices.

Material means Material, machinery, equipment and fixtures forming part of the Work.

Monument means either a Property Monument or a Control Monument.

Owner means the party to the Contract for whom the Work is being performed, as identified in the Agreement, and includes, with the same meaning and import, "Authority."

Pavement means a wearing course or courses placed on the Roadway and consisting of asphaltic concrete, hydraulic cement concrete, Portland cement concrete, or plant or road mixed mulch.

Performance Bond means the type of security furnished to the Owner to guarantee completion of the Work in accordance with the Contract and to the extent provided in the bond.

Plan Quantity means that quantity as computed from within the boundary lines of the Work as shown in the Contract Documents.

Project means the construction of the Work as contemplated by this Contract.

Proper Invoice has the meaning as set out in the Construction Act.

Property Monument means any property bar, concrete pillar, rock post, cut cross or other object that marks the boundary between real property ownership.

Quality Assurance (QA) means a system or series of activities carried out by the Owner to ensure that Work meets the specified requirements.

Quality Control (QC) means a system or series of activities carried out by the Contractor, Subcontractor, supplier, and manufacturer to ensure that Work meets the specified requirements.

Quantity Sheet means a list of the quantities of Work to be done.

Quarried Rock means Material removed from an open excavation made in a solid mass of rock that, prior to removal, was integral with the parent mass.

Quarry means a place where aggregate has been or is being removed from an open excavation made in a solid mass of igneous, sedimentary, or metamorphic rock or any combination of these that, prior to removal, was integral with the parent areas.

Rate of Interest means the prejudgment interest rate determined under subsection 127(2) of the *Courts of Justice Act* or, if the contract or subcontract specifies a different interest rate for the purpose, the greater of the prejudgment interest rate and the interest rate specified in the contract or subcontract.

Records mean any books, payrolls, accounts, or other information that relate to the Work or any Change in the Work, Extra Work, Additional Work or claims arising therefrom.

Roadway means that part of the Highway designed or intended for use by vehicular traffic and includes the Shoulders.

Shoulder means that portion of the Roadway between the edge of the travelled portion of the wearing surface and the top inside edge of the ditch or fill slope.

Special Provisions mean directions containing requirements specific to the Work.

Standard Drawing or Standard Specification means a standard practice required and stipulated by the Owner for performance of the Work.

Statutory Holdback means the holdbacks required under the Construction Act.

Subbase means a layer of Material of specified type and thickness between the Subgrade and the Base.

Subcontractor means a person, partnership or corporation undertaking the execution of a part of the Work by virtue of an agreement with the Contractor.

Subgrade means the earth or rock surface, whether in cut or fill, as prepared to support the pavement structure, consisting of Base, Subbase, and Pavement.

Substantial Performance has the meaning as set out in the Construction Act, R.S.O. 1990, c. C.30**,** as amended.

Subsurface Report means a report or other information identifying the location of Utilities, concealed and adjacent structures, and physical obstructions that fall within the influence of the Work.

Superintendent means the Contractor's authorized representative in charge of the Work and who shall be a “competent person” within the meaning of the definition contained in the Occupational Health and Safety Act, R.S.O. 1990, c. 0.1, as amended.

Surety means the person, partnership or corporation, other than the Contractor, licensed in Ontario to transact business under the Insurance Act, R.S.O. 1990, c.I.8, as amended, executing a bond provided by the Contractor.

Tender means an offer in writing from the Contractor, submitted in the format prescribed by the Owner, to complete the Work.

Time and Material means costs calculated according to clause GC 8.02.05, Payment on a Time and Material Basis.

Utility means an aboveground or underground facility maintained by a municipality, public utility authority or regulated authority and includes services such as sanitary sewer, storm sewer, water, electric, gas, oil, steam, data transmission, telephone, and cable television.

Warranty Period means the applicable time period according to clause GC 7.16.02, Warranty.

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

Working Area means all the lands and easements owned or acquired by the Owner for the construction of the Work.

Working Day means any Day,

a) except Saturdays, Sundays and statutory holidays;

b) except a Day as determined by the Contract Administrator, on which the Contractor is prevented by inclement weather or conditions resulting immediately therefrom, from proceeding with a Controlling Operation. For the purposes of this definition, this shall be a Day during which the Contractor cannot proceed with at least 60% of the normal labour and Equipment force effectively engaged on the Controlling Operation for at least 5 hours;

c) except a Day on which the Contractor is prevented from proceeding with a Controlling Operation, as determined by the Contract Administrator by reason of,

    i. any breach of the Contract by the Owner or if such prevention is due to the Owner, another contractor hired by the Owner, or an employee of any one of them, or by anyone else acting on behalf of the Owner.

    ii. non-delivery of Owner supplied Materials.

    iii. any cause beyond the reasonable control of the Contractor that can be substantiated by the Contractor to the satisfaction of the Contract Administrator.

Working Drawings or **Working Plans** means any Drawings or Plans prepared by the Contractor for the execution of the Work and may, without limiting the generality thereof, include formwork, falsework, and shoring plans; Roadway protection plans; shop drawings; shop plans; or erection diagrams.

GC 1.05 Ontario Traffic Manual

.01 All references in the Contract Documents to the MUTCD, including all Parts and Divisions thereof, or MTO Traffic Control Manual for Roadway Work Operations, or Traffic Control Manual for Roadway Operations Field Edition are hereby deleted and replaced by all currently available books which make up the Ontario Traffic Manual.

GC 1.06 Final Acceptance

.01 For the purposes of determining whether Final Acceptance has occurred, the Contract Administrator shall not take into account, in determining the discharge of the Contractor's obligations, any warranty obligation of the Contractor to the extent that the warranty extends beyond 12 months after Substantial Performance.

GC 1.07 Interpretation of Certain Words

.01 The words "acceptable," "approval," "authorized," "considered necessary," "directed," "required," "satisfactory," or words of like import, shall mean approval of, directed, required, considered necessary, or authorized by and acceptable or satisfactory to the Contract Administrator, unless the context clearly indicates otherwise.

SECTION GC 2.0 - CONTRACT DOCUMENTS

GC 2.01 Reliance on Contract Documents

.01 The Owner warrants that the information furnished in the Contract Documents can be relied upon with the following limitations or exceptions:

a) Based on available information at the time of the contract, the location of all mainline underground Utilities that may affect the Work shall be shown to a tolerance of:

i. 1 m horizontal, and
ii. 0.3 m vertical

.02 The Owner does not warrant or make any representation with respect to:

a) interpretations of data or opinions expressed in any Subsurface Report available for the perusal of the Contractor, that are not included as part of the Contract Documents, and

b) other information specifically excluded from this warranty.

GC 2.02 Order of Precedence

.01 In the event of any inconsistency or conflict in the contents of the following documents, such documents shall take precedence and govern in the following descending order:

a) Agreement

b) Addenda

c) Special Provisions

d) Contract Drawings

e) Standard Specifications

f) Standard Drawings

g) Tender

h) Supplemental General Conditions

i) OPSS.MUNI 100 General Conditions of Contract

j) Working Drawings

Later dates shall govern within each of the above categories of documents.

.02 In the event of any conflict among or inconsistency in the information shown on Drawings, the following rules shall apply:

a) Dimensions shown in figures on a Drawing shall govern where they differ from dimensions scaled from the same Drawing;

b) Drawings of larger scale shall govern over those of smaller scale;

c) Detailed Drawings shall govern over general Drawings; and

d) Drawings of a later date shall govern over those of an earlier date in the same series.

.03 In the event of any inconsistency or conflict in the contents of Standard Specifications the following descending order of precedence shall govern:

a) Owner's Standard Specifications

b) Ontario Provincial Standard Specifications

c) Other standards referenced in OPSSs and OPSDs (e.g., CSA, CGSB, ASTM, and ANSI).

.04 The Contract Documents are complementary, and what is required by any one shall be as binding as if required by all.

SECTION GC 3.0 - ADMINISTRATION OF THE CONTRACT

GC 3.01 Contract Administrator's Authority

.01 The Contract Administrator shall be the Owner's representative during construction and until the issuance of the Completion Certificate or the issuance of the Final Acceptance Certificate, whichever is later. All instructions to the Contractor, including instructions from the Owner, shall be issued by the Contract Administrator. The Contract Administrator shall have the authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

.02 All claims, disputes and other matters in question relating to the performance and the quality of the Work or the interpretation of the Contract Documents shall be referred to the Contract Administrator in writing by the Contractor.

.03 The Contract Administrator may inspect the Work for its conformity with the Contract Documents, and to record the necessary data to establish payment quantities under the schedule of tender quantities and unit prices or to assess the value of the Work completed in the case of a lump sum price Contract.

.04 The Contract Administrator shall provide an estimate of the amounts owing to the Contractor under the Contract as provided for in section GC 8.0, Measurement and Payment.

.05 The Contract Administrator, to not cause delay in the schedule, shall, with reasonable promptness, review and take appropriate action upon the Contractor's submissions such as shop drawings, product data, and samples in accordance with the Contract Documents .

.06 The Contract Administrator shall investigate all allegations of a Change in the Work made by the Contractor and issue appropriate instructions.

.07 The Contract Administrator shall prepare Change Directives and Change Orders for the Owner’s approval.

.08 Upon written application by the Contractor, the Contract Administrator and the Contractor shall jointly conduct an inspection of the Work to establish the date of Substantial Performance of the Work or the date of Completion of the Work or both.

.09 The Contract Administrator shall be, in the first instance, the interpreter of the Contract Documents and the judge of the performance thereunder by both parties to the Contract. Interpretations and decisions of the Contract Administrator shall be consistent with the intent of the Contract Documents and, in making these decisions, the Contract Administrator shall not show partiality to either party.

.10 The Contract Administrator shall have the authority to reject any part of the Work or Material that does not conform to the Contract Documents.

.11 In the event that the Contract Administrator determines that any part of the Work performed by the Contractor is defective, whether the result of poor workmanship the use of defective Material or damage through carelessness or other act or omission of the Contractor and whether or not incorporated in the Work or otherwise fails to conform to the Contract Documents, then the Contractor shall if directed by the Contract Administrator promptly, as directed by the Contract Administrator, remove the Work and replace, make good, or re-execute the Work at no additional cost to the Owner.

.12 Any part of the Work destroyed or damaged by such removals, replacements, or re-executions shall be made good, promptly, at no additional cost to the Owner.

.13 If, in the opinion of the Contract Administrator it is not expedient to correct defective Work or Work not performed in accordance with the Contract Documents, the Owner may deduct from monies otherwise due to the Contractor the difference in value between the Work as performed and that called for by the Contract Documents amount that will be determined in the first instance by the Contract Administrator.

.14 Notwithstanding any inspections made by the Contract Administrator or the issuance of any certificates or the making of any payment by the Owner, the failure of the Contract Administrator to reject any defective Work or Material shall not constitute acceptance of defective Work or Material.

.15 The Contract Administrator shall have the authority to temporarily suspend the Work for such reasonable time as may be necessary:

a) to facilitate the checking of any portion of the Contractor's construction layout;

b) to facilitate the inspection of any portion of the Work; or

c) for the Contractor to remedy its non-compliance with any provisions of the Contract Documents.

The Contractor shall not be entitled to any compensation for suspension of the Work in these circumstances.

.16 The Owner has the right to terminate the Contract for wilful or persistent violation by the Contractor or its workers of any applicable laws or bylaws, including but not limited to, the Occupational Health and Safety Act legislation and regulations, Workplace Safety and Insurance Board Act, and Regulation 347 of the Environmental Protection Act.

.17 If the Contract Administrator determines that any worker employed on the Work is incompetent, as defined by the Occupational Health and Safety Act, or is disorderly, then the Contract Administrator shall provide written notice to the Contractor and the Contractor shall immediately remove the worker from the Working Area. Such worker shall not return to the Working Area without the prior written consent of the Contract Administrator.

GC 3.02 Working Drawings

.01 The Contractor shall arrange for the preparation of clearly identified and dated Working Drawings as called for by the Contract Documents.

.02 The Contractor, to not cause delay in the Work, shall submit Working Drawings to the Contract Administrator with reasonable promptness and in orderly sequence . If either the Contractor or the Contract Administrator so requests, they shall jointly prepare a schedule fixing the dates for submission and return of Working Drawings. Working Drawings shall be submitted in printed form. At the time of submission, the Contractor shall notify the Contract Administrator in writing of any deviations from the Contract Documents that exist in the Working Drawings.

.03 The Contract Administrator shall review and return Working Drawings in accordance with an agreed upon schedule, or otherwise, with reasonable promptness so as not to cause delay.

.04 The Contract Administrator's review shall be to check for conformity to the design concept and for general arrangement only and such review shall not relieve the Contractor of responsibility for errors or omissions in the Working Drawings or of responsibility for meeting all requirements of the Contract Documents, unless a deviation on the Working Drawings has been approved in writing by the Contract Administrator.

.05 The Contractor shall make any changes in Working Drawings that the Contract Administrator may require to make the Working Drawings consistent with the Contract Documents and resubmit, unless otherwise directed by the Contract Administrator. When resubmitting, the Contractor shall notify the Contract Administrator in writing of any revisions other than those requested by the Contract Administrator.

.06 Work related to the Working Drawings shall not proceed until the Working Drawings have been signed and dated by the Contract Administrator.

.07 The Contractor shall keep one set of the reviewed Working Drawings, marked as above, at the site at all times.

GC 3.03 Right of the Contract Administrator to Modify Methods and Equipment

.01 The Contractor shall, when requested in writing, make alterations in the method, Equipment, or work force at any time the Contract Administrator considers the Contractor's actions to be unsafe, or damaging to either the Work or existing facilities or the environment.

.02 The Contractor shall, when requested in writing, alter the sequence of its operations on the Contract so as to avoid interference with work being performed by others.

.03 Notwithstanding the foregoing, the Contractor shall ensure that all necessary safety precautions and protection are maintained throughout the Work.

GC 3.04 Emergency Situations

.01 The Contract Administrator has the right to determine the existence of an emergency situation and, when such an emergency situation is deemed to exist, the Contract Administrator may instruct the Contractor to take action to remedy the situation. If the Contractor does not take timely action or, if the Contractor is not available, the Contract Administrator may direct others to remedy the situation.

.02 If the emergency situation was the fault of the Contractor, the remedial Work shall be done at the Contractor's expense. If the emergency situation was not the fault of the Contractor, the Owner shall pay for the remedial Work.

GC 3.05 Layout Information

.01 The Contract Administrator shall provide background information, including without limitation, baseline and benchmark information, to facilitate the general location, alignment, elevation and layout of the Work.

.02 The Contract Administrator shall provide pre and post construction inventories of all Monuments, etc. that are located within the Working Area.

.03 The Owner shall be responsible only for the correctness of the layout information provided by the Contract Administrator.

GC 3.06 Extension of Contract Time

.01 An application for an extension of Contract Time shall be made in writing by the Contractor to the Contract Administrator as soon as the need for such extension becomes evident and at least 15 Days prior to the expiration of the Contract Time. The application for an extension of Contract Time shall enumerate the reasons and state the length of extension required.

.02 Circumstances suitable for consideration of an extension of Contract Time include the following:

a) Delays, subsection GC 3.07.

b) Changes in the Work, clause GC 3.10.01.

c) Extra Work, clause GC 3.10.02.

d) Additional Work, clause GC 3.10.03.

.03 The Contract Administrator shall, in reviewing an application for an extension to the Contract Time, consider whether the delays, Changes in the Work, Extra Work, or Additional Work involve a Controlling Operation.

.04 The Contract Time shall be extended for such additional time as may be recommended by the Contract Administrator and deemed fair and reasonable by the Owner.

.05 The terms and conditions of the Contract shall continue for such extension of Contract Time.

GC 3.07 Delays

.01 If the Contractor is delayed in the performance of the Work by,

a) war, blockades, and civil commotions;

b) errors in the Contract Documents;

c) an act or omission of the Owner or Contract Administrator, or anyone employed or engaged by them directly or indirectly, contrary to the provisions of the Contract Documents;

d) a stop work order issued by a court or public authority, provided that such order was not issued as the result of an act or omission of the Contractor or anyone employed or engaged by the Contractor directly or indirectly;

e) the Contract Administrator giving notice under section GC 7.0, Suspension of Work;

f) Abnormal Weather; or

g) archaeological finds, in accordance with subsection GC 3.15, Archaeological Finds,

then the Contractor shall be reimbursed by the Owner for reasonable costs incurred by the Contractor as the result of such delay, provided that in the case of an application for an extension of Contract Time due to Abnormal Weather, the Contractor shall, with the Contractor's application, submit evidence from Environment Canada in support of such application. Extension of Contract Time may be granted in accordance with subsection GC 3.06, Extension of Contract Time.

.02 If the Work is delayed by labour disputes, strikes or lock-outs, including lock-outs decreed or recommended to its members by a recognized contractor's association, of which the Contractor is a member or to which the Contractor is otherwise bound, which are beyond the Contractor's control, then the Contract Time shall be extended in accordance with subsection GC 3.06, Extension of Contract Time.

.03 In no case shall the extension of Contract Time be less than the time lost as the result of the event causing the delay, unless a shorter extension is agreed to by the Contractor. The Contractor shall not be entitled to payment for costs incurred as the result of such delays unless such delays are the result of actions by the Owner.

.04 The Contractor shall not be entitled to payment for the cost of delays incurred as a result of a dispute between the Contractor and Owner. The Contractor shall execute the Work and may pursue resolution of the dispute in accordance with subsection GC 3.13, Claims, Negotiations, Mediations.

GC 3.08 Assignment of Contract

.01 The Contractor shall not assign the Contract, either in whole or in part, without the prior written consent of the Owner.

GC 3.09 Subcontracting by the Contractor

.01 Subject to clause GC 3.09.03, Subcontracting by the Contractor, the Contractor may subcontract any part of the Work, in accordance with the Contract Documents and any limitations specified therein.

.02 The Contractor shall notify the Contract Administrator in writing in 10 Days prior to the start of construction of the intention to subcontract. Such notification shall identify the part of the Work, and the Subcontractor with whom it is intended.

.03 The Contract Administrator shall, within 5 Days of receipt of such notification, accept or reject the intended Subcontractor. The rejection shall be in writing and shall include the reasons for the rejection.

.04 The Contractor shall not, without the written consent of the Owner, change a Subcontractor who has been engaged in accordance with this subsection.

.05 The Contractor shall preserve and protect the rights of the Owner under the Contract Documents with respect to that part of the Work to be performed under subcontract and shall,

a) enter into agreements with the intended Subcontractors to require them to perform their Work in accordance with the Contract Documents; and

b) be as fully responsible to the Owner for acts and omissions of the Contractor's Subcontractors and of persons directly or indirectly employed by them as for acts and omissions of persons directly employed by the Contractor.

.06 The Owner's consent to subcontracting by the Contractor shall not be construed to relieve the Contractor from any obligation under the Contract and shall not impose any liability upon the Owner. Nothing contained in the Contract Documents shall create a contractual relationship between a Subcontractor and the Owner.

GC 3.10 Changes

GC 3.10.01 Changes in the Work

.01 The Owner, or the Contract Administrator where so authorized, may, by order in writing, make a Change in the Work without invalidating the Contract. The Contractor shall not be required to proceed with a Change in the Work until in receipt of a Change Order or Change Directive. Upon the receipt of such Change Order or Change Directive the Contractor shall proceed with the Change in the Work.

.02 The Contractor may apply for an extension of Contract Time according to the terms of clause GC 3.06, Extension of Contract Time.

.03 If the Change in the Work relates solely to quantities, payment for that part of the Work shall be made according to the conditions specified in clause GC 8.01.02, Variations in Tender Quantities. If the Change in the Work does not solely relate to quantities, then either the Owner or the Contractor may initiate negotiations upwards or downwards for the adjustment of the Contract price in respect of the Change in the Work pursuant to subsection GC 3.13, Claims, Negotiations, Mediation or payment may be made according to the conditions contained in clause GC 8.02.05, Payment on a Time and Material Basis.

GC 3.10.02 Extra Work

.01 The Owner, or Contract Administrator where so authorized, may instruct the Contractor to perform Extra Work without invalidating the Contract. The Contractor shall not be required to proceed with the Extra Work until in receipt of a Change Order or Change Directive. Upon receipt of such Change Order or Change Directive the Contractor shall proceed with the Extra Work.

.02 The Contractor may apply for an extension of Contract Time according to the terms of clause GC 3.06, Extension of Contract Time.

.03 Either the Owner or Contractor may initiate negotiations upwards or downwards for the payment for the Extra Work pursuant to subsection GC 3.13, Claims, Negotiations, Mediation, or payment may be made according to the conditions contained in clause GC 8.02.05, Payment on a Time and Material Basis.

GC 3.10.03 Additional Work

.01 The Owner, or Contract Administrator where so authorized, may request the Contractor to perform Additional Work without invalidating the Contract. If the Contractor agrees to perform Additional Work, the Contractor shall proceed with such Additional Work upon receipt of a Change Order.

.02 The Contractor may apply for an extension of Contract Time according to the terms of subsection GC 3.06, Extension of Contract Time.

.03 Payment for the Additional Work may be negotiated pursuant to subsection GC 3.13, Claims, Negotiations, Mediation, or payment may be made according to the conditions contained in clause GC 8.02.05, Payment on a Time and Material Basis.

GC 3.11 Notices

.01 Any notice permitted or required to be given to the Contract Administrator or the Superintendent in respect of the Work shall be deemed to have been given to and received by the addressee on the date of delivery if delivered by hand, email, or by facsimile transmission and on the fifth Day after the date of mailing, if sent by mail.

.02 The Contractor and the Owner shall provide each other with the mail and email addresses; cell phone, and telephone numbers for the Contract Administrator and the Superintendent at the commencement of the Work, and update as necessary.

.03 In the event of an emergency situation or other urgent matter the Contract Administrator or the Superintendent may give a verbal notice, provided that such notice is confirmed in writing within 2 Days.

.04 Any notice permitted or required to be given to the Owner or the Contractor shall be given in accordance with the notice provision of the Contract.

GC 3.12 Use and Occupancy of the Work Prior to Substantial Performance

.01 Where it is not contemplated elsewhere in the Contract Documents, the Owner may use or occupy the Work or any part thereof prior to Substantial Performance, provided that at least 30 Days written notice has been given to the Contractor.

.02 The use or occupancy of the Work or any part thereof by the Owner prior to Substantial Performance shall not constitute an acceptance of the Work or parts so occupied. In addition, the use or occupancy of the Work shall not relieve the Contractor or the Contractor's Surety from any liability that has arisen, or may arise, from the performance of the Work in accordance with the Contract Documents. The Owner shall be responsible for any damage that occurs because of the Owner's use or occupancy. Such use or occupancy of any part of the Work by the Owner does not waive the Owner's right to charge the Contractor liquidated damages in accordance with the terms of the Contract.

GC 3.13 Claims, Negotiations, Mediation

GC 3.13.01 Continuance of the Work

.01 Unless the Contract has been terminated or completed, the Contractor shall in every case, after serving or receiving any notification of a claim or dispute, verbal or written, continue to proceed with the Work with due diligence and expedition. It is understood by the parties that such action shall not jeopardize any claim it may have.

GC 3.13.02 Record Keeping

.01 Immediately upon commencing Work that may result in a claim, the Contractor shall keep Daily Work Records during the course of the Work, sufficient to substantiate the Contractor's claim, and the Contract Administrator shall keep Daily Work Records to be used in assessing the Contractor's claim, all in accordance with clause GC 8.02.07, Records.

.02 The Contractor and the Contract Administrator shall attempt to reconcile their respective Daily Work Records on a daily basis, to simplify review of the claim, when submitted. If the Contractor and the Contract Administrator fail to reconcile their respective Daily Work Records, then the Contractor shall submit its Daily Work Records as part of its claim, whereby the resolution of the dispute about the Daily Work Records shall not be resolved until there is a resolution of the claim.

.03 The keeping of Daily Work Records by the Contract Administrator or the reconciling of such Daily Work Records with those of the Contractor shall not be construed to be acceptance of the claim.

GC 3.13.03 Claims Procedure

.01 The Contractor shall give verbal notice of any situation that may lead to a claim for additional payment immediately upon becoming aware of the situation.

.02 The Contractor shall provide written notice within 7 Days of the commencement of any part of the Work that may be affected by the situation.

.03 The Contractor shall submit detailed claims as soon as reasonably possible and in any event no later than 30 Days or such time as mutually agreed after completion of the Work affected by the situation. The detailed claim shall:

a) identify the item or items in respect of which the claim arises;

b) state the grounds, contractual or otherwise, upon which the claim is made; and

c) include the Records maintained by the Contractor supporting such claim.

.04 Within 30 Days of the receipt of the Contractor's detailed claim, the Contract Administrator may request the Contractor to submit any further and other particulars as the Contract Administrator considers necessary to assess the claim. The Contractor shall submit the requested information within 30 Days of receipt of such request.

.05 Within 90 Days of receipt of the detailed claim, the Contract Administrator shall advise the Contractor, in writing, of the Contract Administrator's opinion regarding the validity of the claim.

GC 3.13.04 Negotiations

.01 The parties shall make all reasonable efforts to resolve their dispute by amicable negotiations and agree to provide, without prejudice, open and timely disclosure of relevant facts, information, and documents to facilitate these negotiations.

.02 Should the Contractor disagree with the opinion given in clause GC 3.13.03.05, with respect to any part of the claim, the Contract Administrator shall enter into negotiations with the Contractor to resolve the matters in dispute. Where a negotiated settlement cannot be reached and it is agreed that payment cannot be made on a Time and Material basis in accordance with clause GC 8.02.05, Payment on a Time and Material Basis, the parties shall proceed in accordance with clause GC 3.13.05, Mediation, or subsection GC 3.14, Arbitration.

.03 Prior to the expiry of 30 Business Days from the date of receipt of the Contractors claim, the Contract Administrator shall provide a written response to the Contractor stating the Contract Administrator’s final price for the Change Order and an explanation of the rationale and basis of the Contract Administrator’s position which shall be deemed to be the initial site response.

GC 3.13.05 Mediation

.01 If a claim is not resolved satisfactorily through the negotiation stage noted in clause GC 3.13.04, Negotiations, within a period of 30 Days following the opinion given in clause GC 3.13.03.05, and the Contractor wishes to pursue the issue further, the parties may, upon mutual agreement, utilize the services of an independent third-party mediator.

.02 The mediator shall be mutually agreed upon by the Owner and Contractor.

.03 The mediator shall be knowledgeable regarding the area of the disputed issue. The mediator shall meet with the parties together or separately, as necessary, to review all aspects of the issue. In a final attempt to assist the parties in resolving the issue themselves prior to proceeding to arbitration the mediator shall provide, without prejudice, a non-binding recommendation for settlement.

.04 The review by the mediator shall be completed within 90 Days following the opinion given in clause GC 3.13.03.05.

.05 Each party is responsible for its own costs related to the use of the mediation process. The cost of the third-party mediator shall be equally shared by the Owner and Contractor.

GC 3.13.06 Payment

.01 Payment of the claim shall be made no later than 28 Days after the date of resolution of the claim or dispute. Such payment shall be made according to the terms of section GC 8.0, Measurement and Payment.

GC 3.13.07 Rights of Both Parties

.01 It is agreed that no action taken under subsection GC 3.13, Claims, Negotiations, Mediation, by either party shall be construed as a renunciation or waiver of any of the rights or recourse available to the parties, provided that the requirements set out in this subsection are fulfilled.

.02 It is further agreed that the parties may at any time resort to the adjudication procedure contained in the Construction Act.

GC 3.14 Arbitration

GC 3.14.01 Conditions of Arbitration

.01 If a claim is not resolved satisfactorily through the negotiation stage noted in clause GC 3.13.04, Negotiations, or the mediation stage noted in clause GC 3.13.05, Mediation, either party may invoke the provisions of subsection GC 3.14, Arbitration, by giving written notice to the other party.

.02 Notification that arbitration shall be implemented to resolve the issue shall be communicated in writing as soon as possible and no later than 60 Days following the opinion given in clause GC 3.13.03.05. Where the use of a third-party mediator was implemented, notification shall be within 120 Days of the opinion given in clause GC 3.13.03.05.

.03 The parties shall be bound by the decision of the arbitrator.

.04 The rules and procedures of the Arbitration Act, 1991, S.O. 1991, c.17, as amended, shall apply to any arbitration conducted hereunder except to the extent that they are modified by the express provisions of subsection GC 3.14, Arbitration.

GC 3.14.02 Arbitration Procedure

.01 The following provisions are to be included in the agreement to arbitrate and are subject only to such right of appeal as exist where the arbitrator has exceeded his or her jurisdiction or have otherwise disqualified him or herself:

a) All existing actions in respect of the matters under arbitration shall be stayed pending arbitration;

b) All outstanding claims and matters to be settled are to be set out in a schedule to the agreement. Only such claims and matters as are in the schedule shall be arbitrated; and

c) Before proceeding with the arbitration, the Contractor shall confirm that all matters in dispute are set out in the schedule.

GC 3.14.03 Appointment of Arbitrator

.01 The arbitrator shall be mutually agreed upon by the Owner and Contractor to adjudicate the dispute.

.02 Where the Owner and Contractor cannot agree on a sole arbitrator within 30 Days of the notification of arbitration noted in clause GC 3.14.01.02, the Owner and the Contractor shall each choose an appointee within 37 Days of the notice of arbitration.

.03 The appointees shall mutually agree upon an arbitrator to adjudicate the dispute within 15 Days after the last appointee was chosen or they shall refer the matter to the ADR Institute of Ontario (ADRIO), which may select an arbitrator to adjudicate the dispute within 7 Days of being requested to do so.

.04 The arbitrator shall not be interested financially in the Contract nor in either party's business and shall not be employed by either party.

.05 The arbitrator may appoint independent experts and any other persons to assist him or her.

.06 The arbitrator is not bound by the rules of evidence that govern the trial of cases in court but may hear and consider any evidence that the arbitrator considers relevant.

.07 The hearing shall commence within 90 Days of the appointment of the arbitrator.

GC 3.14.04 Costs

.01 The arbitrator's fee shall be equally shared by the Owner and the Contractor.

.02 The fees of any independent experts and any other persons appointed to assist the arbitrator shall be shared equally by the Owner and the Contractor.

.03 The arbitration hearing shall be held in a place mutually agreed upon by both parties or in the event the parties do not agree, a site shall be chosen by the arbitrator. The cost of obtaining appropriate facilities shall be shared equally by the Owner and the Contractor.

.04 The arbitrator may, in his or her discretion, award reasonable costs, related to the arbitration.

GC 3.14.05 The Decision

.01 The reasoned decision shall be made in writing within 90 Days of the conclusion of the hearing. An extension of time to make a decision may be granted with consent of both parties. Payment shall be made in accordance with clause GC 3.13.06, Payment.

GC 3.15 Archaeological Finds

.01 If the Contractor's operations expose any items that may indicate an archaeological find, such as but not limited to building remains, hardware, accumulations of bones, pottery, or arrowheads, the Contractor shall immediately notify the Contract Administrator and suspend operations within the area identified by the Contract Administrator. Notification may be verbal provided that such notice is confirmed in writing within 2 Days. Work shall remain suspended within that area until otherwise directed by the Contract Administrator in writing, in accordance with subsection GC 7.09, Suspension of Work.

.02 Any delay in the completion of the Contract that is caused by such a suspension of Work shall be considered to be beyond the Contractor's control in accordance with clause GC 3.07.01.

.03 Any Work directed or authorized in connection with an archaeological find shall be considered as Extra Work in accordance with clause GC 3.10.02, Extra Work.

.04 The Contractor shall take all reasonable action to minimize additional costs that may accrue as a result of any work stoppage.

SECTION GC 4.0 - OWNER'S RESPONSIBILITIES AND RIGHTS

GC 4.01 Working Area

.01 The Owner shall acquire all property rights that are deemed necessary by the Owner for the construction of the Work, including temporary working easements, and shall indicate the full extent of the Working Area on the Contract Drawings.

GC 4.02 Approvals and Permits

.01 The Owner shall pay for all plumbing and building permits.

.02 The Owner shall obtain and pay for all permits, licences, and certificates solely required for the design of the Work.

GC 4.03 Management and Disposition of Materials

.01 The Owner shall identify in the Contract Documents the Materials to be moved within or removed from the Working Area and any characteristics of those Materials that necessitates special Materials management and disposition.

.02 In accordance with regulations under the Occupational Health and Safety Act, R.S.O. 1990, c.O.1, as amended, the Owner advises that,

a) the designated substances silica, lead, and arsenic are generally present throughout the Working Area occurring naturally or as a result of vehicle emissions;

b) the designated substance asbestos may be present in cement products, asphalt, and conduits for Utilities;

c) the following hazardous materials are ordinarily present in construction activities: limestone, gypsum, marble, mica, and Portland cement; and

d) exposure to these substances may occur as a result of activities by the Contractor such as sweeping, grinding, crushing, drilling, blasting, cutting, and abrasive blasting.

.03 The Owner shall identify in the Contract Documents any designated substances or hazardous materials other than those identified above and their location in the Working Area.

.04 If the Owner or Contractor discovers or is advised of the presence of designated substances or hazardous Materials that are in addition to those listed in clause GC 4.03.02, or not clearly identified in the Contract Documents according to clause GC 4.03.03, then verbal notice shall be provided to the other party immediately with written confirmation within 2 Days. The Contractor shall stop Work in the area immediately and shall determine the necessary steps required to complete the Work in accordance with applicable legislation and regulations.

.05 The Owner shall be responsible for any reasonable additional costs of removing, managing and disposing of any Material not identified in the Contract Documents, or where conditions exist that could not have been reasonably foreseen at the time of tendering. All work under this paragraph shall be deemed to be Extra Work.

.06 Prior to commencement of the Work, the Owner shall provide to the Contractor a list of those products controlled under the Workplace Hazardous Materials Information System (WHMIS), that the Owner may supply or use on the Contract, together with copies of the Safety Data Sheets for these products. All containers used in the application of products controlled under WHMIS shall be labelled. The Owner shall notify the Contractor in writing of changes to the list and provide relevant Safety Data Sheets.

.07 Unless expressly permitted in the Contract Documents, the Contractor shall not bring onto the Work Area any designated substance or hazardous Material per OHSA without the prior written authorization of the Contract Administrator.

.08 The Contractor shall use all reasonable care to avoid spilling or disturbing any designated substances or hazardous Material per OHSA.

GC 4.04 Construction Affecting Railway Property

.01 The Owner shall pay the costs of all flagging and other traffic control measures required and provided by the railway company unless such costs are solely a function of the Contractor's chosen method of completing the Work.

.02 Every precaution shall be taken by the Contractor to protect all railway property at track crossings; or otherwise, on which construction operations are to take place in accordance with the terms of this Contract.

.03 The Contractor shall be required to conduct the construction operations in such a manner as to avoid a possibility of damaging any railway property in the vicinity of the Works. Every reasonable precaution shall be taken by the Contractor to ensure the safety of the workers, Subcontractors, and Equipment, as well as railway property throughout the duration of the Contract.

GC 4.05 Default by the Contractor

.01 If the Contractor fails to commence the Work within 14 Days of a formal order to commence Work signed by the Contract Administrator or, upon commencement of the Work, should neglect to prosecute the Work properly or otherwise fails to comply with the requirements of the Contract and, if the Contract Administrator has given a written statement to the Owner and Contractor that sufficient cause exists to justify such action, the Owner may, without prejudice to any other right or remedy the Owner may have, notify the Contractor in writing that the Contractor is in default of the Contractor’s contractual obligations and instruct the Contractor to correct the default in the 5 Working Days immediately following the receipt of such notice.

.02 If the Contractor is adjudged bankrupt, or makes a general assignment for the benefit of creditors because of the Contractor’s insolvency or if a receiver is appointed because of the Contractor’s insolvency, the Owner may, without prejudice to any other right or remedy the Owner may have, by giving the Contractor or receiver or trustee in bankruptcy notice in writing, terminate the Contract.

GC 4.06 Contractor's Right to Correct a Default

.01 The Contractor shall have the right within the 5 Working Days following the receipt of a notice of default to correct the default and provide the Owner with satisfactory proof that appropriate corrective measures have been taken.

.02 If the Owner determines that the correction of the default cannot be completed within the 5 Working Days following receipt of the notice, the Contractor shall not be in default if the Contractor,

a) commences the correction of the default within the 5 Working Days following receipt of the notice;

b) provides the Owner with a schedule acceptable to the Owner for the progress of such correction; and

c) completes the correction in accordance with such schedule.

GC 4.07 Owner's Right to Correct Default

.01 If the Contractor fails to correct the default within the time specified in subsection GC 4.06, Contractor's Right to Correct a Default, or subsequently agreed upon, the Owner, without prejudice to any other right or remedy the Owner may have, may correct such default and deduct the cost thereof, as certified by the Contract Administrator, from any payment then or thereafter due to the Contractor.

GC 4.08 Termination of Contractor's Right to Continue the Work

.01 Where the Contractor fails to correct a default within the time specified in subsection GC 4.06, Contractor's Right to Correct a Default, or subsequently agreed upon, the Owner, without prejudice to any other right or remedy the Owner may have, may terminate the Contractor's right to continue the Work in whole or in part by giving written notice to the Contractor.

.02 If the Owner terminates the Contractor's right to continue with the Work in whole or in part, the Owner shall be entitled to,

a) take possession of the Working Area or that portion of the Working Area devoted to that part of the Work terminated;

b) utilize any Material within the Working Area;

d) withhold further payments to the Contractor with respect to the Work or the portion of the Work withdrawn from the Contractor until the Work or portion thereof withdrawn is completed;

d) charge the Contractor the additional cost over the Contract price of completing the Work or portion thereof withdrawn from the Contractor, as certified by the Contract Administrator and any additional compensation paid to the Contract Administrator for such additional service arising from the correction of the default;

e) charge the Contractor a reasonable allowance, as determined by the Contract Administrator, to cover correction to the Work performed by the Contractor that may be required under subsection GC 7.16, Warranty;

f) charge the Contractor for any damages the Owner sustained as a result of the default; and

g) charge the Contractor the amount by which the cost of corrections to the Work under subsection GC 7.16, Warranty, exceeds the allowance provided for such corrections.

GC 4.09 Final Payment to Contractor

.01 If the Owner's cost to correct and complete the Work in whole or in part is less than the amount withheld from the Contractor under subsection GC 4.08, Termination of Contractor's Right to Continue the Work, the Owner shall pay the balance to the Contractor as soon as the final accounting for the Contract is complete.

GC 4.10 Termination of the Contract

.01 Where the Contractor is in default of the Contract the Owner shall, without prejudice to any other right or remedy the Owner may have, terminate the Contract by giving written notice of termination to the Contractor, the Surety, and any trustee or receiver acting on behalf of the Contractor's estate or creditors.

.02 If the Owner elects to terminate the Contract, the Owner shall provide the Contractor and the trustee or receiver with a complete accounting to the date of termination.

GC 4.11 Continuation of Contractor's Obligations

.01 The Contractor's obligation under the Contract as to quality, correction, and warranty of the Work performed prior to the time of termination of the Contract or termination of the Contractor's right to continue with the Work in whole or in part shall continue to be in force after such termination.

GC 4.12 Use of Performance Bond

.01 If the Contractor is in default of the Contract and the Contractor has provided a Performance Bond, the provisions of section GC 4.0, Owner’s Responsibilities and Rights, shall be exercised in accordance with the conditions of the Performance Bond.

GC 4.13 Payment Adjustment

.01 If any situation should occur in the performance of the Work that would result in a Change in the Work, the Owner shall be entitled to an adjustment and those adjustments shall be managed in accordance with clause GC 3.10.01, Changes in the Work.

SECTION GC 5.0 - MATERIAL

GC 5.01 Supply of Material

.01 All Material necessary for the proper completion of the Work, except that listed as being supplied by the Owner, shall be supplied by the Contractor. The Contract price for the appropriate tender items shall be deemed to include full compensation for the supply and delivery of such Material.

GC 5.02 Quality of Material

.01 All Material supplied by the Contractor shall be new, unless otherwise specified in the Contract Documents.

.02 Material supplied by the Contractor shall conform to the requirements of the Contract.

.03 As specified in the Contract Documents or as requested by the Contract Administrator, the Contractor shall make available, for inspection or testing, a sample of any Material to be supplied by the Contractor.

.04 The Contractor shall obtain for the Contract Administrator the right to enter onto the premises of the Material manufacturer or supplier to carry out such inspection, sampling, and testing as specified in the Contract Documents or as requested by the Contract Administrator.

.05 The Contractor shall notify the Contract Administrator of the sources of supply sufficiently in advance of the Material shipping dates to enable the Contract Administrator to perform the required inspection, sampling, and testing.

.06 The Owner shall not be responsible for any delays to the Contractor's operations where the Contractor fails to give sufficient advance notice to the Contract Administrator to enable the Contract Administrator to carry out the required inspection, sampling, and testing before the scheduled shipping date.

.07 The Contractor shall not change the source of supply of any Material without the written authorization of the Contract Administrator.

.08 Material that is not specified shall be of a quality best suited to the purpose required, and the use of such Material shall be subject to the approval of the Contract Administrator.

.09 All Material inspection, sampling, and testing shall be carried out on random basis in accordance with the standard inspection or testing methods required for the Material. Any approval given by the Contract Administrator for the Materials to be used in the Work based upon the random method shall not relieve the Contractor from the responsibility of incorporating Material that conforms to the Contract Documents into the Work or properly performing the Contract and of any liability arising from the failure to properly perform as specified in the Contract Documents.

GC 5.03 Rejected Material

.01 Rejected Material shall be removed from the Working Area expeditiously after the notification to that effect from the Contract Administrator. Where the Contractor fails to comply with such notice, the Contract Administrator may cause the rejected Material to be removed from the Working Area and disposed of, in what the Contract Administrator considers to be the most appropriate manner, and the Contractor shall pay the costs of disposal and the appropriate overhead charges.

GC 5.04 Substitutions

.01 Where the Contract Documents require the Contractor to supply a Material designated by a trade or other name, the Tender shall be based only upon supply of the Material so designated, that shall be regarded as the standard of quality required by the Contract Documents. After the acceptance of the Tender, the Contractor may apply to the Contract Administrator to substitute another Material identified by a different trade or other name for the Material designated as aforesaid. The application shall be in writing and shall state the price for the proposed substitute Material designated as aforesaid, and such other information as the Contract Administrator may require.

.02 Rulings on a proposed substitution shall not be made prior to the acceptance of the Tender. Substitutions shall not be made without the prior approval of the Contract Administrator. The approval or rejection of a proposed substitution shall be at the discretion of the Contract Administrator.

.03 If the proposed substitution is approved by the Contract Administrator, the Contractor shall be entitled to the first $1,000 of the aggregate saving in cost by reason of such substitution and to 50% of any additional saving in cost in excess of such $1,000. Each such approval shall be conveyed to the Contractor in writing or by issuance of a Certificate of Equality on the Owner's standard form of "Certification of Equality" and, if any adjustment to the Contract price is made by reason of such substitution, a Change Order shall be issued as well.

GC 5.05 Owner Supplied Material

GC 5.05.01 Ordering of Excess Material

.01 Where Material is supplied by the Owner and where this Material is ordered by the Contractor in excess of the amount specified to complete the Work, such excess Material shall become the property of the Contractor on completion of the Work and shall be charged to the Contractor at cost plus applicable overheads.

GC 5.05.02 Care of Material

.01 The Contractor shall, in advance of receipt of shipments of Material supplied by the Owner, provide adequate and proper storage facilities acceptable to the Contract Administrator, and on the receipt of such Material shall promptly place it in storage, except where it is to be incorporated forthwith into the Work.

.02 The Contractor shall be responsible for acceptance of Material supplied by the Owner, at the specified delivery point and for its safe handling and storage. If such Material is damaged while under the control of the Contractor, it shall be replaced or repaired by the Contractor at no expense to the Owner, and to the satisfaction of the Contract Administrator. If such Material is rejected by the Contract Administrator for reasons that are not the fault of the Contractor, it shall remain in the care and at the risk of the Contractor until its disposition has been determined by the Contract Administrator.

.03 Where Material supplied by the Owner arrives at the delivery point in a damaged condition or where there are discrepancies between the quantities received and the quantities shown on the bills of lading, the Contractor shall immediately report such damage or discrepancies to the Contract Administrator who shall arrange for an immediate inspection of the shipment and provide the Contractor with a written release from responsibility for such damage or deficiencies. Where damage or deficiencies are not so reported, it shall be assumed that the shipment arrived in good condition and order, and any damage or deficiencies reported thereafter shall be made good by the Contractor at no extra cost to the Owner.

.04 The full amount of Material supplied by the Owner in each shipment shall be accounted for by the Contractor and such Material shall be at the risk of the Contractor after taking delivery. Such Material shall not, except with the written permission of the Contract Administrator, be used by the Contractor for purposes other than the performance of the Work under the Contract.

.05 Empty reels, crates, containers, and other type of packaging from Material supplied by the Owner shall become the property of the Contractor when they are no longer required for their original purpose and shall be disposed of by the Contractor at the Contractor's expense unless otherwise specified in the Contract Documents.

.06 Immediately upon receipt of each shipment, the Contractor shall provide the Contract Administrator copies of bills of lading, or such other documentation the Contract Administrator may require to substantiate and reconcile the quantities of Material received.

.07 Where Material supplied by the Owner is ordered and stockpiled prior to the award of the Contract, the Contractor shall, at no extra cost to the Owner, immediately upon commencement of operations, check the Material, report any damage or deficiencies to the Contract Administrator and take charge of the Material at the stockpile site. Where damage or deficiencies are not so recorded by the Contractor, it shall be assumed that the stockpile was in good condition and order when the Contractor took charge of it, and any damage or deficiencies reported thereafter shall be made good by the Contractor at no extra cost to the Owner.

SECTION GC 6.0 - INSURANCE, PROTECTION AND DAMAGE

GC 6.01 Protection of Work, Persons and Property

.01 The Contractor, the Contractor's agents, and all workers employed by or under the control of the Contractor, including Subcontractors, shall protect the Work, persons, and property from damage or injury. The Contractor shall be responsible for all losses and damage that may arise as the result of the Contractor's operations under the Contract, unless indicated to the contrary below.

.02 The Contractor is responsible for the full cost of any necessary temporary protective Work and the restoration of all damage where the Contractor damages the Work or property in the performance of the Contract. If the Contractor is not responsible for the damage that occurs to the Work or property, the Contractor shall restore such damage, and such Work and payment shall be administered according to these General Conditions.

.03 The Contractor shall immediately inform the Contract Administrator of all damage and injuries that occur during the term of the Contract. The Contractor shall then investigate and report back to the Contract Administrator within 15 Days of occurrence of incident, or as soon as possible. The Contract Administrator may conduct its own investigation and the Contractor shall provide all assistance to the Contract Administrator as may be necessary for that purpose.

.04 The Contractor shall not be responsible for loss and damage that occurs as a result of,

a) war;

b) blockades and civil commotions;

c) errors in the Contract Documents; or

d) acts or omissions of the Owner, the Contract Administrator, their agents and employees, or others not under the control of the Contractor, but within the Working Area with the Owner's permission.

.05 The Contractor and the Contractor’s Surety shall not be released from any term or provision of any responsibility, obligation, or liability under the Contract or waive or impair any of the rights of the Owner, except by a release duly executed by the Owner.

GC 6.02 Indemnification

.01 The Contractor shall indemnify and hold harmless the Owner and the Contract Administrator, their elected officials, agents, officers, and employees from and against all claims, demands, losses, expenses, costs, damages, actions, suits, or proceedings by third parties, hereinafter called "claims", directly or indirectly arising or alleged to arise out of the performance of or the failure to perform the Work, provided such claims are,

a) attributable to bodily injury, sickness, disease, or death or to damage to or destruction of tangible property;

b) caused by negligent acts or omissions of the Contractor or anyone for whose acts the Contractor may be liable; and

c) made in writing within a period of 6 years from the date of Substantial Performance of the Work as set out in the Certificate of Substantial Performance of the Work or, where so specified in the Contract Documents, from the date of certification of Final Acceptance.

.02 The Contractor shall indemnify and hold harmless the Owner from all and every claim for damages, royalties or fees for the infringement of any patented invention or copyright occasioned by the Contractor in connection with the Work performed or Material furnished by the Contractor under the Contract.

.03 The Owner expressly waives the right to indemnity for claims other than those stated in clauses GC 6.02.01 and GC 6.02.02.

.04 The Owner shall indemnify and hold harmless the Contractor, their elected officials, agents, officers, and employees from and against all claims, demands, losses, expenses, costs, damages, actions, suits, or proceedings arising out of the Contractor's performance of the Contract that are attributable to a lack of or defect in title or an alleged lack of or defect in title to the Working Area.

.05 The Contractor expressly waives the right to indemnity for claims other than those stated in clause GC 6.02.04.

GC 6.03 Contractor's Insurance

GC 6.03.01 General

.01 Without restricting the generality of subsection GC 6.02, Indemnification, the Contractor shall provide, maintain, and pay for the insurance coverages listed under clauses GC 6.03.02 and GC 6.03.03. Insurance coverage in clauses GC 6.03.04, GC 6.03.05, and GC 6.03.06 shall only apply when so specified in the Contract Documents.

.02 The Contractor shall provide the Contract Administrator with an original Certificate of Insurance for each type of insurance coverage that is required by the Contract Documents. The Contractor shall ensure that the Contract Administrator is, at all times in receipt of a valid Certificate of Insurance for each type of insurance coverage, in such amounts as specified in the Contract Documents. The Contractor will not be permitted to commence Work until the Contract Administrator is in receipt of such proof of insurance. The Contract Administrator may withhold payments of monies due to the Contractor until the Contractor has provided the Contract Administrator with original valid Certificates of Insurance as required by the provisions of the Contract Documents.

GC 6.03.02 Commercial General Liability Insurance

.01 Commercial General Liability Insurance shall be in the name of the Contractor, with the Owner and the Contract Administrator named as additional insureds, with limits of not less than five million dollars inclusive per occurrence for bodily injury, death, and damage to property including loss of use thereof. The insurance shall be provided in a form acceptable to the Owner.

.02 Approval of this insurance shall be conditional upon the Contractor obtaining the services of an insurer licensed to underwrite insurance in the Province of Ontario and obtaining the insurer's certificate of equivalency to the required insurance.

.03 The Contractor shall submit annually to the Owner, proof of continuation of the completed operations coverage and, if the Contractor fails to do so, the limitation period for claiming indemnity described in clause GC 6.02.01 c), shall not be binding on the Owner.

.04 Should the Contractor decide not to employ Subcontractors for operations requiring the use of explosives for blasting, pile driving or caisson work, removal or weakening of support of property building or land, the Commercial General Liability Insurance shall include the appropriate endorsements.

.05 The policies shall be endorsed to provide the Owner with not less than 30 Days written notice in advance of cancellation, termination, or material change.

.06 "Claims Made" insurance policies shall not be permitted.

GC 6.03.03 Automobile Liability Insurance

.01 Automobile liability insurance in respect of licensed vehicles shall have limits of not less than five million dollars inclusive per occurrence for bodily injury, death and damage to property, in the following forms endorsed to provide the Owner with not less than 30 Days written notice in advance of any cancellation, termination, or material change.

a) standard non-owned automobile policy including standard contractual liability endorsement, and

b) standard owner's form automobile policy providing third party liability and accident benefits insurance and covering licensed vehicles owned or operated by the Contractor.

GC 6.03.04 Aircraft and Watercraft Liability Insurance

GC 6.03.04.01 Aircraft Liability Insurance

.01 Aircraft liability insurance with respect to owned or non-owned aircraft used directly or indirectly in the performance of the Work, including use of additional premises, shall be subject to limits of not less than five million dollars inclusive per occurrence for bodily injury, death, and damage to property including loss of use thereof, and limits of not less than five million dollars for aircraft passenger hazard. Such insurance shall be in a form acceptable to the Owner. The policies shall be endorsed to provide the Owner with not less than 30 Days written notice in advance of cancellation, change, or amendment restricting coverage.

GC 6.03.04.02 Watercraft Liability Insurance

.01 Watercraft liability insurance with respect to owned or non-owned watercraft used directly or indirectly in the performance of the Work, including use of additional premises, shall be subject to limits of not less than five million dollars inclusive per occurrence for bodily injury, death, and damage to property including loss of use thereof. Such insurance shall be in a form acceptable to the Owner. The policies shall be endorsed to provide the Owner with not less than 30 Days written notice in advance of cancellation, change, or amendment restricting coverage.

GC 6.03.05 Property and Boiler Insurance

GC 6.03.05.01 Property Insurance

.01 All risks property insurance shall be in the name of the Contractor, with the Owner and the Contract Administrator named as additional insureds, insuring not less than the sum of the amount of the Contract price and the full value, as may be stated in the Contract Documents, of Material that is specified to be provided by the Owner for incorporation into the Work.

GC 6.03.05.02 Boiler Insurance

.01 Boiler insurance insuring the interests of the Contractor, the Owner and the Contract Administrator for not less than the replacement value of boilers and pressure vessels forming part of the Work, shall be in a form acceptable to the Owner.

GC 6.03.05.03 Use and Occupancy of the Work Prior to Completion

.01 Should the Owner wish to use or occupy part or all of the Work prior to Substantial Performance, the Owner shall give 30 Days written notice to the Contractor of the intended purpose and extent of such use or occupancy. Prior to such use or occupancy, the Contractor shall notify the Owner in writing of

the additional premium cost, if any, to maintain property and boiler insurance, which shall be at the Owner's expense. If because of such use or occupancy the Contractor is unable to provide coverage, the Owner upon written notice from the Contractor and prior to such use or occupancy shall provide, maintain, and pay for property and boiler insurance insuring the full value of the Work, including coverage for such use or occupancy, and shall provide the Contractor with proof of such insurance. The Contractor shall refund to the Owner the unearned premiums applicable to the Contractor's policies upon termination of coverage.

.02 The policies shall provide that in the event of a loss or damage, payment shall be made to the Owner and the Contractor as their respective interests may appear. The Contractor shall act on behalf of both the Owner and the Contractor for the purpose of adjusting the amount of such loss or damage payment with the insurers. When the extent of the loss or damage is determined, the Contractor shall proceed to restore the Work. Loss or damage shall not affect the rights and obligations of either party under the Contract, except that the Contractor shall be entitled to such reasonable extension of Contract Time relative to the extent of the loss or damage as the Contract Administrator may decide in consultation with the Contractor.

GC 6.03.05.04 Payment for Loss or Damage

.01 The Contractor shall be entitled to receive from the Owner, in addition to the amount due under the Contract, the amount at which the Owner's interest in restoration of the Work has been appraised, such amount to be paid as the restoration of the Work proceeds, and in accordance with the requirements of section GC 8.0, Measurement and Payment. In addition, the Contractor shall be entitled to receive from the payments made by the insurers the amount of the Contractor's interest in the restoration of the Work.

.02 The Contractor shall be responsible for deductible amounts under the policies, except where such amounts may be excluded from the Contractor's responsibility by the terms of this Contract.

.03 In the event of a loss or damage to the Work arising from the action or omission of the Owner or others, the Owner shall pay the Contractor the cost of restoring the Work as the restoration of the Work proceeds and in accordance with the requirements of section GC 8.0, Measurement and Payment.

GC 6.03.06 Contractor's Equipment Insurance

.01 All risks Contractor's Equipment insurance covering construction equipment used by the Contractor for the performance of the Work, including boiler insurance on temporary boilers and pressure vessels, shall be in a form acceptable to the Owner and shall not allow subrogation claims by the insurer against the Owner. The policies shall be endorsed to provide the Owner with not less than 30 Days written notice in advance of cancellation, change, or amendment restricting coverage. Subject to satisfactory proof of financial capability by the Contractor for self-insurance of the Contractor's Equipment, the Owner agrees to waive the equipment insurance requirement, and for the purpose of this Contract, the Contractor shall be deemed to be insured. This policy shall be amended to provide permission for the Contractor to grant prior releases with respect to damage to the Contractor's Equipment.

GC 6.03.07 Insurance Requirements and Duration

.01 Each insurance policy as noted in the Contract Documents shall be in effect from the date of commencement of the Work until 10 Days after the date of Final Acceptance of the Work, as set out in the Final Acceptance Certificate.

.02 The Contractor shall provide the Owner, on a form acceptable to the Owner, proof of insurance prior to commencement of the Work and signed by the underwriter or the broker.

.03 The Contractor shall, on request, promptly provide the Owner with a certified true copy of each insurance policy exclusive of information pertaining to premium or premium bases used by the insurer to determine the cost of the insurance. The certified true copy shall include the signature of an officer of the insurer.

.04 Where a policy is renewed, the Contractor shall provide the Owner, on a form acceptable to the Owner, renewed proof of insurance immediately following completion of renewal.

.05 Unless specified otherwise, the Contractor shall be responsible for the payment of deductible amounts under the policies.

.06 If the Contractor fails to provide or maintain insurance as required in subsection GC 6.03, Contractor's Insurance, or elsewhere in the Contract Documents, then the Owner shall have the right to provide and maintain such insurance and give evidence thereof to the Contractor. The Owner's cost thereof shall be payable by the Contractor to the Owner on demand.

.07 If the Contractor fails to pay the cost of the insurance placed by the Owner within 28 Days of the date on which the Owner made a formal demand for reimbursement of such costs, the Owner may deduct the costs thereof from monies which are due or may become due to the Contractor.

GC 6.04 Bonding

.01 The Contractor shall provide the Owner with the surety bonds in the amount required by the Contract Documents.

.02 Such bonds shall be issued by a duly licensed surety company authorized to transact a business of suretyship in the Province of Ontario and shall be to the satisfaction of the Owner. The bonds shall be maintained in good standing until the Final Acceptance.

GC 6.05 Workplace Safety and Insurance Board

.01 The Contractor shall provide the Contract Administrator with a copy of a Certificate of Clearance indicating the Contractor’s good standing with the Workplace Safety and Insurance Board, as follows:

a) Immediately prior to the Contract Administrator authorizing the Contractor to commence Work.

b) Prior to issue of the Certificate of Substantial Performance.

c) Prior to expiration of the Warranty Period.

d) At any other time when requested by the Contract Administrator.

SECTION GC 7.0 - CONTRACTOR'S RESPONSIBILITIES AND CONTROL OF THE WORK

GC 7.01 General

GC 7.01.01 Site Visit

.01 The Contractor warrants that the site of the Work has been visited during the preparation of the Tender and the character of the Work and all local conditions that may affect the performance of the Work are known.

GC 7.01.02 Commencement of Work

.01 The Contractor shall not commence the Work nor deliver anything to the Working Area until the Contractor has received a written order to commence the work from the Contract Administrator.

GC 7.01.03 Control and Responsibility

.01 The Contractor shall have complete control of the Work and shall effectively direct and supervise the Work so as to ensure conformity with the Contract Documents. The Contractor shall be responsible for construction means, methods, techniques, sequences, and procedures and for coordinating the various parts of the Work.

.02 The Contractor shall provide adequate labour, Equipment, and Material to ensure the completion of the Contract in accordance with the Contract Documents. The Work shall be performed as vigorously and as continuously as weather conditions or other interferences may permit.

.03 The Contractor shall have the sole responsibility for the design, erection, operation, maintenance, and removal of temporary structures and other temporary facilities and the design and execution of construction methods required in their use.

.04 Notwithstanding clause GC 7.01.03, where the Contract Documents include designs for temporary structures and other temporary facilities or specify a method of construction in whole or part, such facilities and methods shall be considered to be part of the design of the Work, and the Contractor shall not be held responsible for that part of the design or the specified method of construction. The Contractor shall, however, be responsible for the execution of such design or specified method of construction in the same manner that the Contractor is responsible for the execution of the Work.

.05 The Contractor shall comply with and conform to all statutes, laws, by-laws, regulations, requirements, ordinances, notices, rulings, orders, directives and policies of the municipal, provincial and federal governments and any other lawful authority and all court orders, judgments and declarations of a court of competent jurisdiction (collectively referred to as the “Laws”), applicable to the Work to be provided by, and the undertakings and obligations of, the Contractor under this Contract.

GC 7.01.04 Compliance with the Occupational Health and Safety Act

.01 The Contractor shall execute the terms of the Contract in strict compliance with the requirements of the Occupational Health and Safety Act, R.S.O. 1990, c.O.1, as amended, (the "Act") and Ontario Regulation 213/91, as amended, (that regulates Construction Projects) and any other regulations as amended under the Act (the "Regulations") that may affect the performance of the Work, as the "Constructor" or "employer," as defined by the Act, as the case may be. The Contractor shall ensure that:

a) worker safety is given priority in planning, pricing, and performing the Work;

b) its officers and supervisory employees have a working knowledge of the duties of a "Constructor" and "employer" as defined by the Act and the provisions of the Regulations applicable to the Work, and a personal commitment to comply with them;

c) a copy of the most current version of the Act and the Regulations are available at the Contractor's office within the Working Area, or, in the absence of an office, in the possession of the supervisor responsible for the performance of the Work;

d) workers employed to carry out the Work possess the knowledge, skills, and protective devices required by law or recommended for use by a recognized industry association to allow them to work in safety;

e) its supervisory employees are “Competent Persons” as defined in the OHSA, and carry out their duties in a diligent and responsible manner with due consideration for the health and safety of the workers;

f) all Subcontractors and their workers are properly protected from injury while they are at the Working Area; and

g) following execution of the Contract and prior to the issuance of the order to commence by the Owner, upon request the Contractor submits to the Contract Administrator a copy of the Notice of Project issued to the Ministry of Labour.

.02 The Contractor, when requested, shall provide the Owner with a copy of its health and safety policy and program at the pre-start meeting and shall respond promptly to requests from the Owner for confirmation that its methods and procedures for carrying out the Work comply with the Act and Regulations. The Contractor shall cooperate with representatives of the Owner and the inspectors appointed to enforce the Act and the Regulations in any investigations of worker health and safety in the performance of the Work. The Contractor shall indemnify and save the Owner harmless from any additional expense that the Owner may incur to have the Work performed as a result of the Contractor's failure to comply with the requirements of the Act and the Regulations.

.03 Prior to commencement of the Work, the Contractor shall provide to the Contract Administrator a list of those products controlled under the Workplace Hazardous Materials Information System ~~or~~ “WHMIS”, which the Contractor expects to use on the Contract. Related Safety Data Sheets shall accompany the submission. All containers used in the application of products controlled under “WHMIS” shall be labelled. The Contractor shall notify the Contractor Administrator in writing of changes in the products to be used and provide relevant Safety Data Sheets.

.04 During the course of the Work, the Contractor shall furnish forthwith to the Contract Administrator a copy of all correspondence, reports, orders or charges respecting occupational health and safety, including under the Act, Technical Standards and Safety Act, 2000, S.O. 2000, c.16 as amended, and the Criminal Code, R.S.C., 1985, c. C-46 as amended, which are received by, or which come to the notice of, the Contractor that apply or are relevant to any of the Work or activities conducted under the terms of the Contract.

.05 Nothing in this Contract shall be construed as requiring the Owner to monitor or approve the workplace health and safety practices of the Contractor.

GC 7.01.05 Contractor’s Representatives

.01 The Contractor shall have an authorized representative on the site while any Work is being performed, to supervise the Work and act for or on the Contractor's behalf. Prior to commencement of construction, the Contractor shall notify the Contract Administrator of the names, addresses, positions, and cell phone, and telephone numbers of the Contractor's representatives who can be contacted at any time to deal with matters relating to the Contract, and update as necessary.

.02 The Contractor shall designate a person to be responsible for traffic control and work zone safety. The designated person shall be a competent worker who is qualified because of knowledge, training, and experience to perform the duties; is familiar with Book 7 of the Ontario Traffic Manual; and has knowledge of all potential or actual danger to workers and motorists. Prior to the commencement of construction, the Contractor shall notify the Contract Administrator of the name; address; position; cell phone, and telephone numbers of the designated person, and update as necessary. The designated person may have other responsibilities, including other construction sites, and need not be present in the Working Area at all times.

GC 7.01.06 Assistance to the Contract Administrator

.01 The Contractor shall, at no additional cost to the Owner, furnish all reasonable aid, facilities, and assistance required by the Contract Administrator for the proper inspection and examination of the Work or the taking of measurements for the purpose of payment.

GC 7.01.07 Schedule

.01 The Contractor shall prepare and update, as required, a construction schedule of operations, indicating the proposed methods of construction and sequence of Work and the time the Contractor proposes to complete the various items of Work within the time specified in the Contract Documents. The schedule shall be submitted to the Contract Administrator within 14 Days from the Contract award. If the Contractor's schedule is materially affected by changes in the work, the Contractor shall submit an updated construction schedule, if requested by the Contract Administrator, within 7 Days of the request. This updated schedule shall show how the Contractor proposes to perform the balance of the Work, to complete the Work within the time specified in the Contract Documents.

.02 For Contracts with a specified number of Working Days, the construction time shown on the initial schedule shall not exceed the specified number of Working Days. The activities on the critical path shall assist the Contract Administrator in determining the Controlling Operation for the purpose of the charging of Working Days. The construction schedule shall include all non-working periods and appropriate allowances for Inclement Weather.

.03 For Contracts which specify a Contract Time, the construction time shown on the initial construction schedule shall not extend beyond the specified Contract Time. The construction schedule shall include all non-working periods and appropriate allowances for Inclement Weather.

GC 7.01.08 Errors and Inconsistencies Relating to the Contract

.01 Where the Contractor finds any error, inconsistency, or omission relating to the Contract, the Contractor shall promptly report it to the Contract Administrator and shall not proceed with the activity affected until receiving direction from the Contract Administrator.

.02 The Contractor shall promptly notify the Contract Administrator in writing if the subsurface conditions observed in the Working Area differ materially from those indicated in the Contract Documents.

GC 7.01.09 Utilities

.01 The Contractor shall arrange with the appropriate Utility authorities for the stake out of all underground Utilities and service connections that may be affected by the Work. The Contractor shall observe the location of the stake outs prior to commencing the Work and if there is a discrepancy between the location of the stake outs and the locations shown on the Contract Documents, that may affect the Work, the Contractor shall immediately notify the Contract Administrator and the affected Utility companies, in order to resolve the discrepancy. The Contractor shall be responsible for any damage done to the underground Utilities and service connections by

the Contractor's forces during construction if the stake out locations are within the tolerances given in clause GC 2.01.01 a).

.02 In the case of damage to or interference with any Utilities, pole lines, pipe lines, conduits, farm tiles, or other public or privately-owned works or property, the Contractor shall immediately notify the Owner, Contract Administrator, and the owner of the works of the location and details of such damage or interference.

GC 7.02 Monuments and Layout

.01 Prior to commencement of construction, the Contract Administrator and the Contractor shall locate on site those Monuments that delineate the Working Area and may be used to lay out the Work, all as shown on the Contract Drawings. Property Monuments shall be inventoried in the report format required by the Owner.

.02 These Monuments shall be protected by highly visible T-bars or 1.0 metre tall stakes with survey ribbon set within 0.3 metres of the Monument.

.03 The Contractor shall be responsible for the preservation of all Property Monuments while the Work is in progress, except those Property Monuments that must be removed to facilitate the Work as identified and agreed by the Contractor and Contract Administrator. Monuments removed to facilitate the Work shall be replaced at the Owner's expense, and all others shall be replaced at the Contractor's expense.

.04 All Monuments disturbed, damaged, or removed by the Contractor's operations shall be documented in the inventory report and replaced under the supervision of an Ontario Land Surveyor.

.05 The Monument inventory report referred to in clauses GC 7.02.01 and GC 7.02.04 shall include as a minimum:

a) Contract number, Contract name, Contract Administrator's name;
b) Project/site construction limits;
c) Rough location, type, identification number, and condition of each Monument before and after construction;
d) The solutions for protection of the Monuments that may be impacted by construction;
e) Reference ties;
f) A summary of those Monuments affected by the Work and how they were reset or replaced, and by what type of Monument.

.06 At no extra cost to the Owner, the Contractor shall provide the Contract Administrator with such materials and devices as may be necessary to lay out the baseline and benchmarks, and as may be necessary for the inspection of the Work.

.07 The Contractor shall provide qualified personnel to lay out and establish all lines and grades necessary for construction. The Contractor shall notify the Contract Administrator of any layout work carried out, so that the same may be checked by the Contract Administrator.

.08 The Contractor shall install and maintain substantial alignment markers and secondary benchmarks as may be required for the proper execution of the Work. The Contractor shall supply one copy of all alignment and grade sheets to the Contract Administrator.

.09 The Contractor shall assume full responsibility for alignment, elevations, and dimensions of each and all parts of the Work, regardless of whether the Contractor's layout work has been checked by the Contract Administrator.

.10 All stakes, marks, and reference points shall be carefully preserved by the Contractor. In the case of their destruction or removal, for any reason, before the end of the Contract Time such stakes, marks, and reference points shall be replaced, unless otherwise mutually agreed between the Contractor and the Contract Administrator, at the Contractor's expense.

.11 Benchmarks and survey monuments identified in the Contract Documents shall be protected by the Contractor. In the case of their destruction or removal, such benchmarks and survey monuments shall be replaced by the Owner at the Contractor's expense.

GC 7.03 Working Area

.01 The Contractor shall maintain the Working Area in a tidy condition and free from the accumulation of debris and prevent dust nuisance, mud, and ponding water, other than that caused by the Owner or others.

.02 The Contractor's sheds, site offices, toilets, other temporary structures, and storage areas for Material and Equipment shall be grouped in a compact manner, maintained in a neat and orderly condition at all times and removed upon completion of the Work.

.03 The Contractor shall confine the construction operations to the Working Area. Should the Contractor require additional space, the Contractor shall obtain such space at no additional cost to the Owner.

.04 The Contractor shall not enter upon or occupy any private property for any purpose, unless the Contractor has received prior written permission from the property owner.

.05 Upon completion of the Contract, the Working Area used by the Contractor shall be restored to its original condition or better unless otherwise specified in the Contract Documents including the removal of all excavated and stockpiled materials at the Contractor's expense.

GC 7.04 Damage by Vehicles or Other Equipment

.01 If at any time, in the opinion of the Contract Administrator, damage is being done or is likely to be done to any Roadway or any improvement thereon, outside the Working Area, by the Contractor's vehicles or other Equipment, whether licensed or unlicensed Equipment, the Contractor shall, on the direction of the Contract Administrator, and at no extra cost to the Owner, make changes or substitutions for such vehicles or Equipment, and shall alter loadings, or in some other manner, remove the cause of such damage to the satisfaction of the Contract Administrator.

GC 7.05 Excess Loading of Motor Vehicles

.01 Where a vehicle is hauling Material for use on the Work, in whole or in part; upon a Highway; and where motor vehicle registration is required for such vehicle, the Contractor shall not cause or permit such vehicle to be loaded beyond the legal limit specified in the Highway Traffic Act, R.S.O. 1990, c.H.8, as amended, whether such vehicle is registered in the name of the Contractor or otherwise, except where there are designated areas within the Working Area where overloading is permitted. The Contractor shall bear the onus of weighing disputed loads.

GC 7.06 Maintaining Roads and Detours

.01 Unless otherwise specified in the Contract Documents, if an existing Roadway is affected by construction, it shall be kept open to both vehicular and pedestrian traffic.

.02 Subject to the approval of the Contract Administrator, the Contractor shall, at no additional cost to the Owner, be responsible for providing and maintaining for the duration of the Work an alternative route for both pedestrian and vehicular traffic through the Working Area in accordance with the OTM,

whether along the existing Highway under construction or on a detour road beside or adjacent to the Highway under construction.

.03 Subject to the approval of the Contract Administrator, the Contractor may block traffic for short periods of time to facilitate construction of the Work in accordance with the OTM. Any temporary lane closures shall be kept to a minimum.

.04 The Contractor shall not be required to maintain a road through the Working Area until such time as the Contractor has commenced operations or during seasonal shut down or on any part of the Contract that has been accepted in accordance with these General Conditions. The Contractor shall not be required to apply de-icing chemicals or abrasives or carry out snowplowing.

.05 Where only localized and separated sections of the Highway are affected by the Contractor's operations, the Contractor shall not be required to maintain intervening sections of the Highway until such times as these sections are located within the limits of the Highway affected by the Contractor's general operations under the Contract.

.06 Where the Contract Documents provide for or the Contract Administrator requires detours at specific locations, payment for the construction of the detours and, if required, for the subsequent removal of the detours, shall be made at the Contract prices appropriate to such Work.

.07 Compensation for all labour, Equipment, and Materials to do this Work shall be at the Contract prices appropriate to the Work and, where there are no such prices, at negotiated prices. Notwithstanding the foregoing, the cost of blading required to maintain the surface of such roads and detours shall be deemed to be included in the prices bid for the various tender items and no additional payment shall be made.

.08 Where Work under the Contract is discontinued for any extended period, including seasonal shutdown, the Contractor shall, when directed by the Contract Administrator, open and place the Roadway and detours in a passable, safe, and satisfactory condition for public travel.

.09 Where the Contractor constructs a detour that is not specifically provided for in the Contract Documents or required by the Contract Administrator, the construction of the detour and, if required, the subsequent removal shall be performed at the Contractor's expense. The detour shall be constructed and maintained to structural and geometric standards approved by the Contract Administrator. Removal and site restoration shall be performed as directed by the Contract Administrator.

.10 Where, with the prior written approval of the Contract Administrator, the Highway is closed and the traffic diverted entirely off the Highway to any other Highway, the Contractor shall, at no extra cost to the Owner, supply, erect, and maintain traffic control devices in accordance with the OTM.

.11 Compliance with the foregoing provisions shall in no way relieve the Contractor of its obligations under subsection GC 6.01, Protection of Work, Persons, and Property, dealing with the Contractor's responsibility for damage claims, except for claims arising on sections of Highway within the Working Area that are being maintained by others.

GC 7.07 Access to Properties Adjoining the Work and Interruption of Utility Services

.01 The Contractor shall provide at all times and at no extra cost to the Owner,

a) safe and adequate pedestrian and vehicular access;

b) continuity of Utility services; and

c) access for emergency response services;

to properties adjoining the Working Area.

.02 The Contractor shall provide at all times and at no extra cost to the Owner access to fire hydrants, water and gas valves, and all other Utilities located in the Working Area.

.03 Where any interruptions in the supply of Utility services are required and are authorized by the Contract Administrator, the Contractor shall give the affected property owners notice in accordance with subsection GC 7.11, Notices by the Contractor, and shall arrange such interruptions so as to create a minimum of interference to those affected.

GC 7.08 Approvals and Permits

.01 Except as specified in subsection GC 4.02, Approval and Permits, the Contractor shall obtain and pay for any permits, licences, and certificates, which at the date of tender closing, are required for the performance of the Work.

.02 The Contractor shall arrange for all necessary inspections required by the approvals and permits specified in clause GC 7.08.01, Approvals and Permit.

GC 7.09 Suspension of Work

.01 The Contractor shall, upon written notice from the Contract Administrator, discontinue or delay any or all of the Work and Work shall not be resumed until the Contract Administrator so directs in writing. Delays, in these circumstances, shall be administered according to subsection GC 3.07, Delays.

GC 7.10 Contractor's Right to Stop the Work or Terminate the Contract

.01 If the Owner is adjudged bankrupt or makes a general assignment for the benefit of creditors because of insolvency or if a receiver is appointed because of insolvency, the Contractor may, without prejudice to any other right or remedy the Contractor may have, by giving the Owner or receiver or trustee in bankruptcy written notice, terminate the Contract.

.02 If the Work is stopped or otherwise delayed for a period of 30 Days or more under an order of a court or other public authority and provided that such order was not issued as the result of an act or fault of the Contractor or of anyone directly employed or engaged by the Contractor, the Contractor may, without prejudice to any other right or remedy the Contractor may have, by giving the Owner written notice, terminate the Contract.

.03 The Contractor may notify the Owner in writing, with a copy to the Contract Administrator, that the Owner is in default of contractual obligations if,

a) the Contract Administrator fails to issue certificates in accordance with the provisions of section GC 8.0, Measurement and Payment;

b) the Owner fails to pay the Contractor, within 28 Days of the due dates identified in clause GC 8.02.04, Certification and Payment, the amounts certified by the Contract Administrator or within 28 Days of an award by an arbitrator or court; or

c) the Owner fails to comply with the requirements of the Contract.

.04 The Contractor's written notice to the Owner shall advise that if the default is not corrected in the 7 Days immediately following receipt of the written notice, the Contractor may, without prejudice to any other right or remedy the Contractor may have, stop the Work or terminate the Contract.

.05 If the Contractor terminates the Contract under the conditions set out in subsection GC 7.10, Contractor's Right to Stop the Work or Terminate the Contract, the Contractor shall be entitled to be paid for all Work performed according to the Contract Documents and for any losses or damage as the Contractor may sustain as a result of the termination of the Contract.

GC 7.11 Notices by the Contractor

.01 Before any Work is carried out that may affect the property or operations of any Ministry or agency of government or any person; company; partnership; or corporation, including a municipal corporation or any board or commission thereof, and in addition to such notices of the commencement of specified operations as are prescribed elsewhere in the Contract Documents, the Contractor shall give at least 48 hours advance written notice of the date of commencement of such Work to the person, company, partnership, corporation, board, or commission so affected.

GC 7.12 Environmental Incident Management under Legislation Protecting the Environment and Natural Resources

.01 The Contractor shall be in strict compliance with the requirements of the following legislation, as amended, regarding environmental incidents under the control of the Contractor or that are a result of the Contractor's operations:

a) Environmental Protection Act, R.S.O. 1990, c. E.19

b) Fisheries Act, R.S.C. 1985, c. F-14

c) Technical Standards and Safety Act, 2000, S.O. 2000, c. 16

d) Pesticides Act, R.S.O. 1990, c. P.11

e) Ontario Water Resources Act, R.S.O. 1990, c. O.40

f) Transportation of Dangerous Goods Act, 1992, S.C.1992, c. 34

.02 The requirements of the legislation listed in clause GC 7.12.01 include but are not restricted to:

a) Immediate containment of the material, pollutant, contaminant, deleterious substance, or dangerous good;

b) Immediate notification of the environmental incident to the proper authority; and

c) Clean up and restoration of the environment to preconditions.

.03 The Contractor shall possess a plan demonstrating that environmental incidents shall be managed to satisfy the requirements of clauses GC 7.12.01 and GC 7.12.02.

.04 The Contractor shall provide a copy of the environmental incident plan to the Contract Administrator when required and shall inform the Contract Administrator immediately of:

a) An environmental incident when it occurs; and

b) Any actions taken or intended to be taken by the Contractor regarding the environmental incident.

.05 The Contractor shall indemnify and save the Owner harmless from any additional expense that the Owner may incur to have the Work performed as a result of the Contractor's failure to comply with the requirements of the legislation listed in clause GC 7.12.01.

GC 7.13 Obstructions

.01 Except as otherwise noted in these General Conditions, the Contractor assumes all the risks and responsibilities arising out of any obstruction encountered in the performance of the Work and any traffic conditions, including traffic conditions on any Highway or road giving access to the Working Area caused by such obstructions, and the Contractor shall not make any claim against the Owner for any loss, damage, or expense occasioned thereby.

.02 Where the obstruction is an underground Utility or other man-made object, the Contractor shall not be required to assume the risks and responsibilities arising out of such obstruction, unless the location of the obstruction is shown on the Plans or described in the Contract Documents and the location so shown is within the tolerance specified in clause GC 2.01.01 a), or unless the presence and location of the obstruction has otherwise been made known to the Contractor or could have been determined by the visual site investigation made by the Contractor in accordance with these General Conditions.

.03 During the course of the Contract, it is the Contractor's responsibility to consult with Utility companies or other appropriate authorities for further information in regard to the exact location of these Utilities, to exercise the necessary care in construction operations, and to take such other precautions as are necessary to safeguard the Utilities from damage.

GC 7.14 Limitations of Operations

.01 Except for such Work as may be required by the Contract Administrator to maintain the Work in a safe and satisfactory condition, the Contractor shall not carry out operations under the Contract on Saturdays, Sundays, and any holidays recognized by the Owner without permission in writing from the Contract Administrator.

.02 The Contractor shall cooperate and coordinate the Work with other Contractors, Utility companies, and the Owner and they shall be allowed access to their Work or plant at all reasonable times.

GC 7.15 Cleaning Up Before Acceptance

.01 Upon attaining Substantial Performance of the Work, the Contractor shall remove surplus materials, tools, and Equipment not required for the performance of the remaining Work. The Contractor shall also remove all temporary works and debris other than that caused by the Owner or others and leave the Work and Working Area clean and suitable for occupancy by the Owner, unless otherwise specified.

.02 The Work shall not be deemed to have reached Completion until the Contractor has removed surplus materials, tools, and Equipment. The Contractor shall also have removed debris, other than that caused by the Owner, or others.

GC 7.16 Warranty

.01 Unless otherwise specified in the Contract Documents for certain Materials or components of the Work, the Contractor shall be responsible for the proper performance of the Work only to the extent that the design and standards permit such performance.

.02 Subject to the previous paragraph the Contractor shall correct promptly, at no additional cost to the Owner, defects or deficiencies in the Work that appear,

a) prior to and during the period of 12 months from the date of Substantial Performance of the Work, as set out in the Certificate of Substantial Performance of the Work,

b) where there is no Certificate of Substantial Performance, 12 months from the date of Completion of the Work as set out in the Completion Certificate, or

c) such longer periods as may be specified in the Contract Documents for certain Materials or some of the Work.

The Contract Administrator shall promptly give the Contractor written notice of observed defects or deficiencies.

.03 The Contractor shall correct or pay for damage resulting from corrections made under the requirements of clause GC 7.16.02.

GC 7.17 Contractor's Workers

.01 The Contractor shall only employ orderly, competent, and skillful workers to do the Work and whenever the Contract Administrator shall inform the Contractor in writing that any worker or workers involved in the Work are, in the opinion of the Contract Administrator, incompetent, or disorderly such worker or workers shall be removed from the Work and shall not be employed on the Work again without the consent in writing of the Contract Administrator.

GC 7.18 Drainage

.01 During construction and until the Work is completed, the Contractor shall make all reasonable efforts to keep all portions of the Work properly and efficiently drained, to at least the same degree as that of the existing drainage conditions.

SECTION GC 8.0 - MEASUREMENT AND PAYMENT

GC 8.01 Measurement

GC 8.01.01 Quantities

.01 The Contract Administrator shall make an Estimate in writing once a month, unless otherwise specified in the Contract Documents, of the quantity of Work performed and provide such Estimate to the Contractor within 10 Days of the Cut-Off Date.

.02 Quantities for progress payments shall be construed and held to approximate. The final quantities for the issuance of the Completion Payment shall be based on the measurement of Work completed.

.03 Measurement of the quantities of the Work performed may be either by Actual Measurement or by Plan Quantity principles as indicated in the Contract. Adjustments to Plan Quantity measurements shall normally be made using Plan Quantity principles but may, where appropriate, be made using Actual Measurements. Those items identified on the Tender by the notation (P) in the unit column shall be paid according to the Plan Quantity. Items where the notation (P) does not occur shall be paid according to Actual Measurement or lump sum.

GC 8.01.02 Variations in Tender Quantities

.01 Where it appears that the quantity of Work to be done or Material to be supplied or both by the Contractor under a unit price tender item may exceed or be less than the tender quantity, the Contractor shall proceed to do the Work or supply the Material or both required to complete the tender item and payment shall be made for the actual amount of Work done or Material supplied or both at the unit prices stated in the Tender except as provided below:

a) In the case of a Major Item where the quantity of Work performed or Material supplied or both by the Contractor exceeds the tender quantity by more than 15%, either party to the Contract may make a written request to the other party to negotiate a revised unit price for that portion of the Work performed or Material supplied or both which exceeds 115% of the tender quantity. The negotiation shall be carried out as soon as reasonably possible. Any revision of the unit price shall be based on the actual cost of doing the Work or supplying the Material or both under the tender item plus a reasonable allowance for profit and applicable overhead. Alternatively, where both parties agree, an allowance equal to 10% of the unit price on the amount of the underrun in excess of 15% of the tender quantity shall be paid.

b) In the case of a Major Item where the quantity of Work performed or Material supplied or both by the Contractor is less than 85% of the tender quantity, the Contractor may make a written request to negotiate for the portion of the actual overheads and fixed costs applicable to the amount of the underrun in excess of 15% of the tender quantity. For purposes of the negotiation, the overheads and fixed costs applicable to the item are deemed to have been prorated uniformly over 100% of the tender quantity for the item. Overhead costs shall be confirmed by a statement certified by the Contractor's senior financial officer or auditor and may be audited by the Owner. Alternatively, where both parties agree, an allowance equal to 10% of the unit price on the amount of the underrun in excess of 15% of the tender quantity shall be paid.

Written requests for compensation must be received no later than 60 Days after the issuance of the Completion Payment.

GC 8.02 Payment

GC 8.02.01 Non-Resident Contractor

.01 If the Contractor is not a registered entity in Ontario, the Contractor shall obtain all necessary approvals, consents, permits, licences, certificates, registrations, and other authorizations prior to execution of the Contract.

.02 The Contractor shall ensure that all Subcontractors the Contractor proposes to use for carrying out any of the Work required by the Contract and who are not a registered entity in Ontario have obtained all necessary approvals, consents, permits, certificates, registrations, and other authorizations prior to execution of the subcontract.

GC 8.02.02 Price for Work

.01 Prices for the Work shall be full compensation for all labour, Equipment and Material required in its performance. The term "all labour, Equipment, and Material" shall include Hand Tools, supplies, and other incidentals.

.02 Payment, for Work which is identified in the Contract Documents but not specifically detailed as part of any one item shall be deemed to be included in the items with which it is associated.

GC 8.02.03 Advance Payments for Material

.01 The Owner shall make advance payments for Material intended for incorporation in the Work upon the written request of the Contractor and according to the following terms and conditions:

a) The Contractor shall deliver the Material to a site approved by the Contract Administrator and the Contractor shall, in advance of receipt of the shipment of the Material, arrange for adequate and proper storage facilities.

b) The value of aggregates, processed and stockpiled, shall be assessed by the following procedure:

i. Sources Other Than Commercial

(A) Granular A, B, BI, BII, BIII, M, and O shall be assessed at the rate of 60% of the Contract price.

(B) Coarse and fine aggregates for hot mix asphaltic concrete, surface treatment and Portland cement concrete shall be assessed at the rate of 25% of the Contract price for each aggregate stockpiled.

ii. Commercial Sources
Payment for separated coarse and fine aggregates shall be considered at the above rate when such Materials are stockpiled at a commercial source where further processing is to be carried out before incorporating such Materials into a final product. Advance payments for other Materials located at a commercial source shall not be made.

c) Payment for all other Materials, unless otherwise specified elsewhere in the Contract Documents, shall be based on the invoice price, and the Contractor shall submit proof of cost to the Contract Administrator before payment can be made by the Owner.

d) The payment for all Materials shall be prorated against the appropriate tender item by paying for sufficient units of the item to cover the value of the Material. Such payment shall not exceed 80% of the Contract price for the item.

e) All Materials for which the Contractor wishes to receive advance payment shall be placed in the designated storage location immediately upon receipt of the Material and shall thenceforth be held by the Contractor in trust for the Owner as collateral security for any monies advanced by the Owner and for the due completion of the Work. The Contractor shall not exercise any act of ownership inconsistent with such security, or remove any Material from the storage locations, except for inclusion in the Work, without the consent, in writing, of the Contract Administrator.

f) Such materials shall remain at the risk of the Contractor who shall be responsible for any loss, damage, theft, improper use, or destruction of the Material however caused.

.02 Where the Owner makes advance payments subject to the conditions listed in clause GC 8.02.03.01, such payment shall not constitute acceptance of the Material by the Owner. Acceptance shall only be determined when the Material meets the requirements of the appropriate specification.

GC 8.02.04 Certification and Payment

GC 8.02.04.01 Progress Payment

.01 The Contractor shall submit a Proper Invoice for progress payments monthly or at intervals specified in the Contract Documents after starting the Work on this Contract. The Contractor shall submit the Proper Invoice to the Contract Administrator and to the Owner. This Proper Invoice shall be for work completed at the agreed to Cut-Off Date.

.02 A Proper Invoice shall include;

a) the requirements as set out in section 6.1 of the Construction Act;

b) the quantities of Work performed;

c) the value of Work performed;

d) any advanced payment for Material;

e) the amount of Statutory Holdback, liens, Owner's set-off;

f) the amount of any applicable taxes;

g) the amount due to the Contractor; and

h) any other information that may be prescribed in the Contract Documents.

.03 Payment shall be made within 28 Days of the submission of the Proper Invoice unless a notice of non-payment has been issued in accordance with the Construction Act.

.04 The Owner shall retain the Statutory Holdback in the form and amount as required under the Construction Act.

GC 8.02.04.02 Certification of Subcontract Completion

.01 Before the Work has reached the stage of Substantial Performance, the Contractor may notify the Contract Administrator, in writing that a subcontract is completed satisfactorily and ask that the Contract Administrator certify the completion of such subcontract.

.02 The Contract Administrator shall issue a Certificate of Subcontract Completion, if the subcontract has been completed in a form satisfactory to the Contract Administrator, and all required inspection and testing of the works covered by the subcontract have been carried out and the results are satisfactory to the Contract Administrator.

.03 The Contract Administrator shall set out in the Certificate of Subcontract Completion the date on which the subcontract was completed and, within 7 Days of the date the subcontract is certified complete, the Contract Administrator shall give a copy of the certificate to the Contractor and to the Subcontractor concerned.

GC 8.02.04.03 Subcontract Statutory Holdback Release Certificate and Payment

.01 Following receipt of the Certificate of Subcontract Completion, the Owner shall release and pay the Contractor the Statutory Holdback retained in respect of the subcontract. Such release shall be made 61 Days after the date the subcontract was certified complete and providing the Contractor submits the following to the Contract Administrator:

a) a document satisfactory to the Contract Administrator that shall release the Owner from all further claims relating to the subcontract, qualified by stated exceptions such as holdback monies;

b) evidence satisfactory to the Contract Administrator that the Subcontractor has discharged all liabilities incurred in carrying out the subcontract;

c) a satisfactory clearance certificate or letter from the Workplace Safety and Insurance Board relating to the subcontract; and

d) a copy of the contract between the Contractor and the Subcontractor and a satisfactory statement showing the total amount due the Subcontractor from the Contractor.

.02 Clause GC 8.02.04.03.01 d), shall only apply to Lump Sum Items and then only when the Contract Administrator specifically requests it.

.03 Upon receipt of the Statutory Holdback, the Contractor shall forthwith give the Subcontractor the payment due under the subcontract.

.04 Release of Statutory Holdback by the Owner in respect of a subcontract shall not relieve the Contractor, or the Contractor's Surety, of any of their responsibilities.

GC 8.02.04.04 Substantial Performance of Work

.01 The Contractor, as part of the application for Substantial Performance, shall submit an itemized list of the outstanding work.

.02 Upon application by the Contractor and when the Contract Administrator has verified that the Contract has been substantially performed, the Contract Administrator shall issue a Certificate of Substantial Performance.

.03 The Contract Administrator shall set out in the Certificate of Substantial Performance the date on which the Contract was substantially performed and, within 7 Days after signing the said certificate, and shall provide a copy to the Contractor.

.04 Upon receipt of a copy of the Certificate of Substantial Performance, the Contractor shall forthwith, as required by Section 32(1) Paragraph 5 of the Construction Act, as amended, publish a copy of the certificate in the manner set out in the regulations.

.05 Where the Contractor fails to publish a copy of the Certificate of Substantial Performance as required above within 7 Days after receiving a copy of the certificate signed by the Contract Administrator, the Owner may publish a copy of the certificate at the Contractor's expense.

.06 Except as otherwise provided for in Section 31 of the Construction Act, the 60 Day lien period prior to the release of holdback as referred to in clause GC 8.02.04.05, Substantial Performance Payment and Statutory Holdback Release Payment Certificates, shall commence from the date of publication of the Certificate of Substantial Performance as provided for above.

GC 8.02.04.05 Substantial Performance Payment and Substantial Performance Statutory Holdback Release Payment Certificates

.01 Prior to the Contract Administrator issuing the Certificate of Substantial Performance, the Contractor shall submit a Proper Invoice for the Work completed. In addition to the requirements specified under section 8.02.04.01.02, the Proper Invoice shall include:

a) the value of Work performed to the date of Substantial Performance;

b) the value of outstanding or incomplete Work;

c) the amount of the Statutory Holdback, allowing for any previous releases of Statutory Holdback to the Contractor in respect of completed subcontracts and deliveries of pre-selected Equipment; and

d) the amount due the Contractor.

.02 Payment shall be made within 28 Days of the date of submission of the Proper Invoice.

.03 The Substantial Performance Statutory Holdback Release Payment Certificate shall be a payment certificate releasing to the Contractor the Statutory Holdback due in respect of Work performed up to the date of Substantial Performance. Payment of such Statutory Holdback shall be due 61 Days after the date of publication of the Certificate of Substantial Performance but subject to the provisions of the Construction Act and the submission by the Contractor of the following documents:

a) a satisfactory Certificate of Clearance from the Workplace Safety and Insurance Board; and

b) proof of publication of the Certificate of Substantial Performance.

.04 Any amount of security retained shall be identified on the Substantial Performance Payment Certificate.

GC 8.02.04.06 Certification of Completion

.01 Upon application by the Contractor and when the Contract Administrator has verified that the Contract has reached Completion, the Contract Administrator shall issue a Completion Certificate.

.02 The Contract Administrator shall set out in the Completion Certificate the date on which the Work was completed and, within 7 Days of signing the said certificate, the Contract Administrator shall provide a copy to the Contractor.

GC 8.02.04.07 Completion Payment and Completion Statutory Holdback Release Payment Certificates

.01 Prior to the Contract Administrator issuing the Completion Certificate, the Contractor shall submit a Proper Invoice for the Work completed. In addition to the requirements noted under section 8.02.04.01.02, the Proper Invoice shall include:

a) measurement and value of Work at Completion;

b) the amount of the further Statutory Holdback based on the value of further Work completed over and above the value of Work completed shown in the Substantial Performance Payment Certificate referred to above; and

c) the amount due the Contractor.

.02 The Completion Statutory Holdback Release Payment Certificate shall be a payment certificate releasing to the Contractor the further Statutory Holdback. Subject to any outstanding liens and permissible set-offs and upon submission of a satisfactory Certificate of Clearance from the Workplace Safety and Insurance Board, the Owner shall pay the remaining holdback on the Work done, within 28 Days after the expiration of the 60-Day lien period.

.03 Any amount of security retained shall be identified on the Completion Payment Certificate.

GC 8.02.04.08 Interest

.01 Interest due to the Contractor shall be based on simple interest and calculated using the applicable Rate of Interest. Interest shall begin to accrue on an amount that is not paid when it is due to be paid under Part-I of the Construction Act, at the prejudgment interest rate determined under subsection 127 (2) of the *Courts of Justice Act* or, if the Contract specifies a different interest rate for this purpose, the greater of the prejudgment interest rate and the interest rate specified in the Contract.

GC 8.02.04.09 Interest for Late Payment

.01 Provided the Contractor has complied with the requirements of the Contract, including all documentation requirements, when payment by the Owner to the Contractor for Work performed, or for release of Statutory Holdback, is delayed by the Owner, then the Contractor shall be entitled to receive interest on the outstanding payment at the Rate of Interest, if payment is not received on the dates set out below:

a) Progress Payment: 28 Days after submission of Proper Invoice;

b) Subcontract Statutory Holdback Release Payment: 89 Days after the date on which the subcontract was completed;

c) Substantial Performance Payment: 28 Days after the date of issuance of the certificate;

d) Substantial Performance Statutory Holdback Release Payment: 89 Days after publication of the Payment Certificate of Substantial Performance;

e) Completion Payment: 28 Days after the date certified as the date on which the Contract reached Completion; and

f) Completion Statutory Holdback Release Payment: 89 Days after the date certified as the date that the Work was completed.

.02 If the Contractor has not complied with the requirements of the Contract, including all documentation requirements, prior to expiration of the time periods described in clause GC 8.02.04.09.01, interest shall only begin to accrue when the Contractor has completed those requirements.

GC 8.02.04.10 Interest for Negotiations and Claims

.01 Except as hereinafter provided, where a notice of negotiation, notice of intent to claim and the subsequent claims are submitted in accordance with the time limits or procedure or both described by subsection GC 3.13, Claims, Negotiations, Mediation, the Owner shall pay the Contractor the Rate of Interest on the amount of the negotiated price for that part of the Work or on the amount of the settled claim. Such interest shall not commence until 30 Days after the satisfactory completion of that part of the Work.

.02 Where the Contractor fails to give notice of a claim within the time limit prescribed by subsection GC 3.13, Claims, Negotiations, Mediation, interest shall not be paid.

.03 Where a Contractor fails to comply with the 30 Day time limit and the procedures prescribed in clause GC 3.13.03.03 for submission of claims, interest shall not be paid for the delay period.

GC 8.02.04.11 Owner's Set-Off

.01 Pursuant to the Construction Act, the Owner may retain from monies owing to the Contractor under this Contract an amount sufficient to cover any outstanding or disputed liabilities, including the cost to remedy deficiencies, the reduction in value of substandard portions of the Work, claims for damages by third parties that have not been determined in writing by the Contractor's insurer, undetermined claims by the Owner, and any assessment due the Workplace Safety and Insurance Board.

.02 Under these circumstances the Owner will give the Contractor appropriate notice of such action.

GC 8.02.04.12 Delay in Payment

.01 The Owner shall not be deemed to be in default of the Contract provided any delay in payment does not exceed the due dates as defined in clause GC 8.02.04.09.01.

GC 8.02.05 Payment on a Time and Material Basis

GC 8.02.05.01 Definitions

.01 For the purpose of clause GC 8.02.05 the following definitions apply:

Cost of Labour means the amount of wages, salary, travel, travel time, food, lodging, or similar items and Payroll Burden paid or incurred directly by the Contractor to or in respect of labour and supervision actively and necessarily engaged on the Work based on the recorded time and hourly rates of pay for such labour and supervision but shall not include any payment or costs incurred for general supervision, administration, and management time spent on the entire Work or any wages, salary, or Payroll Burden for which the Contractor is compensated by any payment made by the Owner for Equipment.

Cost of Material means the cost of Material purchased or supplied from stock and valued at current market prices for the purpose of carrying out Extra Work by the Contractor or by others, when such arrangements have been made by the Contractor for completing the Work, as shown by itemized invoices.

Operated Rented Equipment means Rented Equipment for which an operator is provided by the supplier of the Equipment and for which the rent or lease includes the cost of the operator.

Payroll Burden means the payments in respect of workplace insurance, vacation pay, employment insurance, public liability and property damage insurance, sickness and accident insurance, pension fund, and such other welfare and benefit payments forming part of the Contractor's normal labour costs.

Rented Equipment means Equipment that is rented or leased for the special purpose of Work on a Time and Material Basis from a person, firm, or corporation that is not an associate of the lessee as the word "associate" is defined by the Securities Act, R.S.O. 1990, c.S.5, as amended, and is approved by the Contract Administrator.

Road Work means the preparation, construction, finishing, and construction maintenance of roads, streets, Highways, and parking lots and includes all work incidentals thereto other than Work on structures.

Sewer and Watermain Work means the preparation, construction, finishing, and construction maintenance of sewer systems and watermain systems, and includes all work incidental thereto other than Work on structures.

Standby Time means any period of time that is not considered Working Time and which together with the Working Time does not exceed 10 hours in any one Working Day and during which time a unit of Equipment cannot practically be used on other Work but must remain on the site in order to continue with its assigned task and during which time the unit is in fully operable condition.

Structure Work means the construction, reconstruction, repair, alteration, remodelling, renovation, or demolition of any bridge, building, tunnel, or retaining wall and includes the preparation for and the laying of the foundation of any bridge, building, tunnel, or retaining wall and the installation of Equipment and appurtenances incidental thereto.

The 127 Rate means the rate for a unit of Equipment as listed in OPSS.PROV 127, Schedule of Rental Rates for Construction Equipment, Including Model and Specification Reference, that is current at the time the work is carried out or for Equipment that is not so listed, the rate that has been calculated by the Owner, using the same principles as used in determining The 127 Rates.

Work on a Time and Material Basis means Changes in the Work, Extra Work, and Additional Work approved by the Contract Administrator for payment on a Time and Material basis. The Work on a Time and Material Basis shall be subject to all the terms, conditions, Standard Specifications and provisions of the Contract.

Working Time means each period of time during which a unit of Equipment is actively and of necessity engaged on a specific operation and the first 2 hours of each immediately following period during which the unit is not so engaged but during which the operation is otherwise proceeding and during which time the unit cannot practically be transferred to other Work but must remain on the site in order to continue with its assigned tasks and during which time the unit is in a fully operable condition.

GC 8.02.05.02 Daily Work Records

.01 Daily Work Records, prepared as the case may be by either the Contractor's representative or the Contract Administrator reporting the labour and Equipment employed and the Material used on each Time and Material project, should be reconciled and signed each Day by both the Contractor's representative and the Contract Administrator. If it is not possible to reconcile the Daily Work Records, then the Contractor shall submit the un-reconciled Daily Work Records with its claim, whereby the resolution of the dispute about the Daily Work Records shall not be resolved until there is a resolution of the claim.

GC 8.02.05.03 Payment for Work

.01 Payment as herein provided shall be full compensation for all labour, Equipment, and Material to do the Work on a Time and Material Basis except where there is agreement to the contrary prior to the commencement of the Work on a Time and Material Basis. The payment adjustments on a Time and Material basis shall apply to each individual Change Order authorized by the Contract Administrator.

GC 8.02.05.04 Payment for Labour

.01 The Owner shall pay the Contractor for labour employed on each Time and Material project at 135% of the Cost of Labour up to $3,500, then at 120% of any portion of the Cost of Labour in excess of $3,500.

.02 The Owner shall make payment in respect of Payroll Burden for Work on a Time and Material Basis at the Contractor's actual cost of Payroll Burden.

.03 At the Owner's discretion, an audit may be conducted in which case the actual Payroll Burden so determined shall be applied to all Time and Material work on the Contract.

GC 8.02.05.05 Payment for Material

.01 The Owner shall pay the Contractor for Material used on each Time and Material project at 120% of the Cost of the Material up to $3,500, then at 115% of any portion of the Cost of Material in excess of $3,500.

GC 8.02.05.06 Payment for Equipment

GC 8.02.05.06.01 Working Time

.01 The Owner shall pay the Contractor for the Working Time of all Equipment, other than Rented Equipment and Operated Rented Equipment, used on the Work on a Time and Material basis at The 127 Rates with a cost adjustment as follows:

a) Cost $12,000 or less - no adjustment;

b) Cost greater than $12,000 but not exceeding $24,000 - payment $12,000 plus 90% of the portion in excess of $12,000; and

c) Cost greater than $24,000 - $22,800 plus 80% of the portion in excess of $24,000.

.02 The Owner shall pay the Contractor for the Working Time of Rented Equipment used on the Work on a Time and Material Basis at 110% of the invoice price approved by the Contract Administrator up to a maximum of 110% of the 127 Rate. This constraint shall be waived when the Contract Administrator approves the invoice price prior to the use of the Rented Equipment.

.03 The Owner shall pay the Contractor for the Working Time of Operated Rented Equipment used on the Work on a Time and Material Basis at 110% of the Operated Rented Equipment invoice price approved by the Contract Administrator prior to the use of the Equipment on the Work on a Time and Material Basis.

GC 8.02.05.06.02 Standby Time

.01 The Owner shall pay the Contractor for Standby Time of Equipment at 35% of The 127 Rate or 35% of the invoice price whichever is appropriate. The Owner shall pay reasonable costs for Rented Equipment where this is necessarily retained in the Working Area for extended periods agreed to by

the Contract Administrator. This shall include Rented Equipment intended for use on other work, but has been idled due to the circumstances giving rise to the Work on a Time and Material Basis.

.02 In addition, the Owner shall include the Cost of Labour of operators or associated labourers who cannot be otherwise employed during the Standby Time or during the period of idleness caused by the circumstances giving rise to the Work on a Time and Material Basis.

.03 The Contract Administrator may require Rented Equipment idled by the circumstances giving rise to the Work on Time and Material Basis to be returned to the lessor until the Work requiring the Equipment can be resumed. The Owner shall pay such costs as a result from such return.

.04 When Equipment is transported, solely for the purpose of the Work on a Time and Material Basis, to or from the Working Area on a Time and Material basis, payment shall be made by the Owner only in respect of the transporting units. When Equipment is moved under its own power it shall be deemed to be working. The method of moving Equipment and the rates shall be subject to the approval of the Contract Administrator.

GC 8.02.05.07 Payment for Hand Tools

.01 Notwithstanding any other provision of this Section, no payment shall be made to the Contractor for or in respect of Hand Tools or Equipment that are tools of the trade.

GC 8.02.05.08 Payment for Work by Subcontractors

.01 Where the Contractor arranges for Work on a Time and Material Basis, or a part of it, to be performed by Subcontractors on a Time and Material basis and has received approval prior to the commencement of such Work, in accordance with the requirements of subsection GC 3.09, Subcontracting by the Contractor, the Owner shall pay the cost of Work on a Time and Material Basis by the Subcontractor calculated as if the Contractor had done the Work on a Time and Material Basis, plus a markup calculated on the following basis:

a) 20% of the first $3,500; plus

b) 15% of the amount from $3,500 to $12,000; plus

c) 5% of the amount in excess of $12,000.

.02 No further markup shall be applied regardless of the extent to which the work is assigned or sublet to others. If Work is assigned or sublet to an associate, as defined by the Securities Act, no markup whatsoever shall be applied.

GC 8.02.05.09 Submission of Invoices

.01 At the start of the Work on a Time and Material Basis, the Contractor shall provide the applicable labour and Equipment rates not already submitted to the Contract Administrator during the course of such Work.

.02 Separate summaries shall be completed by the Contractor. Each summary shall include the Change Directive or Change Order number and covering dates of the Work and shall itemize separately the labour, Materials, and Equipment. Invoices for Materials, Rented Equipment, and other charges incurred by the Contractor on the Work on a Time and Material Basis shall be included with each summary.

.03 Each month the Contract Administrator shall include with the monthly progress payment, the costs of the Work on a Time and Material Basis incurred during the preceding month all in accordance with the contract administrative procedures and the Contractor's invoice of the Work on a Time and Material Basis.

.04 The final summary as per clause 8.02.05.09.02 shall be submitted by the Contractor within 60 Days after the completion of the Work on a Time and Material Basis.

GC 8.02.05.10 Payment Other Than on a Time and Material Basis

.01 Clause GC 8.02.05 does not preclude the option of the Contract Administrator and the Contractor negotiating a Lump Sum Item or unit price payment for Change in the Work, Extra Work, and Additional Work.

GC 8.02.05.11 Payment Inclusions

.01 Except where there is agreement in writing to the contrary, the compensation, as herein provided, shall be accepted by the Contractor as compensation in full for profit and all costs and expenses arising out of the Work, including all cost of general supervision, administration, and management time spent on the Work, and no other payment or allowance shall be made in respect of such Work.

GC 8.02.06 Final Acceptance Certificate

.01 After the acceptance of the Work or, where applicable, after the Warranty Period has expired, the Contract Administrator shall issue the Final Acceptance Certificate. The Final Acceptance Certificate shall not be issued until all known deficiencies have been adjusted or corrected, as the case may be, and the Contractor has discharged all obligations under the Contract.

.02 Any remaining amount of security shall be released upon Final Acceptance of the Contract.

GC 8.02.07 Records

.01 The Contractor shall maintain and keep accurate Records relating to the Work, Changes in the Work, Extra Work, Additional Work and claims arising therefrom. Such Records shall be of sufficient detail to support the total cost of the Work, Changes in the Work, Extra Work, Additional Work and claims arising therefrom. The Contractor shall preserve all such original Records until 12 months after the Final Acceptance Certificate is issued or until all claims have been settled, whichever is longer. The Contractor shall require that Subcontractors employed by the Contractor preserve all original Records pertaining to the Work, Changes in the Work, Extra Work, Additional Work and claims arising therefrom for a similar period of time.

.02 The Owner may inspect and audit the Contractor's Records relating to the Work, Changes in the Work, Extra Work, and Additional Work at any time during the period of the Contract. The Contractor shall supply certified copies of any part of its Records required, whenever requested by the Owner.

GC 8.02.08 Taxes

.01 Where a change in Canadian Federal or Provincial taxes occurs after the date of tender closing for this Contract, and this change could not have been anticipated at the time of Tender, the Owner shall increase or decrease Contract payments to account for the exact amount of tax change involved.

.02 Claims for compensation for additional tax cost shall be submitted by the Contractor to the Contract Administrator on forms provided by the Contract Administrator to the Contractor. Such claims for additional tax costs shall be submitted not less than 30 Days after the date of Final Acceptance.

.03 Where the Contractor benefits from a change in Canadian Federal or Provincial taxes, the Contractor shall submit to the Contract Administrator on forms provided by the Contract Administrator, a statement of such benefits. This statement shall be submitted not later than 30 Days after Final Acceptance.

.04 Changes in Canadian Federal or Provincial taxes that impact upon commodities, which when left in place form part of the finished Work, or the provision of services, where such services form part of the Work and where the manufacture or supply of such commodities or the provision of such services is carried out by the Contractor or a Subcontractor, are subject to a claim or benefit as detailed above. Services in the latter context means the supply and operation of Equipment, the provision of labour, and the supply of commodities that do not form part of the Work.

.05 The Contractor shall add the Harmonized Sales Tax (HST) to all invoices.

GC 8.02.09 Liquidated Damages

.01 When liquidated damages are specified in the Contract and the Contractor fails to complete the Work in accordance with the Contract, the Contractor shall pay such amounts as are specified in the Contract Documents.

APPENDIX E – CONSTRUCTION SPECIFICATIONS

DIVISION 01 INDEX

DESCRIPTION OF PROVISIONAL ITEMS

PART 1 GENERAL

1.1 DESCRIPTION

.1 This section provides a detailed description of the work to be included in the provisional items indicated on page 3 of the Form of Tender, item 2.2 Schedule of Provisional Items.

PART 2 PROVISIONAL ITEMS

2.1 ITEM NO. P1 – BIOSOLIDS STORAGE TANKS AND MIXING SYSTEM

.1 Supply and Installation of new Biosolids Storage Tank as per Section 44 50 60 and Drawing P0014 and Area 7000 Drawings.

.2 Supply and Installation of new Biosolids Storage Tank Mixing System as per Section 44 07 50 and Section 44 50 61 and as indicated on Drawing P0014 and Area 7000 Drawings.

.3 Provisional Electrical Items:

.1 Supply and installation of new VFDs and associated power and control wiring to biosolids mixing pumps 1 and 2 as indicated on E7501.

.2 Removal of existing plc control panel RTU-3

.3 Provision of network panel NP-71 and PLC control panel CP-71.

2.2 ITEM NO. P2 – OUTFALL DIFFUSER

.1 Supply and Installation of a new outfall diffuser, complete with 4 diffuser ports, as per Section 33 31 14 and Drawing C0100

2.3 ITEM NO. P3 – BIOSOLIDS TRANSFER PUMPS

.1 Supply and Installation of a new biosolids storage pump for solids transfer to biosolids storage as per Section 44 07 50 and Drawings P0013 and P2207.

.2 Provisional Electrical Items:

.1 Supply and installation of VFDs in MCC-30 and associated power and control wiring to biosolids transfer pumps as indicated on drawing E3501.

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

PROVISION OF CONTRACT DOCUMENTS

PART 1 GENERAL

1.1 DESCRIPTION

.1 Following execution of the Contract, an "Approved for Construction" digital revision of the drawings and specifications, which incorporates all addenda issued during the tendering period, will be prepared by the Contract Administrator and provided to the contractor for their review. The contractor shall review the "Approved for Construction" drawings and specifications to confirm that all addenda are included and confirm his acceptance in writing to the Contract Administrator.

.2 The "Approved for Construction" drawings will be provided to the contractor for their initial review no later than 3 weeks following execution of the contract. No claims for delays by the contractor will be considered relating to this schedule.

.3 Following acceptance of the "Approved for Construction" drawings and specifications by the contractor, the Contract Administrator will supply the following items to the contractor:

.1 Access to download the entire set of "Approved for Construction" drawings and specifications in PDF format.

.4 If the contractor requires printed copies of the drawings or specifications, they can be purchased, at the contractor's expense, from the copying company used by the Contract Administrator. Alternatively, the contractor can reproduce the drawings from the PDF version provided.

.5 Electronic drawings in AutoCAD/Revit format are available to the contractor if so requested. Contractor will be responsible to sign a release form provided by the Contract Administrator prior to receiving AutoCAD/Revit drawings. AutoCAD drawings will only be provided on a case-by-case basis at the Contract Administrators' discretion and the contractor will be expected to justify the need for the AutoCAD drawings. Note that some ACAD drawings may require additional Autodesk software to be fully compatible (i.e. Civil3D 2010, Revit, etc.).

END OF SECTION

SUMMARY OF WORK

PART 1 GENERAL

1.1 SECTION INCLUDES

.1 Title and description of Work.

.2 Contractor use of premises.

.3 Owner occupancy.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

.1 Work of this Contract comprises construction of the Phase 1 Upgrades to the existing Wastewater Treatment Plant (WWTP) at 15005 Long Sault Parkway, Ingleside, Ontario. The work associated with this contract includes, but is not limited to, the following:

.1 Construction of a new Headworks building including all architectural, civil, structural, mechanical, electrical, instrumentation and process elements as defined within the contract documents.

.2 Construction of a new UV Disinfection building including all architectural, civil, structural, mechanical, electrical, instrumentation and process elements as defined within the contract documents.

.3 Rehabilitation of elements of the existing Administration Building as defined within the contract documents.

.4 Coordination and Temporary by-passing of the existing outfall metering channel to allow for construction of the new UV Channel followed by connection of the UV facility to the outfall.

.5 All new yard piping, water and stormwater conveyance infrastructure to service the new facilities as well as connections/extensions with the existing wastewater collection system and existing outfall.

.6 Work covered by the contract documents includes Construction of, and Commissioning of the facility as per Section 01 91 13 – Commissioning (Cx) and Division 01 contract documentation requirements.

1.3 CONTRACTOR USE OF PREMISES

.1 Contractor has unrestricted use of site provided that all relevant Township of South Stormont municipal by-laws are adhered to including but not limited to noise, traffic, use of highways and accessibility.

.2 Coordinate use of premises under direction of Contract Administrator.

.3 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.

.4 Remove or alter existing work to prevent injury or damage to portions of existing work which remain.

.5 Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work, as directed by Contract Administrator.

.6 The contractor shall provide all work and/or material required to achieve this including but not limited to temporary pumping, flow diversion structures, temporary power, and intermediate alarming.

.7 Provide 24hr monitoring of all temporary equipment that is not connected and monitored by the alarm monitoring and dialing device as require to ensure 24 hours per day 7 days per week monitoring of the system.

1.4 OWNER OCCUPANCY

.1 Cooperate with Owner in scheduling operations to minimize conflict and to facilitate Owner usage.

1.5 ON-SITE DOCUMENTS

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

.2 Maintain at job site, a minimum of one copy of each document as follows:

.1 Contract Drawings
.2 Specifications
.3 Addenda
.4 Reviewed Shop Drawings
.5 List of Outstanding Shop Drawings
.6 Change Orders
.7 Other Modifications to Contract
.8 Field Test Reports
.9 Copy of Approved Work Schedule
.10 Health and Safety Plan and Other Safety Related Documents
.11 Documents as specified.
.12 On-going, up-to-date As-Built markups

1.6 PERMITS AND FEES

.1 Owner will be responsible for plumbing permits, road cut and boulevard permits.

.2 The Contractor will be responsible for:

.1 electrical permits per the Electrical Safety Authority (ESA) will be the responsibility of the contractor.

.2 All other applicable permit and connection fee's, including NG gas permits.

.3 Hydro One cost will be covered under an allowance.

.4 Bell cost will be covered under an allowance

.5 Office furniture will be covered under an allowance

.6 Other items as defined through the contract documentation and the Allowances Specification 01 21 00.

.7 The work shall not commence until all Ministry of Environment, Conservation and Parks (MECP) approvals have been issued including the Environmental Compliance Approval and the Permit to Take Water, the applications for both of which have been submitted.

1.7 CONTRACT METHOD

.1 Construct the work under the lump sum contact as outlined in the Form of Tender.

.2 Work will be paid on a percent completion basis with a breakdown, as described in various specifications, with insufficient items and detail to track the work progress, at a minimum broken down by specification sections.

1.8 WORK BY OTHERS

.1 Cooperate with other contractors in carrying out their respective works and carrying out instructions from the Contract Administrator.

.2 Coordinate work with that of other Contactors. In any part of work under this Contract depends for its proper execution or result upon work of another Contractor, report promptly to Contract Administrator, in writing, any defect which may interfere with proper execution of Work.

1.9 PARTIAL OWNER OCCUPANCY [NOT USED]

.1 Schedule and substantially complete designated portion so Work for Owner's occupancy prior to Substantial Performance of entire Work as require to phase and complete the project as per the approved schedule and in accordance with the Contract Administrator.

1.10 ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING FACILITIES

.1 Execute work with least possible interference or disturbance to public and normal use of premises. Arrange with the Contract Administrator to facilitate execution of work.

.2 The existing plant shall remain in operations for the duration of the project. Contractor shall not interfere with day-to-day operations of the existing facility and will facilitate a smooth transition from the operation of the existing plant to the new sewage works.

1.11 EXISTING SERVICES

.1 Notify the Contract Administrator and utility companies of intended interruption of services and obtain required permission and permits.

.2 Where work involves breaking into or connecting to existing services, give the Contract Administrator a minimum 72 hours notice for necessary interruption of mechanical or electrical service throughout course of work. Minimize duration of interruptions. Carry out work at times as directed by governing authorities with minimum disturbance to vehicular traffic and services.

.3 Provide alternative routes for vehicular traffic as required.

.4 Establish location and extent of service lines in area of work before starting work. Notify Engineer of findings.

.5 Submit schedule to and obtain approval of Contract Administrator for any shutdown or closure of active service or facility including power and communications services. Adhere to approved schedule and provide notice to affected parties.

.6 Provide adequate bridging over trenches or roads to permit normal traffic.

.7 Where unknown services are encountered, immediately advise the Contract Administrator and confirm findings in writing. The contractor is responsible to be familiar with the existing As-Built/Facility Drawing package and shall assume that previously abandoned work has been left, buried underground.

.8 Protect, relocate or maintain existing active services. When inactive services are encountered, cap off in manner approved by authorities having jurisdiction.

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

PRODUCTS (NOT APPLICABLE)

EXECUTION

1.12 RECOMMENDED SEQUENCE OF CONSTRUCTION

.1 Prepare schedule, sequencing and plan, complete preliminary planning for all required temporary electrical connections and process termination locations.

.2 Engage equipment suppliers, issue purchase orders and coordinate the shop drawing process in order to begin equipment fabrication as soon as possible.

.3 Complete the site set up including Erosion and Sediment Controls Plan and monitoring.

.4 Obtain all require permits.

.5 Complete the temporary outfall bypass.

.6 Install sub-drains, shoring and temporary dewatering as necessary to complete the construction of the foundations, tanks, structures, foundations and yard piping.

.7 Construct the buildings, install equipment, tie-in digester basement, plan and coordinate and execute all tie-ins with all trades.

.8 Install and test all mechanical, electrical and process components in both permanent and temporary power conditions.

.9 Complete outfall tie-in to existing new UV Building.

.10 Complete the tie-in between the new Headworks Building and Aeration Building.

.11 Complete shut-down and tie in for new forcemain extension to the new Headworks Building.

.12 Commission the new facility in coordination with the Owner and Contract Administrator.

.13 P1 – Complete the installation of new Biosolids Storage Tanks and Mixing System.

.14 P2 – Complete the installation of the new outfall diffuser.

.15 P3 – Complete the installation of the biosolids transfer pumps.

END OF SECTION

ALLOWANCES

PART 1 DEMOLITION

.1 Inclusion of Allowances in the Tender Price is not to be construed as implying that any or all of the Allowances will be expended.

.2 Expend each allowance as directed by Contract Administrator.

PART 2 CASH ALLOWANCES

.1 Cash Allowances cover only the net cost to the Contractor of the items, materials, services or contract referred to, as verified by invoices to be submitted to Contract Administrator.

.2 The Contract Price, and not the cash allowances, includes all construction machinery and equipment, freight, handling, unloading, storage, installation, coordination, supervision, overhead and profit and other costs necessary to incorporate the allowance products, services, or contracts into the project, except as otherwise noted.

.3 Each cash allowance will be adjusted to actual cost as defined hereunder and contract price will be amended accordingly by written order.

.4 Contract Price will be adjusted by written order to provide for an excess or deficit to each cash allowance.

.5 Progress payments for work and material authorized under cash allowances will be made in accordance with contract terms of payment.

.6 The Contract Price and not cash allowance, includes contractor’s overhead and profit in connection with such cash allowance.

.7 Progress payments on accounts of work authorized under cash allowances shall be included in monthly certificate for payment.

.8 Schedule shall be prepared jointly by Contract Administrator and Contractor to show when items called for under cash allowances must be authorized by Contract Administrator for ordering purposes so that progress of work will not be delayed.

.9 Provide the following Cash Allowances.

.1 Include $15,000 excluding HST for obtaining the Building Permits. This allowance is only to be used to reimburse the contractor for the Building Permit fee invoices.

.2 Include $20,000 excluding HST for the Utility Connection Fees (Hydro One, Gas and Bell) permit and approval fees associated with the field inspection application to obtain approvals and use permits. This allowance is only to be used to reimburse the contractor for Utility Fee invoices.

.3 Include $10,000 excluding HST for the communications equipment and installation. This allowance is only to be used to reimburse the contractor for additional communications equipment and installation not currently identified in the contract documentation.

.4 Include $10,000 excluding HST for miscellaneous furniture and equipment not currently identified in the contract documentation.

.5 Include $25,000 excluding HST for additional analytical equipment not currently identified in the contract documentation.

PART 3 PRODUCTS (NOT APPLICABLE)

PART 4 EXECUTION (NOT APPLICABLE)

END OF SECTION

TESTING AND LABORATORY SERVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

.1 Inspecting and testing by inspecting firms or testing laboratories designated by Contract Administrator

1.2 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

.1 Particular requirements for inspection and testing to be carried out by testing laboratory designated by Contract Administrator are specified under various sections.

1.3 APPOINTMENT AND PAYMENT

.1 Contract Administrator will appoint and pay for services of testing laboratory except as follows:

.1 Inspection and testing required by laws, ordinances, rules, regulations or orders of public authorities.

.2 Inspection and testing performed exclusively for Contractor's convenience, and Contractor’s QA/QC program.

.3 Testing, adjustment and balancing of conveying systems, mechanical and electrical equipment and systems.

.4 Mill tests and certificates of compliance.

.5 Tests specified to be carried out by Contractor under the supervision of Contract Administrator.

.6 Additional tests specified in the following paragraph.

.2 Where tests or inspections by designated testing laboratory reveal Work not in accordance with contract requirements, pay costs for additional tests or inspections as required by Contract Administrator to verify acceptability of corrected work.

1.4 CONTRACTOR'S RESPONSIBILITIES

.1 Provide labour, equipment and facilities to:

.1 Provide access to Work to be inspected and tested.

.2 Facilitate inspections and tests.

.3 Make good Work disturbed by inspection and test.

.4 Provide storage on site for laboratory's exclusive use to store equipment and cure test samples.

.2 Notify Contract Administrator sufficiently in advance of operations to allow for assignment of laboratory personnel and scheduling of test.

.3 Where materials are specified to be tested, deliver representative samples in required quantity to testing laboratory.

.4 Pay costs for uncovering and making good Work that is covered before required inspection or testing is completed and approved by Contract Administrator.

PRODUCTS (NOT APPLICABLE)

EXECUTION (NOT APPLICABLE)

END OF SECTION

PROJECT MANAGEMENT AND COORDINATION

PART 1 GENERAL

1.1 SECTION INCLUDES

.1 Coordination work with other contractors and subcontractors under administration of Contract Administrator.

.2 Scheduled project meetings.

1.2 RELATED SECTIONS

.1 Section 01 11 00 – Summary of Work.

.2 Section 01 91 13 – General Commissioning (Cx) Requirements.

1.3 DESCRIPTION

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

1.4 PROJECT MEETINGS

.1 Project meetings to be held at times and locations as determined by Contract Administrator.

.2 Contract Administrator will arrange project meetings, record and distribute minutes.

1.5 CONSTRUCTION ORGANIZATION AND START UP

.1 Within ten (10) working days after award of Contract, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.

.2 Establish time and location of meetings and notify parties concerned minimum 5 days before meeting.

.3 Agenda to include following:

.1 Appointment of official representative of participants in Work.

.2 Schedule of Work, progress scheduling in accordance with Section 01 32 00 Construction Progress Documentation.

.3 Schedule of submission of shop drawings, samples, colour chips in accordance with Section 01 33 00 Submittal Procedures.

.4 Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences in accordance with Section 01 51 00 Temporary Utilities.

.5 Delivery schedule of specified equipment in accordance with Section 01 32 00 Construction Progress Documentation.

.6 Site security in accordance with Section 01 52 00 Construction Facilities.

.7 Proposed changes, change orders, procedures, approvals required, mark up percentages permitted, time extensions, overtime, and administrative requirements.

.8 Record drawings in accordance with Section 01 78 00 Closeout Submittals.

.9 Maintenance manuals in accordance with Section 01 78 00 Closeout Submittals.

.10 Take over procedures, acceptance, and warranties in accordance with Section 01 77 00 Closeout Procedures and 01 78 00 Closeout Submittals.

.11 Monthly progress claims, administrative procedures, photographs, and holdbacks.

.12 Appointment of inspection and testing agencies or firms in accordance with Section 01 45 00 Quality Control.

.13 Insurances and transcript of policies.

.4 Comply with Contract Administrator's allocation of mobilization areas of site; for field offices and sheds, for access, traffic, and parking facilities.

.5 During construction coordinate use of site and facilities through Contract Administrator's procedures for intra project communications: Submittals, reports and records, schedules, coordination of drawings, recommendations, and resolution of ambiguities and conflicts.

.6 Comply with instructions of Contract Administrator for use of temporary utilities and construction facilities.

1.6 ON SITE DOCUMENTS

.1 Maintain at job site, one copy each of the following:

.1 Contract drawings.

.2 Specifications.

.3 Addenda.

.4 Reviewed shop drawings.

.5 List of outstanding shop drawings.

.6 Change orders.

.7 Other modifications to Contract.

.8 Field test reports.

.9 Copy of approved Work schedule.

.10 Health and Safety Plan and other Safety related documents.

.11 Manufacturers' installation and application instructions.

.12 Labour conditions and wage schedules.

.13 Other documents as specified.

1.7 SCHEDULES

.1 Submit preliminary construction progress schedule in accordance with Section 01 32 00 Construction Progress Documents to Contract Administrator coordinated with Contract Administrator's project schedule. Schedule to show anticipated progress stages and final completion of work within time period required by contract documents.

.2 After review, revise and resubmit schedule to comply with project schedule requirements.

.3 During progress of Work revise and resubmit at project progress meetings or as directed by Contract Administrator.

1.8 SUBMITTALS

.1 Make submittal to Contract Administrator for review.

.2 Submit preliminary shop drawings, product data and samples in accordance with Section 01 33 00 – Submittal Procedures for review for compliance with Contract Documents; for field dimensions and clearances, for relation to available space, and for relation to Work of other contracts. After review, revise and resubmit for transmittal to Contract Administrator.

.3 Submit requests for payment for review to Contract Administrator.

.4 Submit requests for interpretation of Contract Documents, and obtain instructions through Contract Administrator.

.5 Process change orders through Contract Administrator.

.6 Deliver closeout submittals for review by Contract Administrator.

.7 Coordinate commissioning through the Contract Administrator.

1.9 COORDINATION DRAWINGS

.1 Provide information required by Contract Administrator for preparation of coordination drawings.

.2 Review and approve revised drawings for submittal to Contract Administrator.

.3 Contract Administrator may furnish additional drawings for clarification. These additional drawings have same meaning and intent as if they were included with plans referred to in contract documents.

1.10 CLOSEOUT PROCEDURES

.1 Notify Contract Administrator when Work is considered ready for Substantial Performance.

.2 Accompany Contract Administrator on preliminary inspection to determine items listed for completion or correction.

.3 Comply with Contract Administrator's instructions for correction of items of Work listed in executed certificate of Substantial Performance and for access to Owner occupied areas.

.4 Notify Contract Administrator of instructions of items of Work determined in Contract Administrator's final inspection.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

CONSTRUCTION PROGRESS AND DOCUMENTATION

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 77 00 – Closeout Procedures.

1.2 SCHEDULES REQUIRED

.1 Submit schedules as follows:

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

1.3 FORMAT

.1 Prepare schedule in form of a horizontal bar chart.

.2 Provide a separate bar for each major item of work, trade or operation.

.3 Split horizontally for projected and actual performance.

.4 Provide horizontal time scale identifying first work day of each week.

.5 Format for listings: chronological order of start of each item of work.

.6 Identification of listings: By Systems description.

1.4 SUBMISSION

.1 Submit initial format of schedules within 15 working days after award of Contract.

.2 Submit schedules in electronic format as PDF files.

.3 Owner's Representative will review schedule and return review copy within ten (10) working days after receipt.

.4 Resubmit finalized schedule within seven (7) working days after return of review copy.

.5 Submit revised progress schedule with each application for payment.

.6 Distribute copies of revised schedule to:

.1 Job site office.

.2 Subcontractors.

.3 Other concerned parties.

.7 Instruct recipients to report to Contractor within ten (10) working days, any problems anticipated by timetable shown in schedule.

1.5 CRITICAL PATH SCHEDULING

.1 Include complete sequence of construction activities.

.2 Include dates for commencement and completion of each major element of construction as follows.

.1 Site utilities and site works

.2 Foundation Work.

.3 All Concrete Works.

.4 Structural framing/Miscellaneous metals.

.5 Roofing Systems.

.6 Process Mechanical.

.7 Building Mechanical.

.8 Electrical

.9 Instrumentation and Controls

.10 Special Subcontractor Work.

.11 Process Equipment Installations.

.12 TSSA Review Stages.

.13 Finishes and Architectural Specialties

.3 Show projected percentage of completion of each item as of first day of month.

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

.5 Show changes occurring since previous submission of schedule:

.1 Major changes in scope.

.2 Activities modified since previous submission.

.3 Revised projections of progress and completion.

.4 Other identifiable changes.

.6 Provide a narrative report to define:

.1 Problem areas, anticipated delays, and impact on schedule.

.2 Corrective action recommended and its effect.

.3 Effect of changes on schedules of other prime contractors.

1.6 SUBMITTALS SCHEDULE

.1 Include schedule for submitting shop drawings, product data, and samples.

.2 Indicate dates for submitting, review time, resubmission time, last date for meeting fabrication schedule.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

SUBMITTALS / SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 SECTIONS INCLUDE

.1 Shop drawings and product data.

.2 Samples.

.3 Certificates and transcripts.

.4 Request for Information

1.2 RELATED SECTIONS

.1 Section 01 32 00 – Construction Progress Documentation.

.2 Section 01 45 00 – Quality Control

.3 Section 01 78 00 – Closeout Submittals

1.3 ADMINISTRATIVE

.1 This section specifies general requirements and procedures for contractor's submissions of shop drawings, product data, samples and mock-ups to Contract Administrator for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.

.2 Do not proceed with work until relevant submissions are reviewed by Contract Administrator.

.3 Present shop drawings, product data, samples and mock-ups in SI Metric units.

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

.5 Review submittals prior to submission to Contract Administrator. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project and tagged will be returned without being examined and shall be considered rejected.

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

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

.8 Contractor’s responsibility for errors and omissions in submission is not relieved by Contract Administrator’s review of submittals.

.9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Contract Administrator review of submission, unless Contract Administrator gives written acceptance of specific deviations.

.10 Make any changes in submissions which Contract Administrator may require consistent with Contract Documents and resubmit as directed by Contract Administrator. When resubmitting, notify Contract Administrator in writing of revisions other than those requested.

.11 Notify Contract Administrator, in writing, when resubmitting, of any revisions other than those requested by Contract Administrator.

.12 Keep one reviewed copy of each submission on site.

1.4 SUBMITTALS

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

.2 Coordinate each submission with requirements of work and Contract Documents. Individual submissions will not be reviewed until all related information is available.

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

.4 Allow fifteen (15) working days for Contract Administrator review of each submission.

.5 Adjustments made on shop drawings by Contract Administrator are not intended to change contract price. If adjustments affect value of Work, state such in writing to Contract Administrator immediately after receipt of approval of shop drawings. If value of work is to change, a change order must be issued prior to proceeding with work.

.6 Structural Attachments:

.1 Make changes in shop drawings as Contract Administrator may require, consistent with Contract Documents. When resubmitting, notify Contract Administrator in writing of revisions other than those requested.

.7 Accompany submissions with transmittal letter, containing:

.1 Date.
.2 Project title and number.
.3 Contractor's (and subcontractors) name and address.
.4 Identification and quantity of each shop drawing, product data and sample.
.5 Equipment / Product unique tag number

.8 Submissions shall include:

.1 Date and revision dates.
.2 Project title and number.
.3 Specification section, subsection, unique tag number to be coordinated with the Contract Administrator, and other identifying numbers.
.4 Name and address of:
.1 Subcontractor.
.2 Supplier.
.3 Manufacturer.
.5 Contractor's stamp, signed by Contractor’s authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
.6 Details of appropriate portions of Work as applicable:
.1 Fabrication.
.2 Layout, showing dimensions, including identified field dimensions, and clearances.
.3 Setting or erection details.
.4 Capacities.
.5 Performance characteristics.
.6 Standards.
.7 Operating weight.
.8 Wiring diagrams.
.9 Single line and schematic diagrams.
.10 Relationship to adjacent work.

.9 After Contract Administrator review, distribute copies.

.10 Submit one electronic copy in PDF format of shop drawings for each requirement requested in specification Sections and as Contract Administrator may reasonably request.

.11 Submit electronic copy in PDF format of product data sheets or brochures for requirements requested in Specification Sections and as requested by Contract Administrator where shop drawings will not be prepared due to standardized manufacture of product.

.12 Delete information not applicable to project.

.13 Identify the particular product selections, all feature codes and details.

.14 Supplement standard information to provide details applicable to project.

.15 Cross-reference product data information to applicable portions of Contract Documents.

.16 If upon review by Contract Administrator, no errors or omissions are discovered or if only minor corrections are made, copies will be returned and fabrication and installation of work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of work may proceed. All resubmissions must be complete, resubmission of parts of the shop drawing is not acceptable, whole submissions are required.

.17 Samples: examples of materials, equipment, quality, finishes, workmanship. Label samples with origin and intended use.

.18 Notify Contract Administrator in writing, at time of submission of deviations in samples from requirements of contract documents.

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

.20 Adjustments made on samples by Contract Administrator are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Contract Administrator prior to proceeding with Work.

.21 Make changes in samples, which Contract Administrator may require, consistent with Contract Documents.

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

.23 Submit drawings stamped and signed by Professional Engineer registered or licensed in the Province of Ontario.

1.5 MOCK-UPS

.1 Mock-up: Field erection example of work complete with specified materials and workmanship.

.2 Provide mock-ups requested in various sections of specifications and as may be reasonably required by the Owners Representative.

.3 Erect mock-ups at locations acceptable to the Owners Representative.

.4 Reviewed and accepted mock-ups will become standards of workmanship and material against which installed work will be verified.

.5 Erect mock-ups in accordance with Section 01 45 00 - Quality Control.

1.6 SAMPLES

.1 Submit samples requested in various sections of specification and as may be reasonably required by the Contract Administrator.

.2 Submit samples of adequate size and range of colours or textures to represent material in intended use on project.

.3 Unless the precise colour and pattern is specifically described in the contract documents, wherever a choice of colour or pattern is available in a specified product, submit accurate colour and pattern charts to the Engineer for selection.

.4 Material used on project shall match approved samples for quality, colour and texture, finish and performance. Do not proceed with work until samples are approved.

1.7 PROGRESS PHOTOGRAPHS

.1 Progress photograph to be electronically formatted and labelled as to location and view. These should be submitted monthly with the progress payment certificate.

1.8 SHOP DRAWINGS REVIEW

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

1.9 STRUCTURAL ATTACHMENTS

.1 Contractor to engage a third party Professional Structural Engineer, licensed to practice in the Province of Ontario, for submission of stamped and signed shop

drawings indicating acceptable mounting procedures for all equipment which is suspended, mounted or otherwise attached, as per Section 01 91 13 – Commissioning (Cx) Requirements. The Structural Engineer to also verify correct installation of the equipment.

1.10 DOCUMENTATION REQURIED BEFORE CONSTRUCTION START

.1 Insurance Forms

.2 Performance Bond and Labour & Material Payment Bond as called for in the Information for Tenders and the General Conditions.

.3 WSIB Clearance Certificate, naming the project. This will also be required with each monthly progress claim, Workplace Safety and Insurance Board Clearance Certificate.

.4 Ministry of Labour Project Notice and Site-Specific Health and Safety Items.

1.11 STATUTORY DECLARATION

.1 Submit, with each monthly progress claim, a Statutory Declaration certifying that claim all payments for any liability for which the Owner might become responsible, if unpaid, have been paid.

1.12 AS-BUILT DRAWINGS

.1 Maintain contract drawings at site office for record purposes. Record accurately deviations from contract documents caused by site conditions, change orders, site instructions, and addenda. Mark in red ink. Provide one table for this set to be placed on. The As-Built records must be maintained up-to-date and prepared as the work progresses. In order for any progress payment to be issued, the contractor is required to review the as-built drawings with the Contract Administrator prior to submitting any/all progress claims.

.2 Consult Mechanical and Electrical Divisions for other particular requirements.

.3 Prior to start of Testing and Commissioning, finalize production of as-built drawings.

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

.5 Submit to Contract Administrator for approval and make corrections as directed.

.6 Commissioning to be performed using as-built drawings.

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

.8 Submit copies of as-built drawings for inclusion in final Operation and Maintenance Manuals.

1.13 SCHEDULE OF VALUES

.1 Itemize separately: individual sections of specifications, different phases of the work, bonds & permits, mobilization field supervision and layout, temporary facilities and controls, major equipment, material costs delivered, installation costs, each allowance, clean up, hand over and commissioning.

.2 Prior to submission of the first progress draw, submit a cash flow of all anticipated progress draw values by month for the entire project duration before deduction of holdback amounts and exclusive of anticipated changes.

1.14 PROGRESS REPORTS

.1 Contractor shall prepare daily reports of their operations. Daily report shall contain at least the following information:

- weather conditions
- manpower on the job in each trade
- major items of equipment on the job
- a brief summary of work accomplished that day
- materials, equipment, or owner-furnished items arriving or leaving site
- inspection reports
- significant events
- any tests made and their final results, if known
- any oral instructions received
- visitors to the job

.2 Contractor shall maintain a file of copies of all daily reports on the site and make it available to the Contract Administrator upon request.

.3 Commissioning forms, as further described in sections 01 91 13, 01 91 33, and 01 91 41, shall be prepared and submitted at appropriate times.

1.15 OPERATIONS AND MAINTENANCE MANUALS

.1 Prior to substantial performance, inspection, submit to Consultant, three (3) hard copies and a searchable, digital PDF of the of Instruction and Maintenance Manuals as follows:

.1 Bind data in 215 x 279mm, vinyl covered, locking three-ring loose-leaf binders.

.2 Enclose title sheet, labelled “Instruction and Maintenance Manual” with project name, list of contents, date and names of Owner, Consultant, and Contractor.

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

.2 All operation and maintenance manuals to be submitted in English only.

.3 Neatly type lists and notes. Use clear drawings, diagrams or manufacturer’s literature.

.4 Contents:

.1 As called for in individual sections of these specifications.

.2 Maintenance instructions for exterior and interior floor, wall, and ceiling surfaces as well as all installed fittings as printed by manufacturer.

.3 Operating and maintenance instructions for mechanical, electrical and process equipment called for in Division 20 through 29 and 44 bound separately.

.4 Colour schedule; hardware schedule.

.5 Copies of all guarantees and warranties.

.6 Complete set of final approved shop drawings, bound separately, indicating corrections and charges made during fabrication and installation.

.7 Names, addresses, and phone numbers of sub-contractors and suppliers.

.8 WHMIS Manual described in Section 01 35 30.

1.16 MAINTENANCE MATERIALS

.1 Compile a complete list of all materials and spare parts contained within the various sections of the contract. Turn over these materials and spare parts to the Owners Representative and obtain receipt transmittal. Submit materials in unbroken cartons or if not available in cartons, strongly packed. Identify item, function, colour, room number, unit number, tag number and area materials used on an indelible tag affixed to the packaging.

1.17 DOCUMENTS REQUIRED FOR SUBSTANTIAL PERFORMANCE

.1 Documents required prior to Substantial Performance include:

.1 As-Built Record Drawings.

.2 Manuals of Instruction and Maintenance including:
- .1 Warranties
- .2 Final approved shop drawings
- .3 Schedules
- .4 WHMIS Manual.

.3 Post construction survey drawings.

.4 Mechanical
- .1 Testing, Adjusting and Balancing (TAB) reports
- .2 Operation and Maintenance Manual
- .3 Demonstration and Operating and Maintenance Instruction
- .4 Individual equipment certification and training session outlined in Mechanical Sections and mechanical process section.

.5 Electrical
- .1 Operation and Maintenance Manual
- .2 Electrical Inspection Certificate
- .3 F/A verification certificate (where applicable)
- .4 Demonstration and Operating and Maintenance Instruction

.6 Process
- .1 Operation and Maintenance Manual.
- .2 Commissioning and testing reports.
- .3 CAD “As-built” and/or record drawings.
- .4 Individual equipment certification by the manufacturers.
- .5 Training sessions as outlined by Division 01 91 41 and Division 44 have been completed.
- .6 Piping inspection reports.
- .7 Results of cleaning and disinfection.

PRODUCTS (NOT APPLICABLE)

EXECUTION (NOT APPLICABLE)

END OF SECTION

HEALTH AND SAFETY REQUIREMENTS

PART 1 GENERAL

1.1 REFERENCES

.1 Canadian Standards Association (CSA)

- .1 CAN/CSA-Z259.1 Body Belts and Saddles for Work Positioning and Travel Restraint.
- .2 CAN/CSA-Z259.10 Full body Harnesses.
- .3 CAN/CSA-Z259.11 Energy Absorbers and Lanyards.
- .4 CAN/CSA-Z259.2.1 Fall Arresters, Vertical Lifelines and Rails.
- .5 FCC No. 301 Standard for Construction Operations.
- .6 CSA Z275.2 Occupational Safety Code for Diving Operations.
- .7 CSA Z275.4 Competency Standard for Divers Operations.
- .8 CSA Z797, Code of Practice for Access Scaffold.

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

.3 Transportation of Dangerous Goods Act Regulations.

.4 Occupational Health and Safety Regulation for Construction Projects, Revised Statutes of Ontario, Chapter 321, as amended Regulation 691.

.5 The Workplace Safety & Insurance Act 1997, and regulations as amended.

.6 Ontario Building Code 1997 Regulation 403/97 as amended.

.7 The Occupational Health and Safety Act – Revised Statues of Ontario, Revised Regulation 692/80.

.8 Consolidated Ontario MOL Regulations 860 WHMIS Regulations Under the Occupational Health and Safety Act

.9 Consolidated Ontario and Regulations Occupational Health and Safety Regulations under the Occupational Health and Safety Act.

.10 Canada Labour Code, Part 2.

.11 National Building Code of Canada.

.12 Department of Transportation and Works Occupational Health and Safety Manual.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 35 43 - Environmental Procedures.

.3 Section 01 41 00 - Regulatory Requirements.

.4 Section 02 82 00.02 – Asbestos Abatement.

1.3 SUBMITTALS

.1 At least 10 (ten) working days prior to commencing any site work: submit to Contract Administrator copies of:

.1 A complete Site Specific Health and Safety Plan. Health and Safety Plan must include:

.1 Site-specific safety hazard assessment and measures to be taken to address the anticipated hazards.

.2 Contractor's and Sub-contractor's Safety Communication Plan. Must include contract information for all key contacts.

.3 Contract Administrator will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 7 days after receipt of plan. Revise plan as appropriate and resubmit plan within 5 days after receipt of comments. Comments received from Contract Administrator should not be construed as approval and does not reduce the Contractor's overall responsibility for the Health and Safety of the construction site.

.4 Submit records, upon request, of the Contractor's Health and Safety meetings or daily/weekly tailgate meetings.

.2 If work entails confined space, submit the following:

.1 Copies of current confined space entry training certificates acceptable to WHSCC, as well as copies of confined space entry programs, confined space assessment, safe work practices and rescue plans.

.2 Acceptance of the Site Specific Health and Safety Plan and other submitted documents by the Contract Administrator shall only be viewed as acknowledgement that the contractor has submitted the required documentation under this specification section.

.3 Contract Administrator makes no representation and provides no warranty for the accuracy, completeness and legislative compliance of the Site Specific Health and Safety Plan and other submitted documents by this acceptance.

.4 Responsibility for errors and omissions in the Site Specific Health and Safety Plan and other submitted documents is not relieved by acceptance by Contract Administrator.

.5 Submit copies of reports or directions issued by Federal, Provincial or Territorial Health and Safety Inspectors.

.6 Submit copies of incident and accident reports.

.7 Submit WHMIS MSDS – Material Safety Data Sheets.

.8 Submit Workplace Safety and Insurance Board (WSIB) – Experience Rating Report.

1.4 FILING OF NOTICE

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

.2 If project requires diving, a separate Notice of Project needs to be filed with Provincial Authorities prior to commencement of work.

.3 Submit copies of Notice(s) of Project to the Contract Administrator.

.4 File all other required notices in accordance with Acts and Regulations of the Province of Ontario.

.5 Keep copy of Notice of Project onsite at all times.

1.5 PROJECT/SITE CONDITIONS

.1 Work at site will involve contact with the following hazardous materials:

.1 Watermain, water contaminated equipment, pipes, etc., the contractor will be responsible to clean any and all materials to their satisfaction in order to complete the project work.

.2 Silica in concrete (from concrete demolition and new concrete) and potentials soils.

.3 Corroded metals.

.4 Benzene in fuel oil, paints and adhesives (for new materials).

.5 Volatile organic compounds.

.2 On-site Hazards include, but are not limited to:

.1 Working near, under and/or adjacent to electrical wires.

.2 Working around heavy machinery and moving equipment.

.3 Working near, above and/or in water and/or sewage.

.4 Icy surfaces and/or ice covered water bodies.

.5 Falling hazards.

.6 Extreme temperatures or weather conditions

.7 Pressurized piping containing water or propane.

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

.1 Conduct operations in accordance with latest edition of the Ontario Occupational Health and Safety (OHSA) Act and Regulations, with specific reference to codes and standards.

.2 Prepare a detailed Site Specific Health and Safety Plan that shall identify, evaluate and control job specific hazards and the necessary control measures to be implemented for managing hazards.

.3 Provide a copy of the Site Specific Health and Safety Plan upon request to Ministry of Labour and the Contract Administrator.

.4 The written Site Specific Health and Safety Plan shall incorporate the following:

.1 Hazard assessment results.

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

.3 An organizational structure which shall establish the specific chain of command and specify the overall responsibilities of contractor's employees at the work site.

.4 A comprehensive work plan which shall:

.1 define work tasks and objectives of site activities/operations and the logistics and resources required to reach these tasks and objectives.

.2 establish personnel requirements for implementing the plan.

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

.1 Selection criteria based on site hazards.

.2 Use, maintenance, inspection and storage requirements and procedures.

.3 Decontamination and disposal procedures.

.4 Inspection procedures prior to, during and after use, and other appropriate medical considerations.

.5 Limitations during temperature extremes, heat stress and other appropriate medical consideration.

.6 An emergency response procedure, refer to Clause 1.5 Supervision and Emergency Response Procedure of this section for requirements.

.7 A hazard communication program for informing workers, visitors and individuals outside of the work area as required. This will include but not be limited to a visitor safety and orientation policy and program that will include education on hazards, required PPE and accompaniment while on site.

.8 A hearing conservation program in accordance with the OHS Regulations.

.9 A recent (current year) inspection form for all powered mobile equipment that will be used in fulfilling the terms of the contract. The inspection form shall, at a minimum, state that the equipment is in a safe operating condition.

.10 A complete listing of employee names, their driver's license classification, expiry date, endorsements and the type of equipment that they are qualified

to operate for the complete scope of work for this project. The Driver's License Number should not be provided as this is confidential information.

.11 An acceptable parking policy for all powered mobile equipment to be used on this project. The policy shall, at a minimum, be based on a hazard assessment that considers factors such as equipment type, potential for roll over, load capacity of the parking area, pedestrian and vehicular traffic, and potential for equipment tampering, equipment energy, and equipment contact with power lines.

.12 A health and safety training program which includes a safety training matrix.

.13 General safety rules.

.5 Periodically review and modify as required each component of the Site Specific Health and Safety Plan when a new hazard is identified during completion of work and when an error or omission is identified in any part of the Site Specific Health and Safety Plan.

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

.1 Be solely responsible for investigating, evaluating and managing any report of actual or potential hazards.

.2 Clearly define accident incident investigation procedures.

.3 Clearly define policy and processes for early and safe return to work.

.4 Retain copies of all completed hazard assessments at the project site and make available to the Contract Administrator immediately upon request.

.7 Implement all requirements of the Site Specific Health and Safety Plan.

.1 Ensure that every person entering the project site is informed of requirements under the Site Specific Health and Safety 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 Site Specific Health and Safety Plan.

1.7 CONTRACTORS HEALTH AND SAFETY OFFICER

.1 The contractor shall employ/designate a Contractor's H&S Coordinator (CSO).

.2 The CSO shall:

.1 Be responsible for developing, implementing, daily enforcement, monitoring and updating of the Site Specific Health and Safety Plan.

.2 Be responsible for the delivery of the site safety orientation and ensure that the personnel who have not been orientated are not permitted to enter the site. This applies to workers, inspectors and visitors.

.3 Report directly to and be under direction of the Site Superintendent or Contractor's Project Manager.

.4 Prior to mobilization on-site, hold an orientation meeting with the contractors, subcontractors and Contract Administrator to review project occupational health and safety. Include but not limit meeting to a review of:

.1 Site Specific Health and Safety Plan.

.2 Construction Safety Measures.

.3 Supervision and Emergency Rescue Procedures.

.4 Hazard Assessments

.5 Maintain a daily log of inspections, meetings, infractions and mitigating measures. Log is to be filed daily and copies to be provided to the Site Superintendent and Contract Administrator.

1.8 HEALTH AND SAFETY COMMITTEE

.1 Establish an Occupational Health and Safety Committee where ten or more workers are employed on the job site as per the OH&S Act and Regulations.

1.9 RESPONSIBILITY

.1 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.

.2 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.

.3 Where safety risks exist, the contractor must stop the work until such time as the risk can be mitigated to a safe level.

.4 Take appropriate steps to ensure that the hazards are mitigated to a safe level, workers are notified of the hazards and how to protect themselves. As well, workers must be provided with any new safe work practices or information regarding mitigation of the risk.

1.10 UNFORSEEN HAZARDS

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

1.11 INSTRUCTION AND TRAINING

.1 Workers shall not participate in or supervise any activity on the work site until they have been trained to a level required by this job function and responsibility. 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.

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

.3 Provide copies of all training certificates to Contract Administrator for review, before a worker is to enter the work site.

.4 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 Site Specific Health and Safety 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.

.6 Accompanied while on site, and provided with the appropriate PPE.

.5 All workers will be instructed and trained on the hazards associated with work they will perform and how to protect themselves. This will include a review of all safe work practices, the reporting and documentation of hazards, reporting accidents and injuries as well as, formal training in areas of high risk (i.e. fall protection, power line hazards, traffic control persons training).

.6 The work site shall have the appropriate number of persons trained in emergency and Standard First Aid according to the First Aid Regulations.

1.12 CONSTRUCTION SAFETY MEASURES

.1 Observe construction safety measures of National Building Code, latest edition, Provincial Government, OH&S Act and Regulations, Workplace Health and Safety

Compensation Commission and Municipal Authority provided that in any case of conflict or discrepancy more stringent requirements shall apply.

.2 Administer the project in a manner that will ensure, at all times, full compliance with Federal and Provincial Acts, regulations and applicable safety codes and the Site Specific Health and Safety Plan.

.3 Provide Contract Administrator with copies of all orders, directions and any other documentation, issued by the Ministry of Labour, immediately after receipt.

1.13 POSTING OF DOCUMENTS

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

1.14 HEALTH AND SAFETY MONITORING

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

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

1.15 NOTIFICATION

.1 For projects exceeding thirty (30) days or more, the contractor shall, prior to the commencement of work, notify in writing the Ministry of Labour with the following information:

.1 Name and location of construction site.

.2 Company name and mailing address of contractor doing the work.

.3 The number of workers to be employed.

.4 A copy of the Site Specific Health and Safety Plan if requested.

1.16 CORRECTION OF NON-COMPLIANCE

.1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Contract Administrator.

.2 Provide Contract Administrator with written report of action taken to correct non-compliance of health and safety issues identified within ten (10) working days.

.3 Contract Administrator may stop work if non-compliance of health and safety regulations is not corrected.

1.17 WHMIS

.1 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.

.2 Deliver copies of relevant Material Safety Data Sheets (MSDS) to job site and the Contract Administrator. The MSDS must be acceptable to Labour Canada and Health and Welfare Canada for all controlled products that will be used in the performance of this work. All MSDS should be located in accessible locations for all workers and visitors throughout the site, bound and organized in binders.

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

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

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

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

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

.1 Properly fit workers for personal protective equipment

.2 Train workers in care, use and maintenance of personal protective equipment.

.7 No controlled products are to be brought on-site without prior approved MSDS.

.8 The MSDS are to remain on site at all times.

1.18 OVERLOADING

.1 The Contractor's Full Time CSO and/or Site Superintendent shall ensure no part of work or associated equipment is subjected to loading that will endanger its safety or will cause permanent deformation.

1.19 FALSEWORK

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

1.20 SCAFFOLDING

.1 Design, erect, inspect, operate, modify, and dismantle scaffolding in accordance with CSA Z797, the OH&S Act and Regulations, and the scaffold manufacturer's written instructions.

.2 Provide trained and certified Competent Scaffold Erectors for all scaffold erection, modification and dismantling. Training certification must be valid at time of erection, modification and dismantling of scaffold.

.3 Conduct and document daily inspections of scaffolding by trained and certified Competent Scaffold Inspectors or Erectors. Training certification must be valid at the time of inspection.

.4 Provide a scaffold tagging system as described in CSA Z797.

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

1.21 WORKING AT HEIGHTS

.1 Ensure that fall restraint or fall arrest devices are used by all workers working at elevations greater than 3.05 meters above grade or floor level in accordance with CSA Z259, where alternate fall protection systems are not provided in accordance with Occupational Health and Safety Act and Regulations O.Reg. 297/13.

.2 All workers performing work at height and who will be required to utilize a fall arrest system must be trained in a fall protection program certified by the WHSCC. Training must be current and valid at the time of use.

.3 Prior to working at height workers shall be instructed in a Contractor Safe Work Practice for working at height and associated Rescue Plan for working at heights, developed specific to the work to be performed, locations and risks.

1.22 PERSONAL PROTECTIVE EQUIPMENT

.1 Ensure workers on the jobsite use personal protective equipment appropriate to the hazards identified in the Site Specific Health and Safety Plan and those workers are trained in the proper care, use, and maintenance of such equipment.

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

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

.1 No work shall be performed in an area where an airborne contaminant exceeds recommendations of the ACGIH, do not meet the appropriate standards for the specific contaminants or are not in accordance with the OHS regulations..

.2 Respiratory protection shall be provided in accordance with the requirements of the Occupational Health and Safety Branch, Services NL and these specifications.

.3 Establish, implement and maintain a respirator inspection and maintenance program in accordance with the CSA standard identified in the OHS Regulations.

.4 Copies of all respirator owners' maintenance manuals shall be kept at all times at the contractor's site office.

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

.1 Dermal protection shall be sufficient to act as a protective barrier between the skin and an airborne contaminant or hazardous material. Dermal protection shall also be provided for all physical hazards.

.2 Dermal protection equipment shall not be used after exceeding 75% of the break through time. The break through time shall be based on the contaminant which requires the least amount of time to break through the protective equipment

.3 Copies of all dermal protection user specifications, owners and maintenance manuals shall be kept at all times at the contractor's site office.

.4 Establish, implement and maintain air inspection program to ensure proper dermal protection in accordance with CSA, NIOSH, U.S. EPA and manufacturer's requirements.

.5 Provide all workers and up to five (5) visitors to the site with proper hearing protection. Workers and visitors shall not be exposed to noise levels greater than 85 dB (A) over an eight hour shift without proper hearing protection, in accordance with the Hearing Conservation Program.

.6 Provide all workers and up to five (5) visitors to the site with CSA approved eye protection sufficient to act as a protective barrier between the eye and airborne contaminants, hazardous materials and physical hazard.

.7 Provide workers and up to five (5) visitors to the site with CSA approved hard hats meeting the CSA Z94.1.

.8 Provide high visibility apparel as defined in Occupational Health and Safety Regulations.

.9 Provide CSA approved safety boots meeting CSA Z195.

.10 Provide other personal protective equipment, as may be required by the owner, depending on duties being performed.

1.23 TRAFFIC CONTROL

.1 Provide traffic control measures when working on, or adjacent to, roadways in accordance with the Ontario Traffic Manual (as amended) Book 7 Temporary Conditions and O.Reg 471/16.

1.24 EXCAVATION SAFETY

.1 Protect all excavations in accordance with Part III of O.Reg 471/16 Construction Projects.

1.25 CONFINED SPACE WORK

.1 Comply with the Ontario Occupational Health and Safety Regulations.

.2 Ensure a hazard assessment has been conducted related to the confined space and the work to be performed within the space.

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

.4 Ensure all required PPE is provided to the workers and workers are trained in its use, care and selection.

.5 Develop a confined space entry (CSE) program specific to the nature of work performed and in accordance with OH&S Act and Regulations and ensure supervisors and workers are trained in the confined space entry program. This shall include training on the CSE permit system, rescue plan, testing, communication equipment and all equipment and safe work procedures conducted in and around the confined space.

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

.6 Provide and maintain training of workers through a provider certified by the WHSCC.

.7 Provide Contract Administrator with a copy of an “Entry Permit” for each entry into the confined space to ensure compliance Provincial Legislation.

1.26 HAZARDOUS MATERIALS

.1 Should material resembling hazardous materials (e.g. asbestos/mould) not previously identified/documented be encountered during the execution of work, stop work and notify Contract Administrator. Do not proceed until written instructions have been received from Contract Administrator.

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

1.27 HEAVY EQUIPMENT

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

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

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

.4 Equip cranes with:

.1 A mechanism which will effectively prevent the hook assembly from running into the top boom pulley.

.2 A legible load chart.

.3 A maintenance log book.

1.28 TREE AND BRUSH CLEARING

.1 Ensure workers using chain saws wear the following safety equipment:

.1 CSA safety hat.

.2 Hearing protection, e.g. ear muffs.

.3 CSA approved chain saw pants.

.4 CSA approved chain saw boots.

.5 CSA approved eye protection.

.2 Ensure that all workers using brush saws wear the following safety equipment:

.1 CSA approved safety hat fitted with face screen or shield or approved safety glasses.

.2 Hearing protection, e.g. ear muffs.

.3 CSA approved safety footwear.

.3 Equip chain saws with a safety chain break.

.4 A safe work practice (SWP) must be developed, implemented and all workers trained in the SWP prior to undertaking such tasks and utilizing tree and brush clearing equipment.

1.29 WORK STOPPAGE

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

1.30 EQUIPMENT LOCK-OUT/TAG-OUT

.1 The Contractor shall coordinate and comply with CSA Z460-05 (R2010) “Control of Hazardous Energy – Lockout and Other Methods” for all machines, equipment and process requiring isolation.

PRODUCTS (NOT APPLICABLE)

EXECUTION (NOT APPLICABLE)

END OF SECTION

ENVIRONMENTAL PROTECTION

PART 1 GENERAL

1.1 DEFINITIONS

.1 Environmental Pollution and Damage: presence of chemical, physical, biological elements or agents which adversely affect human health and welfare; unfavourably alter ecological balances of importance to human life; affect other species of importance to humankind; or degrade environment aesthetically, culturally and/or historically.

.2 Environmental Protection: prevention/control of pollution and habitat or environment disruption during construction. Control of environmental pollution and damage requires consideration of land, water, and air; biological and cultural resources; and includes management of visual aesthetics; noise; solid, chemical, gaseous, and liquid waste; radiant energy and radioactive material as well as other pollutants.

1.2 REFERENCE

.1 Contract Section 8: Natural Heritage Assessment Report provides requirements for the erosion and sediment control measures as well as the avoidance and mitigation measures to prevent contravention of the Endangered Species Act which shall be followed by the Contractor in execution of the Contract.

1.3 SUBMITTALS

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

.2 Prior to commencing construction activities or delivery of materials to site, submit Environmental Protection Plan for review and approval by Contract Administrator Environmental Protection Plan is to present comprehensive overview of known or potential environmental issues which must be addressed during construction.

.3 Address topics at level of detail commensurate with environmental issue and required construction tasks.

.4 Environmental protection plan shall include:

.1 Names of persons responsible for ensuring adherence to Environmental Protection Plan.

.2 Names and qualifications of persons responsible for training site personnel.

.3 Descriptions of environmental protection personnel training program.

.4 Erosion and sediment control plan which identifies type and location of erosion and sediment controls to be provided including monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Provincial, and Municipal laws and regulations.

.5 Drawings showing locations of proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials including methods to control runoff and to contain materials on site.

.6 Traffic control plans including measures to reduce erosion of temporary roadbeds by construction traffic, especially during wet weather. Plans include measures to minimize amount of mud transported onto paved public roads by vehicles or runoff.

.7 Work area plan showing proposed activity in each portion of area and identifying areas of limited use or non-use. Plan to include measures for marking limits of use areas including methods for protection of features to be preserved within authorized work areas.

.8 Spill Control Plan: including procedures, instructions, and reports to be used in event of unforeseen spill of regulated substance.

.9 Non-Hazardous solid waste disposal plan identifying methods and locations for solid waste disposal including clearing debris.

.10 Air pollution control plan detailing provisions to assure that dust, debris, materials, and trash, do not become air borne and travel off project site.

.11 Contaminant prevention plan that: identifies potentially hazardous substances to be used on job site; identifies intended actions to prevent introduction of such materials into air, water, or ground; and details provisions for compliance with Federal, Provincial, and Municipal laws and regulations for storage and handling of these materials.

.12 Waste water management plan that identifies methods and procedures for management and/or discharge of waste waters which are directly derived from construction activities, such as concrete curing water, clean-up water, dewatering of ground water, disinfection water, hydrostatic test water, and water used in flushing of lines.

.13 Historical, archaeological, cultural resources biological resources and wetlands plan that defines procedures for identifying and protecting historical, archaeological, cultural resources, biological resources and wetlands.

.14 Pesticide treatment plan: to be included and updated, as required.

1.4 FIRES

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

1.5 DISPOSAL OF WASTES

.1 Do not bury rubbish and waste materials on site.

.2 Do not dispose of waste or volatile materials, such as mineral spirits, oil or paint thinner into waterways, storm or sanitary sewers.

1.6 DRAINAGE

.1 Provide temporary drainage and pumping as necessary to keep excavations and site free from water.

.2 Do not pump water containing suspended materials into waterways, sewer or drainage systems.

.3 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authority requirements.

1.7 SITE CLEARING AND PLANT PROTECTION

.1 Protect trees and plants on site and adjacent properties where indicated.

.2 Wrap in burlap, trees and shrubs adjacent to construction work, storage areas and trucking lanes, and encase with protective wood framework from grade level to height of 2 m.

.3 Protect roots of designated trees to dripline during excavation and site grading to prevent disturbance or damage. Avoid unnecessary traffic, dumping and storage of materials over root zones.

.4 Minimize stripping of topsoil and vegetation.

.5 Restrict tree removal to areas indicated or designated by Contract Administrator.

1.8 WORK ADJACENT TO WATERWAYS

.1 Do not operate construction equipment in waterways.

.2 Do not use waterway beds for borrow material.

.3 Do not dump excavated fill, waste material or debris in waterways.

.4 Design and construct temporary crossings to minimize erosion to waterways.

.5 Do not skid logs or construction materials across waterways.

.6 Avoid indicated spawning beds when constructing temporary crossings of waterways.

.7 Do not blast under water or within 100 m of indicated spawning beds.

1.9 POLLUTION CONTROL

.1 Maintain temporary erosion and pollution control features installed under this contract.

.2 Control emissions from equipment and plant to local authorities emission requirements.

.3 Prevent sandblasting and other extraneous materials from contaminating air beyond application area, by providing temporary enclosures.

.4 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.

1.10 NOTIFICATION

.1 Contract Administrator will notify Contractor in writing of observed non-compliance with Federal, Provincial or Municipal environmental laws or regulations, permits, and other elements of environmental protection. Contractor: after receipt of such notice, inform Contract Administrator of proposed corrective action and take such action as approved by Contract Administrator.

.2 Contract Administrator may issue stop order of work until satisfactory corrective action has been taken.

.3 No time extensions will be granted or equitable adjustments allowed to Contractor for such suspensions.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

QUALITY CONTROL

PART 1 GENERAL

1.1 SECTIONS INCLUDE

.1 Inspection and testing, administrative and enforcement requirements.

.2 Tests and mix designs.

.3 Mock-ups.

.4 Mill tests.

.5 Equipment and system adjust and balance.

1.2 RELATED SECTIONS

.1 Section 01 21 00 – Allowances.

.2 Section 01 33 00 – Submittal Procedures

.3 Section 01 78 00 – Closeout Submittals

1.3 INSPECTION

.1 Allow Contract Administrator access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.

.2 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Contract Administrator instructions.

.3 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.

.4 Contract Administrator may order any part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction. If such Work is found in accordance with Contract Documents, Contract Administrator shall pay cost of examination and replacement.

1.4 INDEPENDENT INSPECTION AGENCIES

.1 Independent Inspection/Testing Agencies will be engaged by Contract Administrator for purpose of inspecting and/or testing portions of Work.

.2 Allocated costs: to Section 01 21 00 – Allowances and Section 01 29 83 – Payment Procedures: Testing Laboratory Services.

.3 Provide equipment required for executing inspection and testing by appointed agencies.

.4 Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.

.5 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Contract Administrator at no cost to Contract Administrator. Pay costs for retesting and reinspection.

1.5 ACCESS TO WORK

.1 Allow inspection/testing agencies access to Work, off site manufacturing and fabrication plants.

.2 Co-operate to provide reasonable facilities for such access.

1.6 PROCEDURES

.1 Notify appropriate agency and Contract Administrator in advance of requirement for tests, in order that attendance arrangements can be made.

.2 Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in an orderly sequence so as not to cause delay in Work.

.3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.

1.7 REJECTED WORK

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

.2 Make good other Contractor's work damaged by such removals or replacements promptly.

.3 If in opinion of Contract Administrator it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Owner may deduct from Contract Price difference in value between Work performed and that called for by Contract Documents, amount of which shall be determined by Contract Administrator.

1.8 REPORTS

.1 Submit 3 copies of inspection and test reports to Contract Administrator, plus electronic copies in PDF format.

.2 Provide copy to Subcontractor of work being inspected or tested, manufacturer or fabricator of material being inspected or tested.

.3 Include copy of all inspection and test reports in Commissioning Manuals.

1.9 MOCK-UPS

.1 Prepare mock-ups for Work specifically requested in specifications. Include for Work of all Sections required to provide mock-ups.

.2 Construct in all locations acceptable to Contract Administrator as specified in specific Section.

.3 Prepare mock-ups for Contract Administrator review with reasonable promptness and in an orderly sequence, so as not to cause any delay in Work.

.4 Failure to prepare mock-ups in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.

.5 Remove mock-up at conclusion of Work or when acceptable to Contract Administrator

.6 Specification section identifies whether mock-up may remain as part of Work or if it is to be removed and when.

.7 Reviewed and accepted mock-ups will become standards of workmanship and material against which installed work will be verified.

.8 Mock-ups may remain as part of Work.

1.10 EQUIPMENT AND SYSTEMS

.1 Submit adjustment and balancing reports for mechanical, electrical and building equipment systems.

.2 Mechanical – coordinate with mechanical division.

.3 Electrical – Coordinate with electrical division.

1.11 FIRE SEPARATIONS

.1 Provide fire separation labelling/stenciling as per Sections 07 84 00 Fire Stopping.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

TEMPORARY UTILITIES

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 52 00 - Construction Facilities.

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

1.2 INSTALLATION AND REMOVAL

.1 Provide temporary utilities controls in order to execute work expeditiously.

.2 Remove from site all such work after use.

1.3 DEWATERING

.1 Provide temporary drainage and pumping facilities to keep excavations and site free from standing water.

.2 Refer to the attached Permit to Take Water Application for detailed dewatering requirement.

1.4 WATER SUPPLY (NOT APPLICABLE)

1.5 TEMPORARY HEATING AND VENTILATION

.1 Pay for costs of temporary heat and ventilation used during construction, including costs of installation, fuel operation, maintenance and removal of equipment. Use of direct, fired heaters discharging waste products into work areas will not be permitted unless prior approval is given by Contract Administrator.

.2 Construction heaters used inside building must be vented to outside or be non-flameless type. Solid fuel salamanders are not permitted.

.3 Provide temporary heat and ventilation in enclosed areas as required to:

.1 Facilitate progress of Work.

.2 Protect Work and products against dampness and cold.

.3 Prevent moisture condensation on surfaces.

.4 Provide ambient temperatures and humidity levels for storage, installation and curing of materials.

.5 Provide adequate ventilation to meet health regulations for safe working environment.

.4 Maintain temperatures of minimum 10˚C and relative humidity less than 60% in areas where construction is in progress.

.1 Maintain minimum temperature of 10˚C or higher where specified as soon as finished work is commenced. Maintain until acceptance of structure by Contract Administrator.

.2 Maintain ambient temperature and humidity levels as required for comfort of office personnel.

.5 Ventilating:

.1 Prevent accumulations of dust, fumes, mists, vapours or gases in areas occupied during construction.

.2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.

.3 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.

.4 Ventilate storage spaces containing hazardous or volatile materials.

.5 Ventilate temporary sanitary facilities.

.6 Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful contaminants.

.6 Maintain strict supervision of operation of temporary heating and ventilating equipment to:

.1 Conform with applicable codes and standards.

.2 Enforce safe practices.

.3 Prevent abuse of services.

.4 Prevent damage to finishes.

.5 Vent direct-fired combustion units to outside.

.7 Be responsible for damage to Work due to failure in providing adequate heat, humidity and protection during construction.

.8 Use of new or existing systems for temporary heating, ventilating or air conditioning will not be permitted.

1.6 TEMPORARY POWER AND LIGHT

.1 Provide and pay for temporary power during constructing for temporary lighting, heating, site construction trailers and operating of power tools in accordance with governing regulations and the Canadian Electrical Code, latest edition.

.2 Arrange for connection with Utility company. Pay all costs for installation, maintenance and removal of cables, distribution and branch panel boards, poles, lighting, heating and general power receptacles as required.

.3 Temporary power for electric cranes and other equipment requiring in excess of above is responsibility of Contractor.

.4 Provide and maintain temporary lighting throughout project. Ensure level of illumination on all floors and stairs is not less than 162 lx. Temporary lighting to

consist of wiring, pig tail sockets and 75 watt shatterproof incandescent lamps to provide a minimum light level of 162 lux.

.5 Electrical power and lighting systems installed under this contract may be used for construction requirements only with prior approval of Contract Administrator provided that guarantees are not affected. Make good damage to electrical system caused by use under this contract. Replace lamps which have been used for more than 3 months.

.6 General contractor responsible for payment of all electrical energy charges associated with temporary power up to date of substantial completion.

1.7 FIRE PROTECTION

.1 Provide and maintain temporary fire protection equipment during performance of Work required by insurance companies having jurisdiction and governing codes, regulations and bylaws.

.2 Burning rubbish and construction waste materials is not permitted on site.

1.8 SANITARY FACILITIES

.1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.

.2 Post notices and take precautions as required by local health authorities. Keep area and premises in sanitary condition.

.3 When permanent water and drain connections are completed, provide temporary water closets and urinals complete with temporary enclosures, inside building. Permanent facilities may be used on approval of Contract Administrator.

1.9 TEMPORARY COMMUNICATION FACILITIES

.1 Provide and pay for temporary telephone, fax, data hook up, lines and equipment necessary for own use and use of Contract Administrator.

1.10 SITE SIGN AND NOTICES

.1 Contractor is responsible for the construction of job sign frame and the installation of the plywood job sign. Locate job sign as directed by Contract Administrator so as to ensure good visibility by passing traffic.

.2 Construct timber job sign frame using two (2) 140 x 140mm timber posts set vertically in concrete to a ground depth of 1000mm or below the frost line, whichever is greater. Install three (3) 38 x 89mm horizontal timber braces. Attach plywood sign to timber frame using galvanized nails. Paint timber frame with two (2) coats of white paint if using untreated timber. Backfill compact and level ground around job sign frame to the satisfaction of the Contract Administrator.

1.11 REMOVAL OF TEMPORARY FACILITIES

.1 Remove temporary facilities from site when directed by Contract Administrator.

.2 When project is closed down at end of construction season keep temporary facilities operational until close down or removal is approved by Contract Administrator.

PRODUCTS (NOT APPLICABLE)

EXECUTION (NOT APPLICABLE)

END OF SECTION

CONSTRUCTION FACILITIES

PART 1 GENERAL

1.1 SECTION INCLUDES

.1 Construction aids.

.2 Office and sheds.

.3 Parking.

.4 Project identification.

1.2 RELATED SECTIONS

.1 Section 01 35 29.06 – Health and Safety Requirements

.2 Section 01 51 00 - Temporary Utilities.

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

1.3 INSTALLATION AND REMOVAL

.1 Provide construction facilities in order to execute work expeditiously.

.2 Remove from site all such work after use.

1.4 SCAFFOLDING

.1 Provide and maintain scaffolding in rigid, secure and safe manner.

.2 Erect scaffolding independent of walls. Remove promptly when no longer required. Refer to Section 01 35 29.06 – Health and Safety Requirements.

1.5 HOISTING

.1 Provide, operate and maintain hoists cranes required for moving of workers, materials and equipment. Make financial arrangements with Subcontractors for use thereof.

.2 Hoists cranes shall be operated by certified operator.

1.6 SITE STORAGE/LOADING

.1 Confine work and operations of employees by Contract Documents. Do not unreasonably encumber premises with products.

.2 Do not load or permit to load any part of Work with a weight or force that will endanger the Work.

1.7 CONSTRUCTION PARKING

.1 Parking will be permitted on site provided it does not disrupt performance of work and/or access to operational facilities.

.2 Provide and maintain adequate access to project site.

.3 Build and maintain temporary roads where indicated or directed by Contract Administrator and provide snow removal during period of Work.

.4 If authorized to use existing roads for access to project site, maintain such roads for duration of Contract and make good damage resulting from Contractor's use of roads.

1.8 CONTRACTOR'S SITE OFFICES

.1 Provide office heated to 22 oC, lighted 750 lx and ventilated, of sufficient size to accommodate site meetings and furnished with drawing laydown table, fax machine, telephone, file cabinet and chair. Provide an accessible washroom within the contractor's site office.

.2 Provide suitable space for weekly construction meetings for up to 12 persons (table, chair, A/V equipment)

.3 Provide a clearly marked and fully stocked first-aid case in a readily available location.

.4 Subcontractors may provide their own offices as necessary. Direct location of these offices.

1.9 CONTRACT ADMINISTRATOR SITE OFFICE

.1 Provide temporary office for Contract Administrator.

.2 Inside dimensions minimum 4.8 m long x 3 m wide x 2.4 m high, with floor 0.3 m above grade, complete with 4 - 50% opening windows and one lockable door.

.3 Insulate building and provide heating system to maintain 22˚C inside temperature at -20˚C outside temperature.

.4 Finish inside walls and ceiling with plywood, hardboard or wallboard and paint in selected colours. Finish floor with 19mm thick plywood.

.5 Install electrical lighting system to provide min 750 lx using surface mounted, shielded commercial fixtures with 10% upward light component.

.6 Site office to have washroom facility complete with running water and sewage disposal. Maintain supply of washroom supplies.

.7 Equip office with drawing laydown table, file cabinet, two chairs, telephone, high speed internet.

.8 Maintain in clean condition.

1.10 EQUIPMENT, TOOL AND MATERIALS STORAGE

.1 Provide and maintain, in a clean and orderly condition, lockable weatherproof sheds for storage of tools, equipment and materials.

.2 Locate materials not required to be stored in weatherproof sheds on site in a manner to cause least interference with work activities.

1.11 SANITARY FACILITIES

.1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.

.2 Post notices and take precautions as required by local health authorities. Keep area and premises in sanitary condition.

1.12 CLEAN-UP

.1 Remove construction debris, waste materials, packaging material from work site daily.

.2 Clean dirt or mud tracked onto paved or surfaced roadways.

.3 Store materials resulting from demolition activities that are salvageable.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

TEMPORARY BARRIERS AND ENCLOSURES

PART 1 GENERAL

1.1 SECTION INCLUDES

.1 Barriers.

.2 Environmental Controls.

.3 Traffic Controls.

.4 Fire Routes.

.5 Site Security.

1.2 RELATED SECTIONS

.1 Section 01 51 00 – Temporary Utilities.

.2 Section 01 52 00 – Construction Facilities.

1.3 INSTALLATION AND REMOVAL

.1 Provide temporary controls in order to execute Work expeditiously.

.2 Remove from site all such work after use.

1.4 SECURITY

.1 Provide temporary gates at the access to the site.

1.5 GUARD RAILS AND BARRICADES

.1 Provide secure, rigid guard rails and barricades around deep excavations, open shafts, open stair wells, open edges of floors and roofs.

.2 Provide as required by governing authorities.

1.6 WEATHER ENCLOSURES

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

.2 Close off floor areas where walls are not finished; seal off other openings; enclose building interior work for temporary heat.

.3 Erect enclosures to allow access for installation of materials and working inside enclosure.

.4 Design enclosures to withstand wind pressure and snow loading.

1.7 DUST TIGHT SCREENS

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

.2 Maintain and relocate protection until such work is complete.

1.8 ACCESS TO SITE

.1 Provide and maintain access roads, sidewalk crossings, ramps and construction runways as may be required for access to Work.

.2 Build and maintain temporary roads where indicated or directed and provide snow removal during period on work.

.3 If authorized to use existing roads for access to project site, maintain such roads for duration of Contract and make good damage resulting from Contractor's use of roads.

1.9 PUBLIC TRAFFIC FLOW

.1 Provide and maintain competent signal flag operators, traffic signals, barricades and flares, lights, or lanterns as required to perform Work and protect the public.

1.10 FIRE ROUTES

.1 Maintain access to property including overhead clearances for use by emergency response vehicles.

1.11 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY

.1 Protect surrounding private and public property from damage during performance of Work.

.2 Be responsible for damage incurred.

1.12 PROTECTION OF BUILDING FINISHES

.1 Provide protection for finished and partially finished building finishes and equipment during performance of Work.

.2 Provide necessary screens, covers, and hoardings.

.3 Confirm with Contract Administrator locations and installation schedule 3 days prior to installation.

.4 Be responsible for damage incurred due to lack of or improper protection.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

COMMON PRODUCT REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

.1 Product quality, availability, storage, handling, protection, and transportation.

.2 Manufacturer's instructions.

.3 Quality of Work, coordination and fastenings.

1.2 RELATED SECTIONS

.1 Section 01 45 00 – Quality Control.

.2 Section 01 73 00 – Execution.

1.3 REFERENCES

.1 Within text of each specifications section, reference may be made to reference standards. Conform to these reference standards, in whole or in part as specifically requested in specifications.

.2 Conform to latest date of issue of referenced standards in effect on date of submission of Tenders, except where specific date or issue is specifically noted.

1.4 QUALITY

.1 Products, materials, equipment and articles (referred to as products throughout specifications) incorporated in Work shall be new, not damaged or defective, and of best quality (compatible with specifications) for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.

.2 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.

.3 Should any dispute arise as to quality or fitness of products, decision rests strictly with Contract Administrator based upon requirements of Contract Documents.

.4 Within seven (7) working days of written request by Contract Administrator, submit following information for material and equipment proposed for supply:

.1 Name and address of manufacturer.

.2 trade name, model and catalogue number,

.3 performance, descriptive and test data,

.4 manufacturer's installation or application instructions,

.5 evidence of arrangements to procure.

.5 Use products of one manufacturer for material and equipment of same type or classification unless otherwise specified.

.6 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

1.5 AVAILABILITY

.1 Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for any items. If delays in supply of products are foreseeable, notify Contract Administrator of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of work.

.2 In event of failure to notify Contract Administrator at commencement of Work and should it subsequently appear that Work may be delayed for such reason, Contract Administrator reserves right to substitute more readily available products of similar character, at no increase in Contract Price or Contract Time.

1.6 STORAGE, HANDLING AND PROTECTION

.1 Handle and store products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.

.2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.

.3 Store products subject to damage from weather in weatherproof enclosures.

.4 Store cementitious products clear of earth or concrete floors, and away from walls.

.5 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.

.6 Store sheet materials, lumber on flat, solid supports and keep clear of ground. Slope to shed moisture.

.7 Store and mix paints in heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.

.8 Remove and replace damaged products at own expense and to satisfaction of Contract Administrator.

.9 Touch-up damaged factory finished surfaces as per the manufacturer's factory requirements and to Contract Administrator satisfaction. Use touch-up materials to match original. Do not paint over name plates.

.10 For all mechanical or electrical equipment stored on site, refer to manufacturer's recommendations regarding maintenance required during storage, and prepare maintenance schedule detailing the rotation, lubrication and/or exercise requirements of the equipment while stored. Provide schedule to Contract Administrator, and demonstrate that the schedule is being followed during storage.

1.7 TRANSPORTATION

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

1.8 MANUFACTURER'S INSTRUCTIONS

.1 Unless otherwise indicated in specifications, install or erect products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with products. Obtain written instructions directly from manufacturers.

.2 Notify Contract Administrator in writing, of conflicts between specifications and manufacturer's instructions, so that Contract Administrator may establish course of action.

.3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes Contract Administrator to require removal and re-installation at no increase in Contract Price or Contract Time.

1.9 QUALITY OF WORK

.1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify Contract Administrator if required Work is such as to make it impractical to produce required results.

.2 Do not employ anyone unskilled in their required duties. Contract Administrator reserves right to require dismissal from site, workers deemed incompetent or careless.

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

1.10 CO-ORDINATION

.1 Ensure cooperation of workers in laying out Work. Maintain efficient and continuous supervision.

.2 Be responsible for coordination and placement of openings, sleeves and accessories.

1.11 CONCEALMENT

.1 In finished areas, conceal pipes, ducts and wiring in floors, walls and ceilings, except where indicated otherwise.

.2 Before installation, inform Contract Administrator if there is interference. Install as directed by Contract Administrator.

1.12 REMEDIAL WORK

.1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Coordinate adjacent affected Work as required.

.2 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of Work.

1.13 LOCATION OF FIXTURES

.1 Consider location of fixtures, outlets, and mechanical and electrical items indicated as approximate.

.2 Locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space and in accordance with manufacturer's recommendations for safety, access and maintenance.

.3 Inform Contract Administrator of conflicting installation. Install as directed.

.4 Submit field drawings to indicate relative position of various services and equipment when required by Contract Administrator.

1.14 FASTENINGS GENERAL

.1 Provide metal fastenings and accessories in same texture, colour and finish as base metal in which they occur. Prevent electrolytic action between dissimilar metals. Use non-corrosive fasteners, anchors and spacers for securing exterior work, unless stainless steel or other material is specifically requested in affected specification section.

.2 Space anchors within individual load limit or shear capacity and ensure they provide positive permanent anchorage. Wood plugs are not acceptable.

.3 Conceal fasteners where indicated. Space evenly and lay out neatly.

.4 Fastenings which cause Spalding or cracking are not acceptable.

.5 Obtain Contract Administrator's approval before using explosive actuated fastening devices. If approval is obtained comply with CSA Z166.

1.15 FASTENINGS - EQUIPMENT

.1 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.

.2 Use heavy hexagon heads, semi-finished unless otherwise specified. Use No. 304 stainless steel for exterior areas.

.3 Bolts may not project more than one diameter beyond nuts.

.4 Use plain type washers on equipment, sheet metal and soft gasket lock type washers where vibrations occur. Use resilient washers with stainless steel.

1.16 PROTECTION OF WORK IN PROGRESS

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

1.17 EXISTING UTILITIES

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

.2 Protect, relocate or maintain existing active services. When services are encountered, cap off in manner approved by authority having jurisdiction. Stake and record location of capped service.

.3 Submit schedule to and obtain approval from Contract Administrator for any shut-down or closure of active services or facility. Adhere to approved schedule and provide notice to affected parties.

.4 Where unknown services are encountered, immediately advise Contract Administrator and confirm findings in writing.

.5 Remove abandoned services lines within 2m of structures. Cap or otherwise seal lines at cut-off points as directed by Contract Administrator.

1.18 SELECTION OF MATERIAL AND EQUIPMENT

.1 Material and equipment will be specified in the tender documents, and selected by Contractor, by one or more of the following methods:

.1 Specification by reference to a relevant Standard, such as CSA, ASTM, ULC, etc., select any material or equipment that meets or exceeds the specified.

.2 Specification by reference to an accepted product evaluation publication, such as the CGSB “Qualified Products List”, or CCMC Registry of Product Evaluations”, - select any manufacturer’s product so listed.

.3 Specification by Prescriptive or Performance specification – select any material or equipment meeting or exceeding specification.

.4 Specification by identification of one or more Manufacturer's specific product(s) as an "Acceptable Product", along with a listing of other manufacturers who may offer equivalent products – select any product so named, or select from equivalent product(s) of other listed manufacturers.

.2 "Acceptable Product" is deemed to be a complete and working commodity as described by a manufacturer's name, catalogue number, trade name, or any combination thereof, and will constitute the minimum standard of acceptance.

.3 Contract Administrator will determine acceptability of Contractor's selection of material and equipment at time of Shop Drawing review.

.4 When material or equipment is specified by a Standard, Prescriptive or Performance specification, upon request of the Contract Administrator, obtain from manufacturer an independent laboratory reporting, showing that material or equipment meets or exceeds the specified requirements.

1.19 SUBSTITUTION OF MATERIAL AND EQUIPMENT

.1 **Prior to Tender** closing bidders may propose addition of other manufacturer's names to those listed in the tender documents providing requests are made in writing at least 10 days prior to tender closing date or bid depository where bid depository is used. Contract Administrator will inform all prospective bidders of decision by addendum, issued at least 5 days prior to the tender closing date.

Where no manufacturer's names are listed, the onus is on contractor to provide material and equipment to meet performance specification.

.2 **After Contract award** substitutions of material or equipment, other than as selected by Contractor from those specified, will be considered by Contract Administrator only if:

.1 material or equipment selected from those specified are not available

.2 delivery date of material or equipment selected from those specified would unduly delay completion of the Contract; or

.3 alternative material or equipment to those specified, provided they are determined by the Contract Administrator to be equivalent to or better that those specified, and will result in a credit to the Contract amount.

.3 Requests for substitutions after Contract award must be accompanied by sufficient information in the form of shop drawings, manufacturer's literature, samples or other data to permit proper investigation of the substitutes used. Requests must also include statements of respective costs of material or equipment originally specified and the proposed substitution.

.4 Should a proposed substitution be accepted after Contract award either in part or in whole, assume full responsibility and costs when substitution affects other work

on Project. Contractor to pay for design or drawing changes required as a result of the substitution.

.5 Amounts of all credits arising from approval of substitutions after Contract award will be determined by Contract Administrator and the Contract amount will be reduced accordingly.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

EXAMINATION AND PREPARATION

PART 1 GENERAL

1.1 SECTION INCLUDES

.1 Field engineering survey services to measure and stake site.

.2 Survey services to establish and confirm inverts for Work.

.3 Recording of subsurface conditions found.

1.2 QUALIFICATIONS OF SURVEYOR

.1 Qualified registered land surveyor, licensed to practise in the Province of Ontario.

1.3 SURVEY REFERENCE POINTS

.1 Existing base horizontal and vertical control points are designated on drawings.

.2 Locate, confirm and protect control points prior to starting site work. Preserve permanent reference points during construction.

.3 Make no changes or relocations without prior written notice to Contract Administrator.

.4 Report to Contract Administrator when reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.

.5 Require surveyor to replace control points in accordance with original survey control.

1.4 SURVEY REQUIREMENTS

.1 Establish permanent benchmarks on site, referenced to established bench marks by survey control points. Record locations, with horizontal and vertical data in Project Record Documents.

.2 Establish lines and levels, locate and lay out, by instrumentation.

.3 Stake for grading, fill placement.

.4 Establish pipe invert elevations.

.5 Stake batter boards for foundations.

.6 Establish foundation column locations and floor elevations.

.7 Establish lines and levels for mechanical and electrical work.

1.5 EXISTING SERVICES

.1 Where work involves breaking into or connecting to existing services, carry out work at times directed by authorities having jurisdiction, with minimum of disturbance to pedestrian and vehicular traffic.

.2 Before commencing work, establish location and extent of service lines in area of Work and notify Contract Administrator of findings.

.3 Remove abandoned service lines within 2 m of structures. Cap or otherwise seal lines at cut-off points as directed by Contract Administrator.

1.6 LOCATION OF EQUIPMENT AND FIXTURES

.1 Location of equipment, fixtures and outlets indicated or specified are to be considered as approximate.

.2 Locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space and in accordance with manufacturer's recommendations for safety, access and maintenance.

.3 Inform Contract Administrator of impending installation and obtain approval for actual location.

.4 Submit field drawings to indicate relative position of various services and equipment when required by Contract Administrator.

1.7 RECORDS

.1 Maintain a complete, accurate log of control and survey work as it progresses.

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

1.8 SUBMITTALS

.1 Submit name and address of Surveyor to Contract Administrator.

.2 On request of Contract Administrator, submit documentation to verify accuracy of field engineering work.

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

1.9 SUBSURFACE CONDITIONS

.1 Promptly notify Contract Administrator in writing if subsurface conditions at Place of Work differ materially from those indicated in Contract Documents, or a reasonable assumption of probable conditions based thereon.

.2 The Contractor is required to be familiar with the existing As-Built and documents.

.3 After prompt investigation, should Contract Administrator determine that conditions do differ materially, instructions will be issued for changes in Work.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

EXECUTION

PART 1 GENERAL

1.1 SECTION INCLUDES

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

1.2 RELATED SECTIONS

.1 Section 01 11 00 - Summary of Work.

.2 Section 01 33 00 - Submittal Procedures.

1.3 SUBMITTALS

.1 Submit written request in advance of cutting or alteration which affects:

.1 Structural integrity of any element of Project.
.2 Integrity of weather-exposed or moisture-resistant elements.
.3 Efficiency, maintenance, or safety of any operational element.
.4 Visual qualities of sight-exposed elements.
.5 X-ray all penetrations to identify rebar layout.
.6 Work of Owner or separate contractor.

.2 Include in request:

.1 Identification of Project.
.2 Location and description of affected Work.
.3 Statement on necessity for cutting or alteration.
.4 Description of proposed Work, and products to be used.
.5 Alternatives to cutting and patching.
.6 Effect on Work of Owner or separate contractor.
.7 Written permission of affected separate contractor.
.8 Date and time work will be executed.

1.4 PREPARATION

.1 Inspect existing conditions, including elements subject to damage or movement during cutting and patching.

.2 After uncovering, inspect conditions affecting performance of Work.

.3 Beginning of cutting or patching means acceptance of existing conditions.

.4 Provide supports to assure structural integrity of surroundings; provide devices and methods to protect other portions of project from damage.

EXECUTION

.5 Provide protection from elements for areas which may be exposed by uncovering work; maintain excavations free of water.

.6 Obtain Contract Administrator approval before cutting, boring or sleeving load-bearing members.

1.5 EXECUTION

.1 Execute cutting, fitting, and patching including excavation and fill, to complete Work.

.2 Fit several parts together, to integrate with other Work.

.3 Uncover Work to install ill-timed Work.

.4 Remove and replace defective and non-conforming Work.

.5 Provide openings in non-structural elements of Work for penetrations of mechanical and electrical Work.

.6 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.

.7 Employ original installer to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.

.8 Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools not allowed on masonry work without prior approval.

.9 Restore work with new products in accordance with requirements of Contract Documents.

.10 Fit Work to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

.11 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with firestopping material in accordance with Section 07 84 00 - Firestopping, full thickness of the construction element.

.12 Refinish surfaces to match adjacent finishes: For continuous surfaces refinish to nearest intersection; for an assembly, refinish entire unit.

.13 Conceal pipes, ducts and wiring in floor, wall and ceiling construction of finished areas except where indicated otherwise.

.14 Make cuts with clean, true, smooth edges.

.15 Where new work connects with existing, and where existing work is altered, cut, patch and make good to match existing work.

EXECUTION

1.6 WASTE MANAGEMENT AND DISPOSAL

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

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

CLEANING

PART 1 GENERAL

1.1 GENERAL

.1 Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws.

.2 Store volatile waste in covered metal containers and remove from premises at end of each working day.

.3 Provide adequate ventilation during use of volatile or noxious substances. Use for building ventilation systems is not permitted for this purpose.

1.2 RELATED SECTION

.1 Section 01 77 00 - Closeout Procedures.

.2 Section 01 74 21 – Construction Waste

1.3 PROJECT CLEANLINESS

.1 Maintain Work in tidy condition, free from accumulation of waste products and debris.

.2 Remove waste materials and debris from site at the end of each working day. Do not burn waste materials on site.

.3 Clear snow and ice from access to building.

.4 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

.5 Provide on-site containers for collection of waste materials and debris.

.6 Clean interior areas prior to start of finish work, maintain areas free of dust and other contaminants during finishing operations.

.7 Store volatile waste in covered metal containers, and remove from premises at end of each working day.

.8 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.

.9 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.

.10 Vacuum clean interior of building areas of dirt when ready to receive finishes and continue vacuum cleaning at least daily until building is ready for substantial completion or occupancy. Sweep floors and pavements clean on a daily basis.

.11 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

.12 Areas in which electrical and mechanical equipment area located and ready for start-up and commissioning must be cleaned of all dusts and debris prior to any equipment being started up. After start up the areas are to be maintained dust free, filters replaced on a weekly basis, the internal areas of control panels, and equipment filters/fans etc. shall be vacuum cleaned on a weekly basis. If in the opinion of the Contract Administrator, there is excessive amounts of dust being drawn into the building through openings, penetrations or due to ambient construction activities outside the operating areas, the contractor will be responsible to provide additional air filtration to achieve a dust free environment.

1.4 FINAL CLEANING

.1 Refer to General Conditions.

.2 When Work is Substantially Performed, remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.

.3 Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.

.4 When the Work is Totally Performed, remove surplus products, tools, construction machinery and equipment. Remove waste products and debris other than that caused by the Owner or other Contractors.

.5 Remove waste materials from the site at regularly scheduled times or dispose of as directed by the Owner's Representative. Do not burn waste materials on site.

.6 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

.7 Leave the work broom clean before the inspection process commences.

.8 Clean and polish glass, mirrors, hardware, wall tile, stainless steel, chrome, porcelain enamel, baked enamel, plastic laminate, and mechanical and electrical fixtures. Replace broken, scratched or disfigured glass.

.9 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fitments, walls, floors and ceilings.

.10 Clean lighting reflectors, lenses, and other lighting surfaces.

.11 Vacuum clean and dust building interiors, behind grilles, louvres and screens.

.12 Wax, seal, shampoo or prepare floor finishes, as recommended by manufacturer.

.13 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.

.14 Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds.

.15 Remove dirt and other disfiguration from exterior surfaces.

.16 Clean roofs, gutters, downspouts and drainage systems. Clean areaways and sunken wells.

.17 Sweep and wash clean paved areas.

.18 Clean equipment and fixtures to a sanitary condition; clean or replace filters of mechanical and electrical equipment.

.19 Remove snow and ice from access to building.

.20 Remove debris and surplus materials from crawl areas and other accessible concealed spaces.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

.1 Text, schedules and procedures for systematic Waste Management Program for construction, deconstruction, demolition, and renovation projects, including:

.1 Diversion of Materials.

.2 Waste Audit (WA) - Schedule A.

.3 Waste Reduction Workplan (WRW) - Schedule B.

.4 Demolition Waste Audit (DWA) - Schedule C.

.5 Cost/Revenue Analysis Workplan (CRAW) - Schedule D.

.6 Materials Source Separation Program (MSSP).

.7 Canadian Governmental Responsibility for the Environment Resources - Schedule E.

1.2 DEFINITIONS

.1 Demolition Waste Audit (DWA): Relates to actual waste generated from project.

.2 Materials Source Separation Program (MSSP): Consists of series of ongoing activities to separate reusable and recyclable waste material into material categories from other types of waste at point of generation.

.3 Recyclable: Ability of product or material to be recovered at end of its life cycle and re-manufactured into new product for reuse by others.

.4 Recycle: Process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.

.5 Recycling: Process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for purpose of using in altered form. Recycling does not include burning, incinerating, or thermally destroying waste.

.6 Reuse: Repeated use of product in same form but not necessarily for same purpose. Reuse includes:

.1 Salvaging reusable materials from re-modelling projects, before demolition stage, for resale, reuse on current project or for storage for use on future projects.

.2 Returning reusable items including pallets or unused products to vendors.

.7 Salvage: Removal of structural and non-structural materials from deconstruction/disassembly projects for purpose of reuse or recycling.

.8 Separate Condition: Refers to waste sorted into individual types.

.9 Source Separation: Acts of keeping different types of waste materials separate beginning from first time they became waste.

1.3 MATERIALS SOURCE SEPARATION PROGRAM (MSSP)

.1 Prepare MSSP and have ready for use prior to project start-up.

.2 Implement MSSP for waste generated on project in compliance with approved methods and as reviewed by authorities having jurisdiction.

.3 Provide on-site facilities for collection, handling, and storage of anticipated quantities of reusable and recyclable materials.

.4 Provide containers to deposit reusable and recyclable materials.

.5 Locate containers in locations, to facilitate deposit of materials without hindering daily operations.

.6 Locate separated materials in areas which minimize material damage.

.7 Collect, handle, store on-site, and transport off-site, salvaged materials in separate condition.

.1 Transport to recycling facility.

1.4 STORAGE, HANDLING AND PROTECTION

.1 Unless specified otherwise, materials for removal become Contractor's property.

.2 Protect, stockpile, store and catalogue salvaged items.

.3 Separate non-salvageable materials from salvaged items. Transport and deliver non-salvageable items to approved local facility.

.4 Protect structural components not removed for demolition from movement or damage.

.5 Support affected structures. If safety of building is endangered, cease operations and immediately notify Department having jurisdiction.

.6 Protect surface drainage, mechanical and electrical from damage and blockage.

.7 Separate and store materials produced during dismantling of structures in designated areas.

.8 Prevent contamination of materials to be salvaged and recycled and handle materials in accordance with requirements for acceptance by designated facilities.

.1 On-site source separation is recommended.

1.5 DISPOSAL OF WASTES

.1 Do not bury OR burn rubbish or waste materials.

.2 Do not dispose of any waste into waterways, storm, or sanitary sewers.

.3 Remove materials from deconstruction as deconstruction/disassembly Work progresses.

.4 Prepare project summary to verify destination and quantities on a material-by-material basis as identified in pre-demolition material audit.

1.6 USE OF SITE AND FACILITIES

.1 Execute work with least possible interference or disturbance to normal use of premises.

.2 Provide security measures approved by Owner's Representative.

1.7 SCHEDULING

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

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 APPLICATION

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

.2 CLEANING

.3 Remove tools and waste materials on completion of Work, and leave work area in clean and orderly condition.

.4 Clean-up work area as work progresses.

.5 Source separate materials to be reused/recycled into specified sort areas.

3.2 DIVERSION OF MATERIALS

.1 From following list, separate materials from general waste stream and stockpile in separate piles or containers, as reviewed by Owner's Representative and consistent with applicable fire regulations.

.1 Mark containers or stockpile areas.

.2 Provide instruction on disposal practices.

.2 On-site sale or distribution of salvaged materials to third parties is not permitted.

END OF SECTION

CLOSEOUT PROCEDURES

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 74 11 - Cleaning.

.2 Section 01 78 00 - Closeout Submittals.

.3 Section 01 91 13 – General Commissioning (Cx) Requirements.

1.2 FINAL INSPECTION AND DECLARATION PROCEDURES

.1 Contractor's Inspection: The Contractor and all Subcontractors shall conduct an inspection of Work, identify deficiencies and defects; repair as required. Notify the Contract Administrator in writing of satisfactory completion of the Contractor's Inspection and that corrections have been made. Request a Contract Administrator's Consultant's Inspection.

.2 Contract Administrator's Inspection: Contract Administrator and the Contractor will perform an inspection of the Work to identify obvious defects or deficiencies. The contractor shall correct Work accordingly.

.3 Completion: submit written certificate that the following have been performed:

.1 Work has been completed and inspected for compliance with Contract Documents.

.2 Defects have been corrected and deficiencies have been completed.

.3 Equipment and systems have been tested, adjusted and balanced and are fully operational.

.4 Certificates required by Fire Commissioner, Utility companies have been submitted.

.5 Operation of systems have been demonstrated to Owner's personnel.

.6 Commissioning of building/process/mechanical and electrical systems: completed in accordance with section 01 91 13 – Commissioning (Cx) Requirements and copies of final Commissioning Report submitted to Contract Administrator.

.7 Work is complete and ready for Final Inspection.

.4 Final Inspection: When items noted above are completed, request final inspection of Work by the Contract Administrator(s) and the Contractor. If Work is deemed incomplete by the Contract Administrator, complete outstanding items and request a reinspection.

.5 Declaration of Substantial Performance: When the Contract Administrator considers deficiencies and defects have been corrected and it appears requirements of Contract have been substantially performed, make application for

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

.6 Commencement of Lien and Warranty Periods: The date of the Owners acceptance of the submitted declaration of Substantial Performance shall be the date for commencement for the warranty period and commencement of the lien period.

.7 Declaration of Total Performance: When the Contract Administrator considers final deficiencies and defects have been corrected and it appears requirements of the Contract have been totally performed, make application for certificate of Total Performance. Refer to General Conditions for specifics to application. If Work is deemed incomplete by the Contract Administrator, complete the outstanding items and request a reinspection.

1.3 REINSPECTION

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

1.4 OCCUPANCY

.1 Owner reserves the right to occupy and operate portions of work whether partially or entirely completed, or whether completed on schedule or not.

.2 Partial occupancy shall not imply acceptance of work in whole or in part nor shall it imply acknowledgement that the terms of Agreement are fulfilled.

1.5 SYSTEM DEMONSTRATION

.1 Prior to Substantial Performance:

.1 Demonstrate operation of each system to Contract Administrator(s).

.2 Instruct personnel in operation, adjustment and maintenance of equipment and systems, using provided operation and maintenance data as basis for instruction.

1.6 WARRANTIES

.1 The contractor shall include a minimum one-year warranty on all products, materials and workmanship. Extended warranties shall be included for various items as defined in the individual specifications.

1.7 SUBMITTALS

.1 Refer to Section 01 33 00 and Contract General Conditions for submission requirements at project completion.

1.8 FINAL CLEANING

.1 Refer to Section 01 74 11 for cleaning requirements.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.1 SECTION INCLUDES

.1 As-built, samples, and specifications.

.2 Equipment and systems.

.3 Product data, materials and finishes, and related information.

.4 Operation and maintenance data.

.5 Spare parts, special tools and maintenance materials.

.6 Warranties and bonds.

.7 Final site survey.

1.2 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 01 45 00- Quality Control.

.3 Section 01 71 00 – Examination and Preparation.

.4 Section 01 77 00 - Closeout Procedures.

.5 Section 01 91 13 – General Commissioning (Cx) Requirements.

1.3 SUBMISSION

.1 Prepare instructions and data using personnel experienced in maintenance and operation of described products.

.2 Submit one copy of completed volumes in final form 15 days prior to final inspection.

.3 Copy will be returned after final inspection, with Contract Administrator's comments.

.4 Revise content of documents as required prior to final submittal.

.5 Two weeks prior to Substantial Performance of the Work, submit to the Contract Administrator, two final copies of operating and maintenance manuals.

.6 Ensure spare parts, maintenance materials and special tools provided are new, undamaged or defective, and of same quality and manufacture as products provided in Work.

.7 If requested, furnish evidence as to type, source and quality of products provided.

.8 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.

.9 Pay costs of transportation.

1.4 FORMAT

.1 Organize data in the form of an instructional manual.

.2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.

.3 When multiple binders are used, correlate data into related consistent groupings. Identify contents of each binder on spine.

.4 Cover: Identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.

.5 Arrange content under Section numbers and sequence of Table of Contents.

.6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.

.7 Text: Manufacturer's printed data, or typewritten data.

.8 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

.9 Provide CAD files in DWG format on digital storage device. Also provide electronic files in searchable PDF format.

1.5 CONTENTS - EACH VOLUME

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

.2 For each product or system:

.1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.

.3 Product Data: mark each sheet to clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information.

.4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.

.5 Typewritten Text: as required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00 - Quality Control.

.6 Training: Refer to Section 01 91 13 – General Commissioning (Cx) Requirements.

1.6 AS-BUILTS AND SAMPLES

.1 In addition to requirements in General Conditions, maintain at the site for Contract Administrator one record copy of:

.1 Contract Drawings.
.2 Specifications.
.3 Addenda.
.4 Change Orders and other modifications to the Contract.
.5 Reviewed shop drawings, product data, and samples.
.6 Field test records.
.7 Inspection certificates.
.8 Manufacturer's certificates.

.2 Store record documents and samples in field office apart from documents used for construction. Provide files, racks, and secure storage.

.3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual. Label each document "PROJECT RECORD" in neat, large, printed letters.

.4 Maintain record documents in clean, dry and legible condition. Do not use record documents for construction purposes.

.5 Keep record documents and samples available for inspection by Contract Administrator.

1.7 RECORDING ACTUAL SITE CONDITIONS

.1 Record information on set of red lined contract document, to the satisfaction of the Contract Administrator.

.2 Provide felt tip marking pens, maintaining red color pens for recording information.

.3 Record information concurrently with construction progress. Do not conceal Work until required information is recorded.

.4 Contract Drawings and shop drawings: legibly mark each item to record actual construction, including:

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

.2 Include UTM coordinates of all underground items, bends, corners, terminations, etc.

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

.4 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.

.5 Field changes of dimension and detail.

.6 Changes made by change orders.

.7 Details not on original Contract Drawings.

.8 References to related shop drawings and modifications.

.5 Specifications: legibly mark each item to record actual construction, including:

.1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.

.2 Changes made by Addenda and change orders.

.6 Other Documents: submit manufacturer's certifications, inspection certifications, field test records, required by individual specifications sections.

.7 At completion of project, provide all recorded information on print drawings. Transfer recorded information to AutoCAD files in DWG format. Submit DWG files, also with electronic files in PDF format as part of the Closeout Submittals.

1.8 FINAL SURVEY

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

1.9 EQUIPMENT AND SYSTEMS

.1 Each Item of Equipment and Each System: include description of unit or system, and component parts. Give function, normal operation characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.

.2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.

.3 Include installed colour coded wiring diagrams.

.4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

.5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

.6 Provide servicing and lubrication schedule, and list of lubricants required.

.7 Include manufacturer's printed operation and maintenance instructions.

.8 Include sequence of operation by controls manufacturer.

.9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

.10 Provide installed control diagrams by controls manufacturer.

.11 Provide Contractor's coordination drawings, with installed colour coded piping diagrams.

.12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

.13 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

.14 Include test and balancing reports

.15 Additional requirements: As specified in individual specification sections.

1.10 MATERIALS AND FINISHES

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

.2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

.3 Moisture-protection and Weather-exposed Products: include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

.4 Additional Requirements: as specified in individual specifications sections.

1.11 SPARE PARTS

.1 Provide spare parts, in quantities specified in individual specification sections.

.2 Provide items of same manufacture and quality as items in Work.

.3 Deliver to site location as directed; place and store.

.4 Receive and catalogue all items. Submit inventory listing to Contract Administrator. Include approved listings in Maintenance Manual.

.5 Obtain receipt for delivered products and submit prior to final payment.

1.12 MAINTENANCE MATERIALS

.1 Provide maintenance and extra materials, in quantities specified in individual specification sections.

.2 Provide items of same manufacture and quality as items in Work.

.3 Deliver to site location as directed; place and store.

.4 Receive and catalogue all items. Submit inventory listing to Contract Administrator. Include approved listings in Maintenance Manual.

.5 Obtain receipt for delivered products and submit prior to final payment.

1.13 SPECIAL TOOLS

.1 Provide special tools, in quantities specified in individual specification section.

.2 Provide items with tags identifying their associated function and equipment.

.3 Deliver to project site place and store.

.4 Receive and catalogue all items. Submit inventory listing to Contract Administrator. Include approved listings in Maintenance Manual.

1.14 STORAGE, HANDLING AND PROTECTION

.1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.

.2 Store in original and undamaged condition with manufacturer's seal and labels intact.

.3 Store components subject to damage from weather in weatherproof enclosures.

.4 Store paints and freezable materials in a heated and ventilated room.

.5 Remove and replace damaged products at own expense and to satisfaction of Contract Administrator.

1.15 WARRANTIES AND BONDS

.1 Develop warranty management plan to contain information relevant to Warranties.

.2 Submit warranty management plan to Contract Administrator's approval.

.3 Warranty management plan to include required actions and documents to assure that Owner receives warranties to which it is entitled.

.4 Provide plan in narrative form and contain sufficient detail to make it suitable for use by future maintenance and repair personnel.

.5 Assemble approved information in binder and submit upon acceptance of work. Organize binder as follows:

.1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.

.2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

.3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of the applicable item of work.

.4 Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Substantial Performance is determined.

.5 Verify that documents are in proper form, contain full information, and are notarized.

.6 Co-execute submittals when required.

.7 Retain warranties and bonds until time specified for submittal.

.6 Include information contained in warranty management plan as follows:

.1 Roles and responsibilities of personnel associated with warranty process, including points of contact and telephone numbers within the organizations of Contractors, subcontractors, manufacturers or suppliers involved.

.2 Listing and status of delivery of Certificates of Warranty for extended warranty items, to include roofs, HVAC balancing, pumps, motors, transformers, and commissioned systems such as fire protection, alarm systems, sprinkler systems, lightning protection systems, process equipment and systems.

.3 Provide list for each warranted equipment, item, feature of construction or system indicating:

.1 Name of item.

.2 Model and serial numbers.

.3 Location where installed.

.4 Name and phone numbers of manufacturers or suppliers.

.5 Names, addresses and telephone numbers of sources of spare parts.

.6 Warranties and terms of warranty: include one-year overall warranty of construction. Indicate items that have extended warranties and show separate warranty expiration dates.

.7 Cross-reference to warranty certificates as applicable.

.8 Starting point and duration of warranty period.

.9 Summary of maintenance procedures required to continue warranty in force.

.10 Cross-Reference to specific pertinent Operation and Maintenance manuals.

.11 Organization, names and phone numbers of persons to call for warranty service.

.12 Typical response time and repair time expected for various warranted equipment.

.4 Procedure and status of tagging of equipment covered by extended warranties.

.5 Post copies of instructions near selected pieces of equipment where operation is critical for warranty and/or safety reasons.

.7 Respond in a timely manner to oral or written notification of required construction warranty repair work.

.8 Written verification will follow oral instructions. Failure to respond will be cause for the Contract Administrator to proceed with action against Contractor.

1.16 PRE-WARRANTY CONFERENCE

.1 Meet with Contract Administrator to develop understanding of requirements of this section. Schedule meeting prior to contract completion, and at time designated by Contract Administrator.

.2 Contract Administrator will establish communication procedures for:

.1 Notification of construction warranty defects.

.2 Determine priorities for type of defect.

.3 Determine reasonable time for response.

.3 Provide name, telephone number and address of licensed and bonded company that is authorized to initiate and pursue construction warranty work action

.4 Ensure contact is located within local service area of warranted construction, is continuously available, and is responsive to inquiries for warranty work.

1.17 WARRANTY TAGS

.1 Tag, at time of installation, each warranted item. Provide durable, oil and water resistant tag approved by Contract Administrator.

.2 Leave date of acceptance until project is accepted for occupancy.

.3 Indicate following information on tag:

.1 Type of product/material.
.2 Model number.
.3 Serial number.
.4 Contract number.
.5 Warranty period.
.6 Inspector's signature.
.7 Construction Contractor.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

COMMISSIONING REQUIREMENTS

PART 1 GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 General requirements relating to commissioning of project's components and systems, specifying general requirements for Installation Verification and Performance Verification of components, equipment, sub-systems, systems, and integrated systems.

.2 Acronyms

.1 CxA – Commissioning Authority.
.2 Cx – Commissioning.
.3 EMCS – Energy Monitoring and Control Systems.
.4 O&M – Operation and Maintenance.
.5 PV – Performance Verification.
.6 TAB – Testing, Adjusting and Balancing.
.7 GC – General Contractor
.8 TSI – Technical Services Inspector
.9 LEED - Leadership in Energy and Environmental Design

1.2 COMMISSIONING INTENT

.1 Undertake Cx to bring the facility to a fully operational state and free of deficiencies in the most effective and timely manner available, ensuring the design intent is met by all systems. Verifying that a fully operational state has been achieved will include the successful operation of the process system, in accordance with its design requirements, for a period of 14 days, the last 7 of which shall be consecutive.

.2 Cx incorporates inspection and quality assurance activities as construction progresses, including start up, installation verification, performance verification, fine tuning, and operator training.

.3 Bear all costs associated with the required personnel and test equipment as outlined in specification sections and Contractor prepared Cx Manual and all costs with organizing and managing the activities of the applicable subtrades as identified in this section.

.4 Fully document all tests and inspections performed during the construction, at start up, installation verification and performance verification and fine tuning. Incorporate into final commissioning documentation.

.5 Provide direct training to designated staff responsible for the operation and maintenance of the building equipment and systems.

1.3 RELATED SECTIONS

.1 Section 01 45 00 - Quality Control.

.2 Section 01 77 00 - Closeout Procedures.

.3 Section 01 78 00 - Closeout Submittals.

.4 Section 01 91 33 - Commissioning (Cx) Forms.

.5 Section 01 91 41 - Commissioning (Cx) Training.

.6 Section 20 05 01 - Mechanical General Requirements

.7 Section 26 05 00 – Electrical General Requirements

.8 Section 44 00 10 – Process General Requirements

1.4 COMMISSIONING OVERVIEW

.1 Cx is a planned program of tests, procedures and checks carried out systematically on systems and integrated systems of the finished project.

.2 Cx is an intensive quality assurance process that begins at the beginning of the project and continues through to the first year of occupancy. The process focuses upon verifying and documenting that the facility and all of its systems and assemblies are planned, designed, installed, tested, operated, and maintained to meet the Owners Project Requirements.

.3 Cx activities supplement field quality and testing procedures described in relevant technical sections.

.4 Cx stages to ensure the built facility is constructed and proven to operate satisfactorily under weather, environmental and occupancy conditions to meet functional and operational requirements. Cx activities include transfer of critical knowledge to facility operational personnel.

.5 Complete inspection and verification activities as required by the specifications and the Contractor prepared Cx Manual as construction progresses.

.6 The General Contractor shall take responsibility to:

.1 Develop the Cx manual and review with the commissioning team.

.2 Complete all items as identified in the Cx manual. This includes work by subcontractors, test agencies, equipment representatives and manufacturer agents.

.3 Review Contract Documents and inspect the Work to ensure completeness of the Work and compliance with the Contract Documents.

.4 Correct deficiencies resulting from installation and performance verifications.

.5 Test, adjust and balance equipment and systems identified in Divisions 2-44.

.6 Submit the completed manual and project record documents as specified.

.7 Update the documentation manuals prior to each project meeting.

.7 The Substantial Completion Certificate will not be issued until the commissioning process is completed and the final reports and commissioning documentation are received.

.8 The Cx Manual provides direction for the Cx process during construction, provides resolution for issues such as scheduling, roles and responsibilities, lines of communication and reporting, approvals and coordination.

1.5 COMMISSIONING TEAM

.1 The commissioning team shall consist of the Contract Administrators, including Engineer, Operator, the General Contractor, sub-contractors preselected equipment suppliers and the General Contractors Commissioning Authority, whom shall be selected and paid for by the General Contractor.

1.6 NON-CONFORMANCE TO PERFORMANCE VERIFICATION REQUIREMENTS

.1 During Cx, should equipment, system components, and associated controls be identified as incorrectly installed, malfunctioning or not performing as per specifications, the contractor shall correct deficiencies, re-verify equipment and components within the system, including related systems as deemed necessary by the Contract Administrator, to ensure effective and accurate operation.

.2 Minor deficiencies may be corrected at the time of identification. For systems requiring major repairs, the Commissioning Team shall move on to the next system to be commissioning. The Contractor shall notify the Contract Administrator when the work is complete.

.3 Costs for corrective work, additional tests, inspections, to determine acceptability and proper performance of such items to be borne by Contractor.

1.7 CONFLICTS

.1 Report conflicts between requirements of this section, other sections, and the Cx Manual to the Contract Administrator to obtain clarification prior to the start of work.

.2 Failure to report conflict and obtain clarification will result in application of most stringent requirement.

1.8 SUBMITTALS

.1 Prior to starting Cx the Contractor shall provide a set of equipment and system submittals, these should be in the form of the Operation and Maintenance Manuals described throughout the specifications. These submittals are supplemented by the installation and start-up procedures, O&M data, performance data, control drawings and any changes that may affect commissioned systems.

1.9 COMMISSIONING DOCUMENTATION

.1 Refer to Section 01 91 33 - Commissioning (Cx) Forms for examples of the forms requirements and instructions for use as well as the Cx Manual.

.2 Checklists/Forms will be provided and maintained to the Contractor by the CxA during the construction stage.

.3 Installing subcontractors are to date and initial the checklists as construction and verifications are completed.

.4 The CxA assemble and track the completed checklists for review and acceptance by the Contract Administrator.

.5 Once the CxA has all documents completed and accepted the Contract Administrator, a final commissioning document shall be submitted in electronic form (PDF) and original signed copies.

1.10 COMMISSIONING SCHEDULE

.1 Submit preliminary Cx schedule in Gantt Chart format to CxA no later than sixteen (16) weeks. The Cx Schedule is to be included in the Cx Manual.

.2 The General Contractor Shall submit final Cx schedule in Gantt Chart format to CxA for review four (4) weeks prior to performance verification.

.3 Provide adequate time for Cx activities prescribed in technical sections, commissioning sections and the Cx manual including all on site activities as well as documentation procedures. Time should be allowed for re-verification should any system be rejected upon completion of initial verification.

.4 Provide adequate time for training.

1.11 STARTING AND TESTING

.1 Contractor assumes liabilities and costs for inspections, including disassembly and re-assembly after approval, starting, testing and adjusting, and supply of testing equipment, and all associated costs of installation and performance verification.

1.12 WITNESSING OF STARTING AND TESTING

.1 Provide twenty eight (28) days' notice prior to commencement.

.2 Contract Administrator to witness start-up and testing.

.3 Contractor's CxA to be present at tests performed and documented by sub-trades, suppliers and equipment manufacturers.

1.13 MANUFACTURER'S INVOLVEMENT

.1 The Contractor shall obtain manufacturers installation, start-up and operations instructions prior to start-up of components, equipment and systems..

.1 Compare completed installation with manufacturer's published data, record discrepancies, and review with manufacturer.

.2 Modify procedures detrimental to equipment performance and review same with manufacturer before start-up.

.2 Integrity of warranties:

.1 Use manufacturer's trained start-up personnel where specified elsewhere in other divisions or required to maintain integrity of warranty.

.2 Verify with manufacturer that testing as specified will not void warranties.

.3 Qualifications of manufacturer's personnel:

.1 Experienced in design, installation and operation of equipment and systems.

.2 Ability to interpret test results accurately.

.3 Ability to report results in clear, concise, logical manner.

1.14 PROCEDURES

.1 Verify that equipment and systems are complete, clean, and operating in normal and safe manner prior to conducting Performance Verification.

.2 Conduct Commissioning in following distinct phases:

.1 Included in delivery and installation:

.1 Verification of conformity to specification, approved shop drawings and completion of product information report forms.

.2 Visual inspection of quality of installation.

.2 Installation Verification: follow accepted start-up procedures.

.3 Performance Verification: document equipment performance. Include repetition of tests after correcting deficiencies.

.4 Post-substantial performance verification: to include fine-tuning.

.3 Correct deficiencies and obtain approval from Contract Administrator after distinct phases have been completed and before commencing next phase.

.4 Document required tests on checklists provided in the Cx Manual as well on any supplied Manufacturer forms.

.5 Failure to follow accepted Commissioning Processes will result in re-evaluation of equipment by an independent testing agency selected by Contract Administrator. If results reveal that equipment Commissioning Process was not in accordance with requirements, and resulted in damage to equipment, implement following:

.1 Minor equipment/systems: if evaluation report concludes that damage is minor, implement corrective measures approved by Contract Administrator.

.2 Major equipment/systems: If evaluation report concludes that major damage has occurred, Contract Administrator shall reject equipment to be removed from site and replaced with new.

.3 Subject new equipment/systems to specified Commissioning Process

1.15 COMMISSIONING DOCUMENTATION

.1 General Contractors CxA shall assemble Installation Verification documentation and submit to Contract Administrator for approval before commencement of Performance Verification.

.2 Installation Verification documentation to include:

.1 Factory and on-site test certificates for specified equipment.

.2 Inspection reports.

.3 Signed Installation Verification check lists.

.4 Start-up reports.

.5 Step-by-step description of complete start-up procedures, to permit the contractor or CxA to repeat start-up at any time.

1.16 OPERATION AND MAINTENANCE OF EQUIPMENT AND SYSTEMS

.1 After Performance Verification, operate and maintain equipment and systems as directed by equipment/system manufacturer.

.2 With assistance of manufacturer develop written maintenance program and submit to CxA for approval before implementation.

.3 Operate and maintain systems for minimum fourteen (14) days for commissioning to be completed, the final seven (7) days of the commissioning process shall be continuous without interruption.

.4 After completion of commissioning, aid the operations group to operate and maintain systems until issuance of Substantial Completion

1.17 TEST RESULTS

.1 If start-up, testing and/or performance verification produce unacceptable results, repair, replace or repeat specified starting and/or performance verification procedures until acceptable results are achieved.

.2 Provide personnel, resources and materials, assume all costs for re-verification.

1.18 INSTRUMENTS / EQUIPMENT

.1 CxA to prepare and submit to Contract Administrator for review and approval:

.1 Complete list of instruments proposed to be used.

.2 Listed data including, serial number, current calibration certificate, calibration date, calibration expiry date and calibration accuracy.

.2 Provide all required equipment to complete commissioning.

.3 Provide all Arc Flash Personal Protective Equipment as required. Provide commissioning personnel with the appropriate Arc Flash Protection training.

1.19 PERFORMANCE VERIFICATION

.1 Notify Commissioning Team at least twenty eight (28) days prior to start of Performance Verifications.

.2 Start Performance Verification after elements of building affecting start-up and performance verification of systems have been completed.

.3 Ensure all HVAC systems have been thoroughly cleaned.

.4 CxA to facilitate performance verification once identified pre-requisite activities are completed for a system and approved by the Contract Administrator.

.5 Test all building and process systems including architectural, structural, civil, mechanical and electrical components and operating procedures by challenging these systems to realistic operating conditions and train operational staff.

.6 Run systems through all sequences of operation and verify response of components.

.7 Notwithstanding all-inclusive requirements specified in this section, additional separate commissioning may be required at a later date for equipment and systems whose full operation is dependent on seasonal conditions.

.8 Carry out Cx:

.1 Under actual operating conditions, over entire operating range, in all modes.

.2 On independent systems and interacting systems.

.9 Cx procedures to be repeatable and reported results are to be verifiable.

.10 Follow equipment manufacturer's operating instructions.

.11 SCADA trending to be available as supporting documentation for performance verification.

.12 Contractor to obtain all documentation, including updated points list, controls sequences and setpoints, and submit documentation to commissioning authority for review. At completion of commissioning, scan completed manuals to electronic format on digital storage devices in PDF format as required and submit to CxA.

1.20 WITNESSING COMMISSIONING

.1 CxA along with designated representatives and Contract Administrator to witness activities and verify results.

1.21 AUTHORITIES HAVING JURISDICTION

.1 Where specified start-up, testing or commissioning procedures duplicate verification requirements of authority having jurisdiction, arrange for authority to witness procedures so as to avoid duplication of tests and to facilitate expedient acceptance of facility.

.2 If the CxA is not available to witness, the certificates of approval from the Authority Having Jurisdiction will be accepted as adequate.

.3 Obtain certificates of approval, acceptance and compliance with rules and regulation of authority having jurisdiction.

.4 Provide copies to Contract Administrator within five (5) working days of test and with Cx report.

1.22 REPEAT VERIFICATIONS

.1 Assume costs incurred by Owner’s Commissioning representatives for second and subsequent verifications where:

.1 Verification of reported results fails to receive Contract Administrator's approval.

.2 Repetition of second verification again fails to receive approval.

.3 Contract Administrator deems Contractor's request for second verification was premature.

1.23 DEFICIENCIES, FAULTS, DEFECTS

.1 Report problems, faults or defects affecting Cx to Contract Administrator in writing. Stop Cx until problems are rectified. Proceed with written approval from Contract Administrator.

.2 Correct deficiencies found during start-up and Cx to satisfaction of Contract Administrator.

1.24 COMPLETION OF COMMISSIONING

.1 Upon completion of Cx leave systems in normal operating mode.

.2 Except for warranty and seasonal verification activities, complete Cx prior to application for Substantial Completion.

.3 Cx to be considered complete when all Cx deliverables have been submitted and accepted by Contract Administrator.

.4 The Contractor is to compile a Final Commissioning Report summarizing all tasks, findings and documentation of the commissioning process. The Final Commissioning Report is to incorporate all test reports by sub-contractors, manufacturer's and controlling authorities including the following list. The Contractor shall turn over all materials per this specification.

.1 Evaluation of operating condition of the systems at the time of functional test completion.

.2 Deficiencies that were discovered and measures taken to correct them.

.3 Functional test procedures and results.

.4 Documentation of all commissioning field activities as they progressed.

.5 Description and estimated schedule of required deferred testing.

.5 The Contractor to provide O&M manuals, maintenance materials, warranties and training records.

1.25 ACTIVITIES UPON COMPLETION OF COMMISSIONING

.1 When changes are made to baseline components or system settings established during Cx process notify the Commissioning Team. The Contractor will update and provide Cx forms for affected item.

1.26 TRAINING

.1 In accordance with Section 01 91 41 - Commissioning (Cx) – Training, the Cx Manual and respective technical sections.

1.27 MAINTENANCE MATERIALS, SPARE PARTS, SPECIAL TOOLS

.1 Supply, deliver, and document maintenance materials, spare parts, and special tools as specified in contract. Provide transmittal documenting all materials provided.

1.28 OCCUPANCY

.1 Cooperate fully with the Commissioning Team during stages of acceptance and occupancy of facility.

1.29 PERFORMANCE VERIFICATION TOLERANCES

.1 Application tolerances:

.1 Specified range of acceptable deviations of measured values from specified values or specified design criteria, except for special areas, to be within +/- 5 % of specified values.

.2 Instrument accuracy tolerances:

.1 To be of higher order of magnitude than equipment or system being tested.

.3 Measurement tolerances during verification:

.1 Unless otherwise identified, recorded values to be within +/- 2 % of specified values.

1.30 OWNER'S PERFORMANCE TESTING

.1 Performance testing of equipment or system by CxA will not relieve Contractor from compliance with specified start-up and testing procedures.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 SCHEDULE

.1 Provide a detailed schedule as per this section for on-site verification activities by the commissioning team based on the Cx Manual provided by the Contractor. Be responsible for resource allocation respecting the exact number and duration for personnel required to perform the tasks required.

.2 This schedule shall be submitted with the general construction schedule monthly. The level of detail shall increase as the construction progresses.

3.2 COMMISSIONING TASKS

.1 The Cx Manual will provide a list of tasks to be conducted for the commissioning process. Further specifics are provided within applicable specification sections.

END OF SECTION

EQUIPMENT INSTALLATION AND START UP

PART 1 GENERAL

1.1 INTENT

.1 This section describes general requirements for process, hoisting, mechanical, and electrical equipment relating to supply, installation, testing, and commissioning; and the verification thereof.

1.2 DEFINITIONS

.1 Manufacturer: The Manufacturer is the person, partnership, or corporation responsible for the fabrication of equipment provided to the Contractor for the completion of the Work.

.2 Manufacturer's Representative: A Manufacturer's Representative is a trained serviceman empowered by the Manufacturer to provide installation, testing, and commissioning assistance to the Contractor in his performance of these functions.

1.3 EXPERTISE AND RESPONSIBILITY

.1 The Owner recognizes the expertise of the Manufacturers.

.2 Should the Contract Administrator issue an Addendum, Field Order, Change Order, Site Instruction to change the Work which would, in the opinion of the Contractor, compromise the success or safety of the Work, then it shall be incumbent on the Contractor to promptly notify in writing the Contract Administrator and the Owner to this effect within two days.

1.4 EQUIPMENT DELIVERY

.1 The Contractor shall be responsible for receiving, unloading, and storage of all equipment.

.2 The Contractor shall ensure that he has fully informed himself of precautions to be taken in the unloading of equipment and its subsequent storage.

.3 The Contractor shall inspect the contents of any equipment delivery to satisfy himself of the contents thereof and damage which may have occurred during transport.

.4 For equipment being delivered to the site, the Contractor shall advise the Contract Administrator seven days in advance of the arrival of the equipment.

.5 Where the Contractor identifies damage or deficiencies in the equipment delivered, this damage or deficiency shall be reported to the Contract Administrator and Manufacturer prior to unloading.

1.5 IDENTIFICATION OF EQUIPMENT

.1 Provide a manufacturer's nameplate on each piece of equipment.

.2 Provide tag numbers on all valves and on each piece of equipment. Include abbreviated descriptions on each piece of equipment. Minimum size 75mm x 35mm x 2.5mm thick laminated plastic with black face and engraved white lettering. Letters to be 6mm high.

.3 Submit list to Contract Administrator for approval.

1.6 INSTALLATION ASSISTANCE

.1 Before commencing installation of equipment, the Contractor shall arrange for the attendance of the Manufacturer's Representative to provide instructions in the methods, techniques, precautions, and other information relevant to the successful installation of the equipment.

.2 The Contractor shall inform the Contract Administrator, in writing, of the attendance at the site of any Manufacturer's Representative for installation training at least fourteen days prior to arrival.

.3 When the Manufacturer's Representative is satisfied that the Contractor is aware of all installation requirements, he shall so certify by completing Form 101 attached to this specification.

.4 Installation of the equipment shall not commence until the Contract Administrator has advised that he has received the completed Form 101.

1.7 INSTALLATION

.1 If necessary, or if so directed by the Contract Administrator during the course of installation, the Contractor shall contact the Manufacturer to receive clarification of installation procedures, direction, or any other additional information necessary to continue or complete the installation in an appropriate manner.

.2 If it is found necessary, or if so directed by the Contract Administrator, the Contractor shall arrange for the Manufacturer's Representative to visit the site to provide assistance during installation, all at no cost to the Owner.

.3 Prior to completing installation, the Contractor shall inform the Manufacturer and arrange for the attendance at the site of the Manufacturer's Representative to verify successful installation.

.4 The Contractor shall advise the Contract Administrator in writing, at least seven days prior, of the Manufacturer's Representative schedule arrival.

.5 The Manufacturer's Representative shall conduct a detailed inspection of the installation including alignment, electrical connections, belt tensions, rotation

direction, running clearances, lubrication, workmanship and all other items as required to ensure successful operation of the equipment.

.6 The Manufacturer's Representative shall identify any outstanding deficiencies in the installation.

.7 In the presence of the Manufacturer's Representative, the Contractor, and the Contract Administrator, the equipment shall then be given a minimum of one hour trial run.

.8 If deficiencies noted by the Manufacturer's Representative or which become evident in the trial run prejudice the successful completion of the trial run the deficiencies will be rectified by the Contractor and the Manufacturer's Representative will be required to re-inspect the installation, at no cost to the Owner.

.9 On successful completion of the trial run in the second or subsequent attempt, the Manufacturer's Representative will certify successful installation by completing Form 102 attached to this specification.

.10 The completed Form 102 shall be delivered to the Contract Administrator prior to departure of the Manufacturer's Representative form the site.

.11 Tag the equipment with a 100mm by 200mm blue card stating "Equipment Checked". "Do Not Run" stenciled in large black letters. The Contractor shall sign and date each card.

1.8 OPERATION AND PERFORMANCE VERIFICATION

.1 Equipment will be subjected to a demonstration, running test, and performance tests after the installation has been verified and any identified deficiencies have been remedied.

.2 The Contractor shall inform the Contract Administrator at least fourteen days in advance of conducting the tests and arrange for the attendance of the Manufacturer's Representative. The tests may be concurrent with the inspection of satisfactory installation if mutually agreed by the Contractor and the Contract Administrator. The contractor shall provide the Contract Administrator with a copy of the performance test plan and list parameters to observe with the acceptable range of the parameters."

.3 The Manufacturer's Representative will conduct all necessary checks to equipment and if necessary, advise the Contractor of any further checking, flushing, cleaning, or other work needed prior to confirming the equipment is ready to run.

.4 The Contractor shall then operate the equipment for at least one hour to demonstrate to himself the operation of the equipment and any required ancillary

services. Any remedial measures required to ensure satisfactory operation shall be promptly undertaken.

.5 The Contractor shall then notify the Contract Administrator of his readiness to demonstrate the operation of the equipment. The Contract Administrator shall attend, as expeditiously as possible. The Owner's representative, also shall attend if deemed appropriate by the Owner.

.6 With the assistance of the Manufacturer's Representative, the Contractor will demonstrate that the equipment is properly installed. Alignment, piping, connections, electrical connections, etc. will be checked and if appropriate, code certifications provided.

.7 The equipment shall then be run for a minimum of one hour. Detailed equipment specifications may require longer durations than one hour – refer to detailed specifications. Local control shall be satisfactorily verified by cycling the equipment through several start-stop operations, modulating its output, or some combination. Operating parameters such as temperature, pressure, voltage, vibration, etc. will be checked to ensure that they are within the specified Manufacturer's recommended limits, whichever is more stringent.

.8 On satisfactory completion of the demonstration run, the equipment will be stopped and critical parameters, such as alignment, will be rechecked.

.9 The equipment will be restarted and run for three days, of which the last twenty-four hours shall be consecutive. During this period, as practical, conditions will be simulated which represent maximum or most severe, average, and minimum or least severe conditions. These conditions will be mutually agreed by the Contractor and Contract Administrator on the basis of the information contained in the technical specifications, as well as the methods utilized to create the simulated conditions and the time periods allotted to each.

.10 Performance tests will be conducted either concurrent with or subsequent to the running test, as practical and agreed between the Contract Administrator and the Contractor.

.11 Performance tests shall be dictated in the technical specifications for each item of equipment or as reasonably required by the Contract Administrator to prove adherence to the requirements listed in the specification.

.12 Results of the performance tests shall be documented and summarized by the Contractor in a format acceptable to the Contract Administrator.

.13 All water, chemicals (unless otherwise noted), temporary power, heating, or any other ancillary service required to complete the initial demonstration, running test and performance tests shall be the responsibility of the Owner.

.14 Should the initial demonstration, running test or performance tests reveal any defects, then these defects shall be promptly rectified and the demonstration,

running tests, and/or performance tests shall be repeated to the satisfied of the Contract Administrator. Additional costs incurred by Contractor, the Contract Administrator, or the Owner, due to repeat demonstration, running tests, and/or performance tests shall be the responsibility of the Contractor.

.15 On successful completion of the demonstration, running test, and performance tests, Form 103 attached to this specification will be signed by the Manufacturer's Representative, Contractor, and the Engineer. The contractor shall affix to form 103 the results of performance test including the data documenting the observed values or characteristics of the performance parameters.

.16 The Contractor shall affix to the tested equipment a 100mm by 200mm yellow card reading "Operable Condition" – Do not Operate without Contractors Permission" stenciled on in large black letter.

1.9 OPERATOR TRAINING

.1 For equipment specified to include training, arrange for the attendance of the Manufacturer's Representative to provide classroom training session(s).

.2 Coordinate the training session(s) with the supplier.

1.10 SECTION INCLUDES

.1 Commissioning forms to be completed for equipment, systems and integrated systems.

1.11 RELATED SECTIONS

.1 Section 01 78 00 – Closeout Submittals.

.2 Section 01 91 13 – Commissioning (Cx) Requirements.

.3 Section 01 91 41 – Commissioning (Cx) Training.

1.12 INSTALLATION VERIFICATION CHECK LISTS

.1 Prior to initiation of Performance Verification the Contractor will develop and provide the required project specific Cx Manual which will include the Installation Verification check lists, included with this specification.

.2 Completed Installation Verification Checklists to be submitted to Contract Administrator for review and approval.

.3 Include the following data:

.1 Product manufacturer's installation instructions and recommended checks.

.2 Special procedures as specified in relevant technical sections.

.3 Items considered good installation and Contract Administratoring industry practices deemed appropriate for proper and efficient operation.

.4 Equipment manufacturer's installation/start-up check lists are acceptable for use in conjunction with installation verification check lists forming part of the Cx manual. Manufacturer's check sheets used must be attached to final document submittals.

.5 Installer to sign check lists upon completion, certifying stated checks and inspections have been performed. Completed check lists to be submitted by the contractor at completion of the Commissioning Process.

.6 Use of check lists will be considered part of commissioning process.

1.13 PERFORMANCE VERIFICATION CHECK LISTS

.1 The Contractor will develop and provide to the Commissioning Team the required project specific Cx Manual including the Performance Verification check lists.

.2 Completed Performance Verification Checklists to be submitted to Contract Administrator for review and approval.

.3 Strategy for Use:

.1 Contractor will provide required shop drawings information and verify correct installation and operation of items indicated on these forms.

.2 Confirm operation as per design criteria and intent.

.3 Identify variances between design and operation and reasons for variances.

.4 Verify operation in specified normal and emergency modes and under specified load conditions.

.5 Record analytical and substantiating data.

.6 Verify reported results.

.7 Form to bear signatures of recording technician and reviewed and signed off by General Contractor, Installing Contractor, Contract Administrator, and the Commissioning Agent.

.8 Reported results in true measured SI (metric) unit values.

.9 Maintain copy on site during start-up, testing and commissioning period.

.10 Forms to be both hard copy and electronic format.

.4 Upon completion of Performance Verification the contractor shall submit all completed checklists to the Commissioning Team and will include the checklists within the Operation and Maintenance Manuals.

.5 Final submittal shall include all Installation Verification, Performance Verification check lists, training records, maintenance materials transmittals, written warranties and a list of all Cx activities postponed due to seasonal, climatic, occupancy, or other reasons beyond the contractor's control.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

PART 4 COMMISSIONING FORMS

CERTIFICATE OF READINESS TO INSTALL
FORM 101

I have familiarized the installer of the specific installation requirements related to the equipment listed below and am satisfied that he understands the required procedures.

PROJECT:

ITEM OF EQUIPMENT:

TAG NO.:

REFERENCE SPECIFICATION:

COMMENTS:

Print: Signature:

MANUFACTURE'S REPRESENTATIVE (DATE)

CERTIFICATE OF SATISFACTORY INSTALLATION
FORM 102

I have completed my check and inspection of the installation listed below and confirm that it is satisfactory and that defects have been remedied to my satisfaction except any as noted below.

PROJECT:

ITEM OF EQUIPMENT:

TAG NO.:

REFERENCE SPECIFICATION:

OUTSTANDING DEFECTS:

Print: Signature:

MANUFACTURE'S REPRESENTATIVE (DATE)

CERTIFICATE OF EQUIPMENT SATISFACTORY PERFORMANCE
FORM 103

We certify that the equipment listed below has been operated for at least three days of which the last twenty-four hours were consecutive and that the equipment operates satisfactorily and meets its specified operating criteria. No defects in the equipment were found. The equipment is therefore classed as “conforming”.

PROJECT:

ITEM OF EQUIPMENT:

TAG NO.:

REFERENCE SPECIFICATION:

Print: Signature:
MANUFACTURE’S REPRESENTATIVE (DATE)

Print: Signature:
GENERAL CONTRACTOR’S REPRESENTATIVE (DATE)

Print: Signature:
CONTRACT ADMINISTRATOR (DATE)

END OF SECTION

COMMISSIONING FORMS

PART 1 GENERAL

1.1 SECTION INCLUDES

.1 Commissioning forms to be completed for equipment, systems and integrated systems.

1.2 RELATED SECTIONS

.1 Section 01 78 00 – Closeout Submittals.

.2 Section 01 91 13 – Commissioning (Cx) Requirements.

.3 Section 01 91 41 – Commissioning (Cx) Training.

1.3 INSTALLATION VERIFICATION CHECK LISTS

.1 Prior to initiation of Performance Verification the Contractor will develop and provide the required project specific Cx Manual which will include the Installation Verification check lists, developed in accordance with this specification.

.2 Completed Installation Verification Checklists to be submitted to Contract Administrator for review and approval.

.3 Include the following data:

.1 Product manufacturer's installation instructions and recommended checks.

.2 Special procedures as specified in relevant technical sections.

.3 Items considered good installation and engineering industry practices deemed appropriate for proper and efficient operation.

.4 Equipment manufacturer's installation/start-up check lists are acceptable for use in conjunction with installation verification check lists forming part of the Cx manual. Manufacturer’s check sheets used must be attached to final document submittals.

.5 Installer to sign check lists upon completion, certifying stated checks and inspections have been performed. Completed check lists to be submitted by the contractor at completion of the Commissioning Process.

.6 Use of check lists will be considered part of commissioning process.

1.4 PERFORMANCE VERIFICATION CHECK LISTS

.1 The Contractor will develop and provide to the Commissioning Team the required project specific Cx Manual including the Performance Verification check lists.

.2 Completed Performance Verification Checklists to be submitted to Contract Administrator for review and approval.

.3 Strategy for Use:

.1 Contractor will provide required shop drawings information and verify correct installation and operation of items indicated on these forms.

.2 Confirm operation as per design criteria and intent.

.3 Identify variances between design and operation and reasons for variances.

.4 Verify operation in specified normal and emergency modes and under specified load conditions.

.5 Record analytical and substantiating data.

.6 Verify reported results.

.7 Form to bear signatures of recording technician and reviewed and signed off by General Contractor, Installing Contractor, Contract Administrator, and the Commissioning Agent.

.8 Reported results in true measured SI (metric) unit values.

.9 Maintain copy on site during start-up, testing and commissioning period.

.10 Forms to be both hard copy and electronic format.

.4 Upon completion of Performance Verification the contractor shall submit all completed checklists to the Commissioning Team and will include the checklists within the Operation and Maintenance Manuals.

.5 Final submittal shall include all Installation Verification, Performance Verification check lists, training records, maintenance materials transmittals, written warranties and a list of all Cx activities postponed due to seasonal, climatic, occupancy, or other reasons beyond the contractor's control.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

COMMISSIONING TRAINING

PART 1 GENERAL

1.1 SECTION INCLUDES:

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

1.2 RELATED SECTIONS:

.1 Section 01 78 00 – Closeout Submittals.

.2 Section 01 91 13 – Commissioning (Cx) Requirements.

.3 Section 01 91 33 – Commissioning (Cx) Forms.

1.3 TRAINEES

.1 Trainees: personnel selected for operating and maintaining this facility including, but not limited to, Facility Manager, building operators, maintenance staff, security staff, and technical specialists as required.

.2 Trainees may be available for training during any stage of construction.

1.4 INSTRUCTORS

.1 The Cx Manual will contain:

.1 Descriptions of systems.

.2 Instruction on design philosophy, design criteria, and design intent.

.2 Contractor and certified factory-trained manufacturers' personnel: to provide instruction on the following:

.1 Start-Up, operation, shut-down and maintenance of equipment, components and systems.

.2 Control features and reasons for, results of, implications on associated systems of adjustment of set points of control and safety devices.

.3 Instructions on servicing, maintenance and adjustment of systems, equipment and components.

.4 Training to be completed after Installation and Performance Verification are completed.

1.5 TRAINING OBJECTIVES

.1 Training to be detailed and of sufficient duration to ensure:

.1 Safe, reliable, cost-effective, energy-efficient operation of systems in normal, automatic and emergency modes under all conditions.

.2 Effective on-going inspection, measurements of system performance.

.3 Proper preventive maintenance, diagnosis, trouble-shooting and maintenance.

.4 Ability to update documentation.

.5 Ability to operate equipment and systems under emergency conditions until appropriate qualified assistance arrives.

1.6 TRAINING MATERIALS

.1 Instructors to be responsible for content and quality. Provide copies for all those in attendance.

.2 Prepare a draft handout taking the form of the relevant sections of the operation and maintenance manual supplemented with any other information needed to fully explain the equipment operation.

.3 Prepare an agenda, broken into suitable time periods outlining the content of the training sessions. Allow 0.5 hours at the beginning of the first period for the Engineer to provide a summary of the design intent relating to that equipment.

.4 Training materials to include:

.1 "As-Built" Contract Documents.

.2 Operating Manual.

.3 Maintenance Manual.

.4 Testing, adjusting and balancing and performance verification reports where applicable.

.5 Contract Administrator will review training manuals.

.6 Training materials to be in a format that permits future training procedures to the same degree of detail with or without the instructor.

1.7 SCHEDULING

.1 Contractor to include in schedule time for training. Provide a detailed commissioning schedule indicating all Cx tasks and training.

.2 Deliver training during regular working hours, training sessions to be determined in Commissioning meetings.

.3 The final date for the training sessions will be established by the Contract Administrator. The date will not necessarily coincide with testing or installation visits by the Manufacturer’s Representatives.

.4 Training to be completed prior to Substantial Completion, it will be incumbent upon the Contractor to verify that the Trainee’s have confirmed that they have received adequate training to operate and maintain the facility. The training is not considered complete, nor with Substantial Completion be awarded, until the Trainee’s have verified that they have received adequate training.

1.8 RESPONSIBILITIES

.1 Contractor shall be responsible for:

.1 Implementation of training activities,
.2 Coordination among instructors,
.3 Quality of training, training materials,

.2 Contract Administrator will evaluate training and materials.

.3 Upon completion of training, provide written report, signed by Instructors, witnessed by Contract Administrator. Include list of those in attendance. The Cx manual will provide templates for these submittals.

1.9 TRAINING CONTENT

.1 Training to include demonstrations by Instructors using the installed equipment and systems.

.2 Content includes:

.1 Review of facility and occupancy profile.
.2 Functional requirements.
.3 System philosophy, limitations of systems and emergency procedures.
.4 Review of system layout, equipment, components and controls.
.5 Equipment and system start-up, operation, monitoring, servicing, maintenance and shut-down procedures.
.6 System operating sequences, including step-by-step directions for starting up, shut-down, operation of valves, dampers, switches, adjustment of control settings and emergency procedures.
.7 Maintenance and servicing.
.8 Trouble-shooting diagnosis.
.9 Inter-Action among systems during integrated operation.
.10 Review of O&M documentation.

.3 Provide specialized training as specified in relevant Technical Sections of the construction specifications.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

DIVISION 3 INDEX

CONCRETE RESTORATION

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 03 20 00 - Concrete Reinforcing

.2 Section 03 30 00 - Cast in Place Concrete

1.2 SCOPE

.1 This section details the repair of existing concrete surfaces as indicated on the drawings, as specified, or as required to complete the Work. This specification covers the furnishing of all labor, equipment and materials required to rehabilitate spalled, scaled, cracked, or structurally damaged concrete surfaces. The repair shall restore the concrete to its' original surface profiles, performance and specifications.

1.3 SUBMITTALS

.1 Specifications and data covering physical properties, the mixtures, application procedures, and curing procedures of the materials proposed shall be submitted in accordance with the Submittals Procedures section. Submittals shall include the approvals required from the material manufacturer.

1.4 QUALITY ASSURANCE

.1 Manufacturer's Field Services

.1 The material manufacturer shall provide engineering field services to review the project and the selected material application prior to any preparation; to approve the applicator, the material used, and the procedure to be used; to observe and approve surface preparation; and to observe application and curing procedures.

.2 Materials

.1 Material manufacturer shall provide proof of documented quality assurance.

.3 Applicator

.1 The repair contractor shall have experience and proficiency specific to the repair type and shall be acceptable to Engineer and the material supplier. The applicator shall submit, through Contractor, a satisfactory experience record including references for previous application of the specified materials to concrete structures of similar design and complexity.

.4 Pre-Construction Meeting

.1 At least 30 days prior to planned performance of the Work, Contractor shall conduct a meeting to review the detailed requirements for the Work. Site conditions, surface preparation, proposed equipment, procedures, material mixing, placing and finishing procedures, and curing methods shall be discussed and approved by Engineer and by the manufacturer's field representative. Contractor shall require the attendance of all involved parties, including but not limited to Contractor's superintendent, repair contractor if applicable, manufacturer's field representative and proposed equipment supplier representative. Minutes of the meeting shall be recorded, typed and printed by Contractor and distributed to all parties, including Owner's Representative, within 5 days after the meeting.

.5 Site Conditions

.1 Job conditions shall be maintained at standards that allow material placement within temperature and cleanliness requirements.

.2 Unusual conditions or unexpected additional deterioration uncovered during the course of Work by Contractor shall be brought to the Owner's Representative's attention for analysis and disposition.

.3 These conditions include but are not limited to poor quality base concrete, severely corroded reinforcing steel, random cracks, and any other condition which would prevent completion of the Work in accordance with manufacturer's recommendations and this specification.

.4 Pre-Bid Inspection

.1 The Contractor shall visit the site prior to bid submittal.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Repair Materials:

.1 SikaTop 123 plus.
.2 SikaDur 31 Hi-Mod Gel
.3 SikaTop Armatec 110 EpoCem
.4 SikaGard 75 EpoCem
.5 SikaGard EWL Trowel Grade
.6 SikaGard 550W Elastic
.7 Sika MonoTop 410 F
.8 SikaGrout 212 HP
.9 Sikaflex 2C-NS sealant
.10 Sikaflex 202 primer

2.2 Delivery, Storage and Handling:

.1 Deliver materials to site in manufacturer's original unopened containers and packaging, bearing labels as to type and names of products and manufacturers.

PART 3 EXECUTION

3.1 Site Conditions:

.1 Thoroughly ventilate spaces where materials containing volatile solvents are being used. Use forced air ventilation to thoroughly dissipate solvents for a minimum period of 72 hours to such time that the product is thoroughly cured.

3.2 Inspection:

.1 Report, in writing, any defects in previously prepared work, or unsatisfactory site conditions. Proceed with work under this section only when such defects have been entirely corrected.

.2 The repair material manufacturer's technical representative is to provide periodic inspections of work in progress. As a minimum, manufacturer's technical representative is to be present to review surface preparation prior to placing patching material and again when patching work is approximately 50% complete. A final inspection is to be performed upon substantial completion of work.

3.3 Surface Preparation:

.1 Crack Repairs:

- .1 Flush debris and deleterious materials out of crack prior to injecting flexible polyurethane grout.
- .2 Rout out all visible cracks and remove all loose edges.
- .3 Refer to drawings for details.

.2 Surface Repairs:

- .1 Remove all deteriorated, cracked, unsound or damaged concrete.
- .2 Conform to repair mortars manufacturer’s requirements for surface texture and preparation.
- .3 High pressure wash using min. 4,000 to 6000 psi (28 MPa) to thoroughly clean the entire area to be repaired, patched and/or coated.
- .4 Refer to drawings for details.

3.4 Installation of Flexible Polyurethane Grout:

.1 Conform to manufacturer's written instructions for installation of flexible polyurethane grout.

.2 Use injection ports inclined to intersect crack. Grind injection ports flush with concrete surface upon completion of crack injection.

.3 Remove excess flexible polyurethane grout from exposed surfaces.

3.5 Installation of Repair Mortar:

.1 Conform to manufacturer's written instructions for installation of repair mortar.

.2 Extend repair mortar with 10 mm pea gravel aggregate for patches greater than 38 mm in thickness, but do not exceed 100 mm in a single lift.

.3 Blend surfaces of patch with surface of existing concrete's finished surface with a smooth steel trowel or broom finish when existing surface is non-slip.

.4 Wet cure patches for a minimum of 7 days.

3.6 Cleaning:

.1 Clean-up:

.1 Leave finished work and work area in a neat, clean condition without evidence of spillovers onto adjacent areas.

END OF SECTION

CONCRETE FORMING AND ACCESSORIES

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 03 20 00 - Concrete Reinforcing.

.2 Section 03 30 00 - Cast-in-place Concrete.

1.2 REFERENCES

.1 Canadian Standards Association (CSA) – Current Editions

- .1 CAN/CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
- .2 CSA-O86S1, Supplement No. 1 to CAN/CSA-O86-01, Engineering Design in Wood.
- .3 CSA O121, Douglas Fir Plywood.
- .4 CSA O151, Canadian Softwood Plywood.
- .5 CAN/CSA-S269.1, Falsework and Formwork.
- .6 CSA 0153, Poplar Plywood.
- .7 CSA 0437, Standards for OSB and Waferboard.
- .8 CSA 0188, Interior Mat Formed Wood Particleboard.
- .9 CAN/CSA-0141, Softwood Lumber

.2 National Lumber Grade Authority (NLGA): Standard Grading Rules for Canadian Lumber.

.3 Ontario Provincial Standards Specification (OPSS): 919 Construction Specification for Formwork and Falsework – Current Edition.

1.3 SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00 – Submittals.

.2 Indicate method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, special architectural exposed finishes, ties, liners, camber, and locations of temporary embedded parts. Comply with CSA S269.1, for falsework and formwork drawings.

.3 Indicate formwork design data, such as permissible rate of concrete placement, and temperature of concrete in forms.

.4 Indicate sequence of erection and removal of formwork/falsework. Indicate location of all construction joints in slabs and walls.

.5 Design, construct and dismantle falsework and formwork in accordance with the requirements of CSA A23.1, CSA S269.1 – Falsework for Construction Purposes, and CSA 269.3 – Concrete Formwork.

.6 All temporary supports and shoring for formwork shall be designed by a Professional Engineer Registered in the Province of Ontario.

.7 Each shop drawing submission shall bear stamp and signature of qualified professional engineer licensed in Province of Ontario.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Formwork materials:

.1 Plywood for exposed concrete to be new factory resin coated medium density overlaid Douglas Fir plywood, 19mm thick, base material with 7 ply Cofiform Grade finish. Coated side to be in contact with concrete. Plywood for concealed concrete may be re-used Douglas Fir Plywood. See below for form liner requirements.

.2 For concrete without special architectural features, use wood and wood product formwork materials to CSA-O121, CSA 0141, CSA 0437 or CSA-0153.

.3 For concrete with special architectural features, use formwork materials to CSA-A23.1/A23.2.

.4 Form tie minimum working strength of 13kN.

.5 Snap ties shall release at 25mm from face of concrete without damaging concrete.

.6 Cone ties to be internal disconnecting type which snap 38mm from concrete surface.

.7 Form release agent: chemically active release agents containing components that react with free lime in concrete to provide water insoluble soaps, preventing set of film of concrete in contact with form (Formshield WB by Euclid Chemical or Noxcrete Form Coating).

.8 Plastic Anchor Bolt Sleeves: Dayton/Richmond D-1-S Anchor Bolt Sleeves. Size to suit anchor bolt diameter and embedment.

.2 Form ties:

.1 Water Retaining Structures and Headworks Concrete Walls – Use plastic cone type coil ties which break off or are removeable 38mm inside the concrete surface complete with neoprene washers in centre of tie to break surface continuity and prevent water seepage (water retaining and concrete basement walls below grade). Standard of acceptance: - National Concrete Accessories – 2 or 4 strut Waterseal Tyscru with

Tycones. Fill tie holes with light grey concrete plugs by OCM or approved equivalent.

.2 For concrete not designated 'Architectural', use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm dia. in concrete surface.

.3 For Architectural concrete (other than above), use snap ties complete with plastic cones and light grey concrete plugs.

.4 Unexposed concrete surfaces – snapties, coil ties or she-bolts to suit application. They are to be free of devices leaving holes larger than 25mm diameter.

.3 Form liner:

.1 Zemdrain MD, Type III Controlled Permeability Formliner (CPF) – maximum 3 uses prior to discard or Zemdrain Classic, Type II Controlled Permeability Formliner (CPF) – maximum single use prior to discard.

.4 Form release agent: chemically active release agents containing compounds that react with free lime in concrete resulting in water insoluble soaps, non-toxic, biodegradable.

.5 Falsework materials: to CSA-S269.1.

.6 Sealant: to Section 07 92 00 - Joint Sealants

PART 3 EXECUTION

3.1 FABRICATION AND ERECTION

.1 Verify lines, levels and centres before proceeding with formwork/falsework and ensure dimensions agree with drawings.

.2 It is acceptable to leave timber formwork in place along north side of new wall adjacent to building (500mm void space) at the discretion of the contractor.

.3 Fabricate and erect falsework in accordance with CSA S269.1 and COFI Exterior Plywood for Concrete Formwork.

.1 Variation from plumb: plumbness of columns and walls shall be within 1:400 but not more than 15mm.

.2 Variation of cross-section of beams, columns, wall thickness, and slab thickness other than slab on grade shall be +/-8mm (0-300mm), +/-12mm (301-1000mm), and 20mm (>1000mm).

.3 Average slope of floors, beams and other horizontal units shall be within 1:400 but not more than 20mm for the total length of the structure.

.4 Variation of the linear building lines from established position in plan for all elements to be 6mm (0-6000mm) and +/- 12mm (>6000mm).

.4 Concrete exposed to view is considered as requiring architectural exposed finishes.

.5 Utilize form liner on all vertical concrete surfaces (all sides of walls, piers, columns and beams) and underside of exposed concrete soffits. Space anchors at not more than 400mm o.c. each way in strict accordance with the manufacturer's written instructions. Ensure the liner is tight throughout as to avoid any indentations in the surface of newly cast concrete. Follow manufacturer's instructions.

.6 Camber all formwork to compensate for anticipated deflections in formwork prior to hardening of concrete. Positive means of adjustment (wedges or jacks) or shores and struts to be provided and all settlement taken up during concrete placing operations.

.7 Do not place shores and mud sills on frozen ground.

.8 Provide site drainage to prevent washout of soil supporting mud sills and shores.

.9 Fabricate and erect formwork in accordance with CAN/CSA-S269.3, to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA-A23.1/A23.2.

.10 Align form joints and make watertight. Keep form joints to minimum.

.11 Locate horizontal form joints for exposed columns 2400 mm above finished floor elevation.

.12 Use 20 mm chamfer strips on external corners and/or 20 mm fillets at interior corners, joints, unless specified otherwise.

.13 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.

.14 Construct forms for architectural concrete, and place ties as indicated and/or as directed. Joint pattern not necessarily based on using standard size panels or maximum permissible spacing of ties.

.15 Build in anchors, sleeves, and other inserts required to accommodate work specified in other sections. Ensure that all anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.

.16 Provide temporary cleanout and inspection openings at the base of wall forms at maximum 5000mm o.c. Openings shall be located such that flushing water will drain from the form. Close temporary openings with tight fitting panels, flush with the inside form face prior to concrete placement. Joints to be neat and tight.

.17 Clean formwork in accordance with CSA-A23.1/A23.2, before placing concrete.

3.2 REMOVAL AND RESHORING

.1 Conform to CSA A23.1.

.2 Leave formwork in place for the following minimum periods of time after placing:

.1 7 days for elevated slabs, beams and walls. Install re-shores immediately at 3000 o.c. each direction.

.2 4 days for columns, piers and foundation walls

.3 2 days for footings

.3 Remove slab formwork when concrete has reached 75% of its design strength or minimum period noted above, whichever is longer, and replace immediately with adequate re-shoring (maximum 3000 o.c each direction). Ensure the slab is not loaded until the concrete reaches its design strength.

.4 Provide all necessary reshoring of members where early removal of forms may be required or where members may be subjected to additional loads during construction as required.

.5 Space reshoring in each principal direction in accordance with engineered design.

.6 Remove any sections of liner which may have become embedded in the concrete and restore the surface at these locations to the approval of the Engineer.

.7 All concrete surfaces, including those with form liners, shall be finished with a sack rubbed parge coat.

.8 Re-use formwork and falsework subject to requirements of CSA-A23.1A23.2.

END OF SECTION

CONCRETE REINFORCING

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 03 10 00 – Concrete Forming and Accessories.

.2 Section 03 30 00 - Cast-in-Place Concrete.

.3 Section 03 41 13 – Precast Concrete Hollow Core Planks.

1.2 REFERENCES

.1 American Concrete Institute (ACI) – Current Editions

.1 ACI SP-66, ACI Detailing Manual, 2004.

.2 American Society for Testing and Materials International (ASTM) – Current Editions

.1 ASTM A82/A28M, Standard Specification for Steel Wire, Plain for Concrete Reinforcement.

.2 ASTM A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.3 ASTM A185/A185M, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.

.4 ASTM A497/A497M, Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete.

.5 ASTM A1022/A1022M, Standard Specification for Deformed and Plain Stainless Steel Wire and Welded Wire for Concrete Reinforcement.

.3 Canadian Standards Association (CSA) – Current Editions

.1 CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of test and Standard Practices for Concrete.

.2 CSA-A23.3, Design of Concrete Structures.

.3 CSA-G30.18, Carbon Steel Bars for Concrete Reinforcement.

.4 CSA-G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel /Structural Quality Steel.

.5 CAN/CSA-G164, Hot Dip Galvanizing of Irregularly Shaped Articles.

.6 CSA W186, Welding of Reinforcing Bars in Reinforced Concrete Construction.

.4 Reinforcing Steel Institute of Canada (RSIC) – Current Edition

.1 RSIC, Reinforcing Steel Manual of Standard Practice.

1.3 SUBMITTALS

.1 Submit product data in accordance with section 01 33 00 – Submittals.

.2 Indicate on shop drawings, bar bending details, lists, quantities of reinforcement, sizes, spacings, locations of reinforcement and mechanical splices if approved by Owner's Representative, with identifying code marks to permit correct placement without reference to structural drawings. Indicate sizes, spacings and locations of chairs, spacers and hangers. Prepare reinforcement drawings in accordance with Reinforcing Steel Manual of Standard Practice - by Reinforcing Steel Institute of Canada. ACI SP-66, ACI Detailing Manual, American Concrete Institute.

.3 Detail lap lengths and bar development lengths to CSA-A23.3, unless otherwise indicated.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Substitute different size bars only if permitted in writing by Owner's Representative.

.2 Reinforcing steel: billet steel, grade 400, deformed bars to CAN/CSA-G30.18, unless indicated otherwise.

.3 Cold-drawn annealed steel wire ties: to ASTM A82/A82M.

.4 Welded steel wire fabric: to ASTM A185/A185M. Provide in flat sheets only. Chair wire fabric in position indicated on drawings.

.5 Chairs, bolsters, bar supports, spacers: to CSA-A23.1/A23.2.

.6 Mechanical splices: subject to approval of Owner's Representative.

.7 Plain round bars: to CSA-G40.20/G40.21.

2.2 FABRICATION

.1 Fabricate reinforcing steel in accordance with CSA-A23.1A23.2, ACI SP-66, and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.

.2 Obtain Owner's Representative's approval for locations of reinforcement splices other than those shown on placing drawings.

.3 Upon approval of Owner's Representative, weld reinforcement in accordance with CSA W186.

.4 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

2.3 SOURCE QUALITY CONTROL

.1 Upon request, provide Owner's Representative with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum 4 weeks prior to commencing reinforcing work.

.2 Upon request inform Owner's Representative of proposed source of material to be supplied.

PART 3 EXECUTION

3.1 FIELD BENDING

.1 Do not field bend or field weld reinforcement except where indicated or authorized by Owner's Representative.

.2 When field bending is authorized, bend without heat, applying a slow and steady pressure.

.3 Replace bars which develop cracks or splits.

3.2 PLACING REINFORCEMENT

.1 Place reinforcing steel as indicated on reviewed placing drawings and in accordance with CSA-A23.1/A23.2.

.2 Use plain round bars as slip dowels in concrete. Paint portion of dowel intended to move within hardened concrete with one coat of asphalt paint. When paint is dry, apply a thick even film of mineral lubricating grease.

.3 Use only non-corrodible materials such as plastic or concrete block chairs to support wire mesh or rebar in slabs on grade. Lifting of mesh during concrete placement is not acceptable.

.4 Prior to placing concrete, obtain Owner's Representative approval of reinforcing material and placement.

.5 Ensure cover to reinforcement is maintained during concrete pour.

3.3 SPLICES

.1 Reinforcing steel bars shall have Class "B" splices unless otherwise indicated.

.2 Stagger splices a minimum of 1500 o.c.

.3 Coordinate splices with pour sequencing and construction joint locations

END OF SECTION

CAST IN PLACE CONCRETE

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 03 10 00 - Concrete Forming and Accessories.

.2 Section 03 20 00 - Concrete Reinforcing.

.3 Section 03 35 00 - Concrete Finishing.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM) – Current Editions

.1 ASTM C260, Standard Specification for Air-Entraining Admixtures for Concrete.

.2 ASTM C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

.3 ASTM C494/C494M, Standard Specification for Chemical Admixtures for Concrete.

.4 ASTM C900 Test Method for Pullout Strength of Hardened Concrete.

.5 ASTM D1751, Standard Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

.2 Canadian General Standards Board (CGSB) – Current Edition

.1 CAN/CGSB-51.34, Vapour Barrier, Polyethylene Sheet for Use in Building Construction.

.3 Canadian Standards Association (CSA) – Current Editions

.1 CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.2 CAN3-A266.4, Guidelines for the Use of Admixtures in concrete.

.3 CAN/CSA-A3000, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

.4 CSA-A3001, Cementitious Materials for Use in Concrete.

.5 CSA G30.18, Carbon Steel Bars for Concrete Reinforcement.

1.3 MEASUREMENT AND PAYMENT

.1 The total volume of the Cast-in-Place concrete will not be measured and the work will be paid for at the price included in the Form of Tender for this section based on the percentage of the work completed.

.2 Heating of water and aggregates and providing cold weather protection will not be measured but considered incidental to work.

.3 Cooling of concrete and providing hot weather protection will not be measured but considered incidental to work.

.4 Coordination with other trades for the supply of hardware, pipe sleeves, and other embedded materials including the related layout drawing and installation will not be measured but considered incidental to work.

.5 Supply and installation of waterstops, construction joints, and expansion joints will not be measured but considered incidental to work.

.6 Repair of all cracks will not be measured but considered incidental to work.

.7 Repair of any deficiencies in the concrete will not be measured but be considered incidental to work

1.4 SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00 – Submittals.

.2 Shop Drawings:

.1 Submit placing drawings prepared in accordance with plans to clearly show size, shape location and details of reinforcing.

.2 Submit drawings showing formwork and falsework design to CSA A23.1/A23.2.

.3 At least 4 weeks prior to commencing work, inform Owner’s Representative of proposed source of aggregates and provide access for sampling.

.4 Submit testing results and reports for review by Owner’s Representative and do not proceed without written approval when deviations from mix design or parameters are found.

.5 Certificates:

.1 Minimum 4 weeks prior to starting concrete work submit to Owner’s Representative manufacturer's test data and certification by qualified independent inspection and testing laboratory that following materials will meet specified requirements:

.1 Portland cement.

.2 Blended hydraulic cement.

.3 Supplementary cementing materials.

.4 Grout.

.5 Admixtures.

.6 Aggregates.

.7 Water.

.8 Waterstops.

.9 Waterstop joints.

.10 Joint filler.

.11 Curing compounds

.2 Provide certification that mix proportions selected will produce concrete of quality, yield and strength as specified in concrete mixes, and will comply with CSA-A23.1/A23.2.

.3 Provide certification that plant, equipment, and materials to be used in concrete comply with requirements of CSA-A23.1/A23.2.

.4 Ready Mix Concrete Producer: Certified member in good standing with the local Ready Mix Concrete Association.

.5 Provide Certification that the plant, equipment, and materials to be used in concrete are adjusted to prevent alkali aggregate reactivity problems.

.6 Pour Sequence Plan

.1 Submit pour sequence plan showing location of the proposed construction joints.

.2 Location of construction joints shall be coordinated with Section 03 20 00 – Concrete Reinforcement, to produce reinforcement shop drawings.

.7 Hydrostatic Leak Test Plan

.1 Submit hydrostatic leak test plan outlining procedures of performing a leak test for each liquid-containing tank and in accordance with ACI 350.1.

1.5 QUALITY ASSURANCE

.1 Minimum 4 weeks prior to starting concrete work, submit proposed quality control procedures in accordance with Section 01 45 00 - Quality Control for Owner's Representative approval for following items:

.1 Falsework erection.

.2 Hot weather concrete.

.3 Cold weather concrete.

.4 Curing.

.5 Finishes.

.6 Formwork removal.

.7 Joints.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Concrete hauling time: maximum allowable time for concrete to be delivered to site of Work and discharged not to exceed 120 minutes after batching.

.1 Modifications to maximum time limit must be agreed to Owner's Representative and concrete producer as described in CSA A23.1/A23.2.

.2 Deviations to be submitted for review by Owner's Representative.

.2 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.

1.7 QUALIFICATIONS OF WORKER

.1 At all times there shall be at least one person present during concrete placement who shall direct the work and who is familiar with the materials being placed and understands the best method for their placement.

1.8 CONCRETE TESTING

.1 All concrete testing will be paid by the owner. Provide coordination with consultant/owner as required to schedule all required concrete testing.

.2 Field control tests will be carried out in accordance with CSA-A23.1/A23.2 to ensure that concrete quality meets the minimum specified properties.

.3 There will be no addition of water and/or chemical additives to the concrete without the approval of the consultant.

1.9 GEOTECH TESTING

.1 Geotechnical consultant to verify all bearing surfaces prior to placement of structural fill, mudslabs or structural concrete. Geotech to verify all structural backfill.

.2 If final bearing elevations require adjustment from those elevations noted on structural drawings, notify consultant in writing prior to proceeding with work.

1.10 COORDINATATION

.1 Coordinate location and supply of all embedded items such as sleeves, hangers, anchor bolts, bearing plates, etc. with other trades and install same. Supply embedded items which are not specified as being supplied by other trades.

.2 Report any errors uncovered during the course of this work for Consultant's direction. Corrective measures to be the responsibility of the trade responsible for the error.

.3 All temporary openings and permanent sleeves in structural concrete are required to be properly waterproofed after work is complete.

.4 Confirm all exact equipment locations and penetration sizes and locations with other trades. Report any discrepancies to the consultant.

PART 2 PRODUCTS

2.1 DESIGN CRITERIA

.1 Alternative 1 – Performance: to CSA A23.1/A23.2.

2.2 PERFORMANCE CRITERIA

.1 Ensure concrete supplier meets performance criteria of concrete and provide verification of compliance as indicated under Part 1.

2.3 MATERIALS

.1 Portland cement: to CAN/CSA-A3001, Type GU – General Use.

.2 Cementitious Hydraulic Slag: to CSA A3000.

.1 For structural and architectural concrete mixes, the supplier may incorporate cementitious slag into the proposed mix design as a replacement for up to 50 percent by mass of the quantity of Type GU Portland cement.

.2 For lean concrete, slag cannot be used to replace any of the Portland cement.

.3 Fly Ash is not accepted.

.4 Water: to CAN/CSA-A23.1.

.5 Aggregates: to CSA-A23.1/A23.2. The use of recycled concrete as aggregate is not permitted.

.6 Admixtures: no chlorides

.1 Air entraining admixture: to ASTM C260.

.2 Chemical admixtures: to ASTM C494, Owner's Representative to approve accelerating or set retarding admixtures during cold and hot weather placing.

.7 Non premixed dry pack grout: composition of non metallic aggregate Portland cement with sufficient water for the mixture to retain its shape when made into a ball by hand and capable of developing compressive strength of 50 MPa at 28 days.

.8 Curing/Sealing compound: to CSA A23.1/A23.2 and ASTM C309, Type 1, Class B, water based acrylic, compatible with other concrete applied products. Sika Florseal WB 25 or approved equivalent.

.9 Expanding Concrete Joint Waterstop:
Adeka MC-2010MN with Adeka Ultra Seal P-201.

.10 Expanding Concrete Expansion Joint Waterstop:

Adeka KM-3030MN with Adeka Ultra Seal P-201

.11 Tie Hole Grout: non-metallic, non-staining, non-toxic grout, CPD Fastcrete ultra or approved equal.

.12 Premoulded joint fillers:

.1 Bituminous impregnated fiber board (minimum 13mm): to ASTM D1751.

.13 Polyethylene film: minimum 0.25 mm thickness to ASTM C171.

.14 Bonding adhesive: synthetic latex.

.15 Weep hole tubes: plastic.

.16 Control joint filler: semi-rigid filler.

.1 For sawcuts made with soft cut saw: two component epoxy.

.2 For conventional sawcuts in interior slab: two component epoxy urethane.

.3 For conventional sawcuts in exterior slabs: two or multi-component polyurethane based elastomeric.

.17 Construction joint sealant: Sikaflex 2C-NS sealant with related Sikaflex 202 primer.

.18 Grout for pipe penetrations, pipe puddle flanges and wall in-fills as indicated: Sika Grout 212.

.19 Self compacting, cement based concrete repair: Sikacrete -08 SCC or approved equivalent.

.20 Bonding agent and reinforcement protections: Sika Armatec 110 EpoCem or approved equivalent.

.21 Cementitious repair mortar: Sika MonoTop-622 or approved equivalent.

.22 Abrasion Resistant Coating: Sikagard E.W.L. Trowel Grade or approved equivalent.

.23 Epoxy/Cement, Resurfacing and Pore-Filling Mortar: Sikagard 75 EpoCem.

.24 Strip and Seal system for sealing difficult to seal or high movement joints: Sikadur Combiflex SG System or approved equivalent.

.25 Crack-Bridging and Anti-Carbonation, Protective and Decorative Coating: Sikagard-550W Elastic.

.26 Epoxy Modified Cementitious Mortar: Tnemec Motarclad Series 218.

.27 Modified Polyamine Epoxy: Perma-Glaze Series 435.

2.4 CONCRETE MIXES

.1 Use ready-mix concrete proportioned in accordance with CSA A23.1, alternative 1 – Performance Method for Specifying Concrete.

.2 Meet the performance criteria of concrete in hardened state as indicated on the structural drawings.

.3 Pump mix designs shall not be modified from normal from normal concrete mix designs. Specifically fine aggregate contents shall not be increased or coarse aggregate contents reduced to accommodate pumping.

.4 Admixtures apart from water reducing agents and air entrainers are not permitted unless approved in writing by Consultant. Calcium chloride shall not be added to concrete.

.5 Construction joint grout shall be of the same proportions and materials as concrete but without coarse aggregate and with a 150mm slump.

2.5 ANCHORS

.1 Mechanical expansion anchors shall be Hilti Kwik Bolt TZ. Adhesive anchors in concrete and solid filled masonry shall be Hilti HIT- HY 200 or Hilti HIT-RE 500 as specified. Adhesive anchors in hollow masonry shall be Hilti HIT-HY 270. Use Hilti HAS-E rods. Use stainless steel where noted.

PART 3 EXECUTION

3.1 PREPARATION

.1 Obtain Owner's Representative approval before placing concrete. Provide two (2) working days notice prior to placing of concrete.

.2 Place concrete reinforcing in accordance with Section 03 20 00 - Concrete Reinforcing.

.3 During concreting operations:

.1 Development of cold joints not allowed.

.2 Ensure concrete delivery and handling facilitates placing with minimum of re-handling, and without damage to existing structure or work.

.4 Pumping of concrete is permitted only after approval of equipment and mix.

.5 Ensure reinforcement and inserts are not disturbed during concrete placement.

.6 Prior to placing of concrete obtain Owner's Representative approval of proposed method for protection of concrete during placing and curing in adverse weather.

.7 Protect previous work from staining.

.8 Clean and remove stains prior to application for concrete finishes.

.9 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.

.10 Do not place load upon new concrete until authorized by Owner's Representative.

3.2 CONSTRUCTION

.1 Do cast-in-place concrete work in accordance with CSA-A23.1/A23.2.

.2 Sleeves and inserts.

.1 No sleeves, ducts, pipes or other openings shall pass through joists, beams, column capitals or columns, except where indicated or approved by Owner's Representative.

.2 Where approved by Owner's Representative, set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere. Sleeves and openings greater than 100 x 100 mm not indicated, must be approved by Owner's Representative.

.3 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of modifications from Owner's Representative before placing of concrete.

.4 Check locations and sizes of sleeves and openings shown on drawings.

.5 Set special inserts for strength testing as indicated and as required by non-destructive method of testing concrete.

.3 Anchor rods.

.1 Set anchor rods to templates under supervision of appropriate trade prior to placing concrete.

.2 With approval of Owner's Representative, grout anchor rods in preformed holes or holes drilled after concrete has set. Formed holes to be minimum 100 mm diameter. Drilled holes to be manufacturer's recommendations.

.3 Protect anchor bolt holes from water accumulations, snow and ice build-ups.

.4 Set bolts and fill holes with shrinkage compensating grout.

.5 Locate anchor rods used in connection with expansion shoes, rollers and rockers with due regard to ambient temperature at time of erection.

.4 Grout under base plates using procedures in accordance with manufacturer's recommendations which result in 100 % contact over grouted area.

.5 Finishing

.1 Finish concrete in accordance with CSA-A23.1/A23.2.

.2 Non-exposed Concrete Finish:

A “rough form finish” as defined by CSA A23.1/A23.2 for concrete surface not exposed to view in finished structures.

.3 Exposed Concrete Finish:

.1 A “smooth form finish” as defined by CSA A23.1/A23.2 for concrete surfaces exposed to view in finished structures. This includes all tank walls.

.2 Use cone type coil ties with setback plugs, chamfered corners and symmetrical joint arrangement for all exposed walls, beams and columns.

.4 Slab surfaces to be hard, smooth trowelled surfaces free from blemishes.

.5 As soon as forms are removed, the surfaces shall be thoroughly washed with clean water under pressure. All fins, projections and offsets smoothed off. Tie projections to be removed to a minimum of 25mm below surface.

.6 Placing

.1 Place concrete in accordance with A23.1.

.2 Notify consultant for inspection a minimum of 48 hrs prior to all concrete pours. Do not place concrete until approval of consultant.

.3 Ensure the method of placement will permit continuous placement until completed.

.4 Pump shall have the capacity and ability to pump without requiring concrete mix redesign. Pump shall be capable of transporting concrete at the discharge end with the specified air entrainment and the specified slump, while concrete supplied to the pump shall have a slump no more than 20mm greater than the specified slump.

.5 Concrete will be rejected if not placed within 90min. since commencement of plant mixing.

.6 Vibrate all concrete thoroughly. Use internal type vibrators wherever practicable. Keep a spare vibrator on site during all concrete placing operations. Take care not to over-vibrate, which would result in segregation or the formation of excess surface water. Take particular care to ensure the proper deposit of concrete in and around corners, joint inserts and at construction joints.

.7 Limit free drop of concrete to 1500mm maximum in accordance with requirements of CSA A23.1-14, Clause 7.2.4 – Depositing.

.8 Unless otherwise approved, concrete shall be placed in a single operation to the full thickness of slabs, beams, etc. and shall be placed in horizontal layers not exceeding 600mm in walls, columns and similar members. In walls the first batches in each lift shall be placed at each end of the segment and then placing shall progress towards the centre. Concrete shall be placed as rapidly as possible to ensure bonding of successive layers. No temporary joints shall be allowed to become "cold" before adjacent concrete is placed. The maximum allowable time between lifts shall be 45 minutes.

.9 Place walls so that straight runs do not exceed 15m and vertical construction joints are no closer than 2m to a wall corner, wall intersection, a column or beam supported by the wall, or an opening in the wall greater than 600mm in width.

.10 Allow a minimum of 4 days between placing new concrete against recently placed concrete in walls and slabs.

.11 Protect previous work from concreting operations.

.12 Deposit 100mm of wall and column grout evenly along horizontal construction joints in bottom of form through an elephant trunk immediately before placing wall or column concrete.

.13 Wet cure using concrete curing blankets – Terrafix 240R non-woven geotextile (white). Minimum seven day wet cure for all slabs (ground and second) – three days for other concrete. Overlap adjacent edges 150 mm and tightly seal with sand on wood planks. Weigh sheets down to maintain close contact with concrete during the entire curing period. Maintain continuously wet during the curing period.

.14 Finish concrete floor to meet requirements of CSA-A23.1/A23.2.

.15 Concrete floor to have finish hardness equal or greater than Mohs hardness in accordance with CSA-A23.1/A23.2.

.16 Provide swirl-trowelled finish for exterior walks, ramps, pads.

.17 Provide float finish for interior floor slabs.

.18 Rub exposed sharp edges of concrete with carborundum to produce 3 mm radius edges unless otherwise indicated.

.7 Waterstops

.1 Install waterstops to provide continuous water seal. Install waterstops in strict accordance with manufacturer's requirements.

.8 Construction Joints

.1 At all construction joints in water retaining structures, install specified waterstops.

.2 For all other structures, install waterstops in construction joints below grade where shown on drawings.

.3 At all construction joints, thoroughly clean and intentionally roughen the surface of set concrete to an amplitude of 5mm. No formed surface shall remain at joint locations. This shall be carried out by chiselling or by sandblasting to expose coarse aggregate.

.4 For all horizontal construction joints, clean the surface of all laitance and foreign matter. This shall be done with high pressure water blast (4000 psi) or small chippers. Place a 300mm thick layer of concrete and vibrate thoroughly into waterstop, joint surface and any irregularities of hardened surface before placing subsequent pours of concrete.

.9 Joint fillers.

.1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by Owner's Representative.

.2 When more than one piece is required for a joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.

.3 Locate and form, isolation, construction and expansion joints as indicated. Install joint filler.

.4 Use 12 mm thick joint filler to separate slabs-on-grade from vertical surfaces and extend joint filler from bottom of slab to within 12 mm of finished slab surface unless indicated otherwise.

.10 Inserts

.1 Set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere. Sleeves and openings greater than 100x100 not indicated on the structural drawings must be approved by the Consultant.

.2 No sleeves, ducts, or other openings shall pass through joists, beams, lintels, or columns except where indicated on structural drawings.

.3 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain Consultants approval.

.4 All openings greater than 100mm diameter must be sleeves cast in concrete walls.

.5 Indicate all openings on rebar shop drawings illustrating size and location. Coordinate location and size with all disciplines. Report discrepancies to Consultant.

.11 Curing

.1 Cure all concrete in accordance with the requirements of A23.1/A23.2.

.2 Protect new concrete from damage due to cold, heat, rain, drying winds or other conditions that can adversely affect the concrete quality.

.3 Curing methods and materials shall ensure concrete will be protected from drying out or undergoing wet/dry periods for the duration of the curing period. Concrete shall be wet cured for a period of 10 days, at

a minimum temperature of 10oC while being maintained continuously wet.

.12 Patching

.1 No patching or repairing shall be carried out without the approval of the Engineer.

.2 All preparation for repairs is to be reviewed by the engineer.

.3 All patches, bug holes, and suspected honeycomb are to be reviewed by the engineer prior to patching.

.4 All repairs shall be colour matched to the parent concrete

.5 Neatly sawcut perpendicular to surface for a minimum depth of 25mm. Remove all defective concrete down to sound concrete to Consultant's satisfaction. Keep required area wet for 24 hours prior to patching. Dampen area +150mm all around just before patching. Remove standing water, area should be saturated surface dry. Follow the specified repair product manufacturers recommendations.

.6 Completely fill all cone tie holes with tie hole grout. Follow all manufacturer's directions. Use slurry bond coat of Fastcrete Ultra and additional liquid polymer. Substrate preparation directions and temperature limitations must be followed.

.7 All visible cracks in liquid retaining structures shall be repaired. Submit a detailed plan and details for review by Engineer before beginning any repair or injection. As the standard repair methodology, unless otherwise approved by the Engineer, cracks shall be injected with epoxy or polyurethane, depending on the application. Clean face of concrete after injection is complete.

.8 Prior to the leak test all visible cracks are to be repaired by epoxy injection.

.13 Exterior Slabs

.1 Broom finish all exterior slabs. Seal with 2 coats of acrylic sealer.

.14 Equipment Bases, Inertia Slabs and Pits

.1 Confirm exact location and dimensions of equipment bases, slabs and pits with other trades. Report discrepancies to Consultant.

.2 Unless indicated otherwise, bases shall rest on the concrete floor slab. Scarify floor slab to make a good bond or key between the bases and floor slab.

.3 Refer to drawings for bases, slab and pit reinforcing.

.4 Chamfer exposed edges 20mm.

.5 Provide 25mm grout between equipment baseplates and concrete bases. Grout shall consist of non-shrink pre-mixed grout. Clean surface of concrete and wet prior to grouting. Do not remove levelling wedges until grout attains its final set. Fill voids left by removal of wedges with grout and finish exposed surface.

.15 Watertightness Testing

.1 Test all water retaining structures under the supervision on the Consultant upon completion of the work in order to determine the degree of watertightness. Permissible leakage from these structures when tested shall not exceed the value specified in .3.

.2 Use only potable water for testing unless otherwise approved by the consultant.

.3 Fill all water retaining tanks to the maximum level for an absorption period of 24 hours. Re-fill tank and measure water level after 24 hours and after 48 hours. Permissible leakage shall not cause a drop in water level exceeding 6mm over the 24 hour period. Any leakage exceeding the above quantity, or any flowing water is visible, shall be repaired and tanks retested at the Contractor's expense, until the tests are satisfactory in every respect.

.4 Tanks lined with waterproof membranes or otherwise waterproofed shall not be permitted to show any leakage or dampness.

.5 Carry out tests with adjoining tanks empty. Tanks must be backfilled, but this shall not relieve the Contractor of the cost of re-excavation for subsequent repair.

.6 All permanently exposed exterior tank walls, including the common walls between buildings and tanks shall be subject to close visual inspections. All exposed joints, cracks, or other areas that show signs of leakage, sweating or porosity, shall be waterproofed on the inside of the tanks at the Contractor's expense by a specialist guaranteeing their work. The Contractor is to supply water for testing purposes.

.7 Take appropriate measures, approved by the Consultant, to produce a watertight structure and repeat tests until a satisfactory result is obtained.

3.3 FIELD QUALITY CONTROL

.1 Inspection and testing of concrete and concrete materials will be carried out by a Testing Laboratory designated by Owner's Representative in accordance with CSA-A23.1/A23.2, and Section 01 45 00 - Quality Control.

.2 Owner will pay for costs of tests for Testing Laboratory Services. Costs of retesting due to deficient work will be paid for by contractor, by credit change order.

.3 Contractor is responsible for coordinating all testing and inspection with testing laboratory designated by the owner. Coordinate test types and frequency with the Owner and Owner's representative.

.4 Non-destructive Methods for Testing Concrete shall be in accordance with CSA-A23.1/A23.2.

.5 Provide Certificate of Field Quality Inspection and Testing to Owner's Representative for inclusion in Commissioning Manual.

.6 Inspection or testing will not augment or replace Contractor quality control nor relieve the Contractor of his contractual responsibility.

END OF SECTION

CAPILLARY WATERPROOFING (ADMIXTURE)

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 03 10 00 – Concrete Forming and Accessories

.2 Section 03 20 00 – Concrete Reinforcement

.3 Section 03 30 00 – Cast in Place Concrete

.4 Section 07 92 00 – Joint Sealants

1.2 SUMMARY

.1 Section Includes: Furnishing of all labor, materials, services and equipment necessary for the supply and installation of crystalline waterproofing additive to concrete structures as indicated on the drawings and as specified herein. The crystalline waterproofing material shall be added to concrete during the mixing cycle and shall be used in above or below-grade walls and slabs, including liquid retaining structures where enhanced chemical resistance is required. Also refer to architectural drawings for additional capillary waterproofing locations.

1.3 REFERENCES

.1 American Society for Testing and Materials (ASTM) – Current Editions

.1 ASTM C260, Standard Specification for Air-Entraining Admixtures for Concrete.

.2 ASTM C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

.3 ASTM C494/C494M, Standard Specification for Chemical Admixtures for Concrete.

.4 ASTM C900 Test Method for Pullout Strength of Hardened Concrete.

.5 ASTM D1751, Standard Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

.2 American Concrete Institute (ACI)

.3 NSF International (NSF)

.4 Canadian Standards Association (CSA) – Current Editions

.1 CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.2 CAN3-A266.4, Guidelines for the Use of Admixtures in concrete.

.3 CAN/CSA-A3000, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

.4 CSA-A3001, Cementitious Materials for Use in Concrete.

.5 CSA G30.18, Carbon Steel Bars for Concrete Reinforcement.

.5 Army Corps of Engineers (CRD)

1.4 SYSTEM DESCRIPTION

.1 Crystalline Waterproofing Additive: Concrete waterproofing and protection system shall be of the crystalline type that chemically controls and permanently fixes a non-soluble crystalline structure within the pores and capillary tracts of the concrete. This crystalline system causes the concrete to become sealed against the penetration of liquids from any direction and protects the concrete from deterioration due to harsh environmental conditions. The system is used for above or below-grade walls and slabs, including liquid retaining structures and where enhanced chemical resistance is required.

1.5 SYSTEM PERFORMANCE REQUIREMENTS

.1 Testing Requirements: Crystalline waterproofing system shall be tested in accordance with the following standards and conditions, and the testing results shall meet or exceed the performance requirements as specified herein.

.2 Independent Laboratory: Testing shall be performed by an independent laboratory meeting the requirements of ASTM E 329-90 and certified by the United States Bureau of Standards. Testing laboratory shall obtain all concrete samples and waterproofing product samples.

.3 Crystalline Formation: Crystallizing capability of waterproofing system shall be evidenced by independent SEM (Scanning Electron Microscope) photographs showing crystalline formations within the concrete matrix.

.4 Permeability: Independent testing shall be performed according to U.S. Army Corps of Engineers CRD-C48-73 "Permeability of Concrete". Treated concrete samples shall be pressure tested to 150 psi (350 foot head of water) or 1.05 MPa (106 m head of water). The treated samples shall exhibit no measurable leakage.

.5 Chemical Resistance: Independent testing shall be performed to determine "Sulfuric Acid Resistance of Concrete Specimens". Treated concrete samples (dosage rates of 3%, 5%, and 7%) shall be tested against untreated control samples. All samples shall be immersed in sulfuric acid and weighed daily until a control sample reaches a weight loss of 50% or over. On final weighing the percentage weight loss of the treated samples shall test significantly lower than the control samples.

.6 Compressive Strength: Independent testing shall be performed according to ASTM C39 "Compressive Strength of Cylindrical Concrete Specimens". Concrete samples containing the crystalline waterproofing additive shall be tested against untreated control sample. At 28 days, the treated samples shall exhibit a minimum of 10% increase in compressive strength over the control sample.

.7 Potable Water Approval: Independent testing shall be performed according to NSF Standard 61, and approval for use of waterproofing material on structures holding potable water shall be evidenced by NSF certification.

1.6 SUBMITTALS

.1 General: Submit listed submittals in accordance with conditions of the Contract and with Division 1 Submittal Procedures Section.

.2 Product Data: Submit product data, including manufacturer's specifications, installation instructions, and general recommendations for waterproofing applications. Also include manufacturer's certification or other data substantiating that products comply with requirements of Contract Documents.

.3 Test Reports: Submit, for acceptance, complete test reports from approved independent testing laboratories certifying that waterproofing system conforms to performance characteristics and testing requirements specified herein.

.4 Manufacturer’s Certification: Provide certificate signed by manufacturer or manufacturer's representative certifying that the materials to be installed comply in all respects with the requirements of this specification.

1.7 QUALITY ASSURANCE

.1 Manufacturer Qualifications: Manufacturer to be ISO 9001 registered, and to have no less than 10 years experience in manufacturing the crystalline waterproofing additive for the required work. Manufacturer must be capable of providing field service representation during construction phase. Manufacturers that cannot provide the performance test data specified herein will not be considered for the project.

.2 Applicator: Installer of crystalline waterproofing additive shall be approved by the manufacturer or manufacturer's representative in writing.

.3 Pre-Installation Conference: Prior to installation of waterproofing, conduct meeting with Architect/Engineer, owner's representative, applicator (concrete supplier), concrete placer and waterproofing manufacturer's representative to verify and review the following:

.1 Project requirements for waterproofing as set out in Contract Document.

.2 Manufacturer’s product data including application instructions.

.4 Technical Consultation: The waterproofing manufacturer's representative shall provide technical consultation on waterproofing application.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.

.2 Delivery: Deliver packaged waterproofing materials to project site in original undamaged containers, with manufacturer's labels and seals intact.

.3 Storage: Store waterproofing materials in dry, enclosed location, at temperature and humidity conditions recommended by manufacturer.

1.9 WARRANTY

.1 Project Warranty: Refer to conditions of the Contract for project warranty provisions.

.2 Manufacturer’s Warranty: Manufacturer shall provide standard product warranty executed by authorized company official. Term of warranty shall be [specify term] years from Date of Substantial Completion.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Acceptable Manufacturer: Xypex Chemical Corporation.

.2 Proprietary Products: Xypex crystalline waterproofing materials as follows:

.1 Xypex Admix C-500

.3 Contractor to coordinate product type with concrete mix designer to determine correct product and dosage.

.4 Source Quality: Obtain all proprietary crystalline waterproofing products from a single manufacturer.

2.2 DOSAGE

.1 General: Xypex Admix must be added to concrete mix at time of batching.

.2 Dosage Rate: Under normal conditions, the crystalline waterproofing powder shall be added to the concrete mix at the following rates:

.1 Xypex Admix C-500: 2% – 3% by weight of portland cement content

.3 For enhanced chemical protection or meeting specific project requirements, or where the concrete mix design contains higher than 20% fly ash content or includes a portland cement/slag cement blend, consult with manufacturer or its authorized representative to determine appropriate dosage rates.

CAPILLARY WATERPROOFING (ADMIXTURE)

PART 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: Comply with manufacturer's product data regarding installation, including technical bulletins, product catalogue, installation instructions and product packaging labels.

3.2 PROJECT CONDITIONS

.1 Reinforcement: All reinforcement shall be rib deformed bar in accordance with applicable standards. Exposed concrete decks (joint free) shall contain sufficient reinforcement to minimize thermal movement and control cracking.

.2 Setting Time and Strength: Some retardation of set may occur when using Xypex Admix products. The amount of retardation will depend upon the concrete mix design, the particular Admix product used, dosage rate of the Admix, temperature of the concrete and climatic conditions. Concrete containing a Xypex Admix product may develop higher ultimate strengths than plain concrete. Conduct trial mixes under project conditions to determine setting time and strength of the concrete. Consult with manufacturer or manufacturer's representative regarding concrete mix design, project conditions and proper dosage rate.

.3 Weather Conditions: For mixing, transporting and placing concrete under conditions of high temperature or low temperature, follow concrete practices as referred to in ACI 305R-77 (Hot Weather Concreting) and ACI 306R-78 (Cold Weather Concreting). For flatwork being placed in either hot, dry or windy conditions use of monomolecular film (evaporation retardant) is recommended to control loss of bleed water.

3.3 APPLICATION

.1 General: Xypex Admix shall be added to the concrete mix at time of batching. Thorough blending of the Xypex Admix throughout the concrete mix is essential for correct performance of the product and, therefore, care should be taken to ensure that a homogeneous mixture is obtained.

.2 Concrete Batching and Mixing: Procedures for mixing will vary according to type of batch plant operation and equipment.

.1 Ready Mix Plant - Dry Batching Operation: Add Xypex Admix powder to drum of ready-mix truck, then add 60% - 70% of required water along with 300 – 500 lb. (136 – 227 kg) of aggregate. Mix the materials for 2 - 3 minutes to ensure that the Admix is distributed evenly throughout the mix water. Add balance of materials to the ready-mix truck and mix in accordance with standard batch practices.

.2 Ready Mix Plant - Central Mix Operation: Mix Xypex Admix with water to form a very thin slurry (e.g. 15 – 20 lb. or 6.75 – 9 kg of powder mixed with 3 gallons or 13.6 litres of water). Pour the required amount of material in drum of ready-mix truck. The aggregate, cement and water

should be batched and mixed in the plant in accordance with standard practices (taking into account the quantity of water that has already been placed in the ready-mix truck). Pour the concrete into the truck and mix for at least 5 minutes to ensure even distribution of the Xypex Admix throughout the concrete.

3.4 CURING

.1 General: Concrete containing Xypex Admix shall be moist cured in accordance with ACI Reference 308, "Standard Practice for Curing Concrete".

.2 Curing Compounds: Curing compounds may be used in the event that project requirements or conditions prevent moist curing. Curing compounds shall comply with ASTM C-309.

3.5 PROTECTION

.1 Protection: Protect installed product and finished surfaces from damage during construction.

3.6 FIELD QUALITY CONTROL

.1 Examination for Defects: Do not conceal Xypex treated concrete before it has been observed by Architect / Engineer, waterproofing manufacturer's representative and other designated entities. Concrete shall be examined for structural defects such as faulty construction joints, cold joints and cracks. Such defects to be repaired in accordance with manufacturer's repair procedures.

.2 Flood Testing for Suspended Slabs:

.1 Perform flood test on completed waterproofing installation before placement of other construction.

.2 Plug or dam drains and fill area with water to a depth of two inches (50 mm) or to within 0.5 inch (12.5 mm) of top of waterproofing treatment.

.3 Let water stand for 24 hours.

.4 If leaks are discovered, make repairs and repeat test until no leaks are observed.

3.7 INTERACTION WITH OTHER MATERIALS

.1 Backfilling: Normal backfilling procedures may be used after concrete has been cured for at least seven days. If backfill takes place within seven days after concrete placement, then backfill material shall be moist so as not to draw moisture from the concrete. In no event shall backfilling take place before concrete has gained sufficient strength to withstand the applied load.

.2 Grout, Cement Parge Coat, Plaster or Stucco: Because concrete containing Xypex Admix forms a relatively smooth surface and the resulting crystalline formation fills the concrete pores thereby reducing suction characteristics of the concrete, it may be necessary to use a suitable bonding agent for proper bonding of cementitious systems.

CAPILLARY WATERPROOFING (ADMIXTURE)

END OF SECTION

CONCRETE FLOOR FINISHING

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 03 30 00 – Cast in Place Concrete.

1.2 REFERENCES

.1 Canadian General Standards Board (CGSB) – Current Edition

.1 CAN/CGSB-25.20, Surface Sealer for Floors.

.2 Canadian Standards Association (CSA) – Current Edition

.1 CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.3 American Society for Testing and Materials (ASTM) – Current Edition

.1 ASTM C309, Standard Specification for Liquid Membrane – Forming Compounds for curing Concrete.

1.3 PERFORMANCE REQUIREMENTS

.1 Product quality and quality of work in accordance with Section 01 61 00 - Common Product Requirements.

.2 Submit written declaration that components used are compatible and will not adversely affect finished flooring products and their installation adhesives.

1.4 PRODUCT DATA

.1 Submit WHMIS MSDS - Material Safety Data Sheets. WHMIS MSDS acceptable to Labour Canada and Health and Welfare Canada for concrete floor treatment materials. Indicate VOC content.

.2 Include application instructions for concrete floor treatment.

1.5 ENVIRONMENTAL REQUIREMENTS

.1 Temporary lighting:

.1 Minimum 1200 W light source, placed 2.5 m above floor surface, for each 40 sq m of floor being treated.

.2 Electrical power:

.1 Provide sufficient electrical power to operate equipment normally used during construction.

.3 Work area:

.1 Make the work area water tight protected against rain and detrimental weather conditions.

.4 Temperature:

.1 Maintain ambient temperature of not less than 10°C from 7 days before installation to at least 48 hours after completion of work and maintain relative humidity not higher than 40% during same period.

.5 Moisture:

.1 Ensure concrete substrate is within moisture limits prescribed by flooring manufacturer.

.6 Safety:

.1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials.

.7 Ventilation:

.1 Ventilate area of work as directed by Owner's Representative by use of approved portable supply and exhaust fans.

.2 Ventilate enclosed spaces in accordance with Section 01 51 00 - Temporary Utilities.

.3 Provide continuous ventilation during and after coating application.

PART 2 PRODUCTS

2.1 DENSIFIERS

.1 All slabs shall be treated with CPD Cipadeck L (Lithium Silicate) or Sika Sikafloor-3S penetrating liquid concrete densifier.

2.2 WET CURE

.1 Wet cure concrete commencing immediately after concrete hardens. Use non-staining geotextile covering (Sika UltraCure – non staining white). All surfaces shall be maintained continuously wet for the duration of the curing period per CSA A23.1/A23.2. Alternatively, a compatible curing compound in accordance with CSA A23.1/A23.2 and ASTM C309 will be considered.

2.3 MIXES

.1 Mixing, ratios and application in accordance with manufacturer's instructions.

2.4 JOINT SEALANT

.1 Joint sealants to Section 07 92 00 – Joint Sealants.

2.5 CONCRETE SLAB TOLERANCE

.1 Concrete slab tolerances in accordance with CSA-A23.1/A23.2, F-number Method, F_F =25, F_L = 20.

PART 3 EXECUTION

3.1 EXAMINATION

.1 Verify that slab surfaces are ready to receive work and elevations are as indicated on drawings by manufacturer.

3.2 PREPARATION OF EXISTING SLAB

.1 Rub exposed sharp edges of concrete with carborundum to produce 3 mm radiused edges unless otherwise indicated.

.2 Saw cut control joints to CSA-A23.1/A23.2, 24 hours maximum after placing of concrete.

.3 Use mechanical stripping to remove chlorinated rubber or existing surface coatings.

.4 Use protective clothing, eye protection, respiratory equipment during stripping of chlorinated rubber or existing surface coatings.

3.3 APPLICATION

.1 Apply floor densifier (CPD Cipadeck L) or Sikafloor-3S to all slab surfaces at a rate of 600ft2/Gallon. Install in strict accordance with manufacturer’s instructions.

.2 After floor treatment is dry, seal control joints and joints at junction with vertical surfaces with sealant.

.3 Clean overspray. Clean sealant from adjacent surfaces.

3.4 PROTECTION

.1 Protect finished installation in accordance with manufacturer's instructions.

END OF SECTION

PRECAST CONCRETE HOLLOW CORE PLANKS

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 03 10 00 - Concrete Forming and Accessories.

.2 Section 03 20 00 - Concrete Reinforcing.

.3 Section 03 30 00 – Cast in Place Concrete

.4 Section 03 35 00 - Concrete Finishing.

1.3 REFERENCES

.1 ASTM A123/A123M-17 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.2 ASTM A416/A416M-18 - Steel Strand, Uncoated Seven-Wire for Prestressed Concrete.

.3 ASTM A421/A421M-15 – Stress-Relieved Steel Wire for Prestressed Concrete.

.4 ASTM A615 / A615M-18e1 - Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.

.5 ASTM A666-15 - Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

.6 ASTM F3125/F3125M-18 - High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions.

.7 CSA-A23.1-19/A23.2-19 - Concrete Materials and Methods of Concrete Construction/ Methods of Test for Concrete.

.8 CSA-A23.3-19 - Design of Concrete Structures.

.9 CSA-A23.4-16 - Precast Concrete - Materials and Construction.

.10 CSA-A3000-18 - Cementitious Materials Compendium.

.11 CSA-G40.20-13/G40.21-13 (R2018) - General Requirements for Rolled or Welded Structural Quality Steel/ Structural Quality Steel.

.12 CSA-W47.1-19 - Certification of Companies for Fusion Welding of Steel.

.13 CSA W59-13 Welded Steel Construction (Metal Arc Welding).

.14 CSA W186-M1990 (R2016) Welding of Reinforcing Bars in Reinforced Concrete Construction.

.15 CPCI (Canadian Precast/Prestressed Concrete Institute) Design Manual – 5th Edition.
Details - Order Offline

.16 PCI (Precast Concrete Institute) MNL 116 Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products.

.17 PCI (Precast Concrete Institute) Manual for Design of Hollowcore Slabs.

.18 PCI MNL-124 – Design for Fire Resistance of Precast/Prestressed Concrete, 3rd Edition.

.19 National Building Code of Canada 2015 (NBC)

1.4 PERFORMANCE REQUIREMENTS

.1 Size components to withstand design loads as per the contract documents.

.2 Maximum Allowable Deflection of Planks as per CSA-A23.3-19 and the contract documents.

.3 Design components to accommodate construction tolerances, as per relevant CSA codes.

.4 Precast components to be designed with concrete mix that will achieve 41 MPa compressive strength at 28 days, with properties according to CSA-A23.1-19 Table 2 for Class N exposure. Slump and air tests are not applicable according to CSA-A23.1-19 Clause 8.9.6.

.5 Grout mix to be 20 MPa at 28 days.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Section 01 31 00: Project management and coordination procedures.

.2 Coordination:

.1 Hollowcore Manufacturer to provide information and drawings to General Contractor to coordinate with other work having a direct bearing on work of this section.

.2 General Contractor to coordinate field cut openings with affected section.

.3 Pre-installation Meetings:

.1 General Contractor to convene two weeks before starting work of this section.

.2 General Contractor to discuss anchor and weld plate locations, sleeve locations, and cautions regarding cutting or core drilling.

1.6 SUBMITTALS FOR REVIEW

.1 Section 01 33 00: Submission procedures.

.2 Product Data: Indicate standard component configuration, design loads, deflections, and cambers (maximum 25mm)

.3 Shop Drawings: Indicate plank locations, connection details, edge conditions, bearing requirements, support conditions, dimensions, openings, openings intended to be field cut and relationship to adjacent materials, to be stamped, signed and dated by a qualified engineer licensed in the province of Ontario.

.4 Installation Data: Fabricator's special installation requirements, indicating special procedures, and perimeter conditions requiring special attention.

1.7 SUBMITTALS FOR INFORMATION

.1 Section 01 33 00: Submission procedures.

.2 Sustainable Design:

.1 Section [01 35 18]: LEED documentation procedures.

.2 Provide required LEED documentation for Product [recycled content] [regional materials] as required by contract documents.

1.8 CLOSEOUT SUBMITTALS

.1 Section 01 78 10: Submission procedures.

.2 Sustainable Design Closeout Documentation.

1.9 QUALITY ASSURANCE

.1 Fabricator:

.1 Precast concrete manufacturers to be certified to Canadian Precast Concrete Quality Assurance (CPCQA) Certification Program in Commercial Precast and Prestressed Concrete Products (Structural) Category C2 prior to the time of bid.

.2 Precast fabrication to meet the requirements of CSA-A23.4-16, including Annexes A and B, together with PCI MNL-116 and 117 and CPCQA certification requirements.

.3 Only precast elements fabricated under the CPCQA plant certification program to be acceptable, and plant certification is to be maintained for the duration of fabrication, [erection,] and until warranty expires.

.2 Perform welding to CSA W59-13 and CSA W186-M1990 (R2016).

.3 Welder: Qualified within previous two years to CSA-W47.1-19.

.4 Maintain plant records and quality control program during production of precast planks. Make records available upon request.

.5 Erector: Company specializing in performing the work of this section with minimum five years documented experience.

.6 Design precast concrete members under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed at the place where the Project is located.

.7 Provide standard CPCI warranty with a duration of one year in accordance with the General Conditions. Warranty shall be in writing and shall warrant work under this section to be free from defects for the

1.10 REGULATORY REQUIREMENTS

.1 Conform to applicable code for design load and on-site handling requirements.

1.11 DELIVERY, STORAGE, AND PROTECTION

.1 Section 01 61 00: Transport, handle, store, and protect products.

.2 Lifting or Handling Devices: Capable of supporting member in positions anticipated during manufacture, storage, transportation, and erection.

.3 Mark each member with date of production.

PART 2 Products

2.1 CONCRETE

.1 Unless otherwise specified , use concrete mix designed to produce a minimum 35 MPa compressive strength at 56 days, with a maximum water/cement ratio of 0.40.

.2 Use cement and supplementary cementing materials that conform to CSA A23.1/A23.2.

.3 Use of calcium chloride is not permitted.
.4 Exposure Class: C-1 in accordance with CSA A23.1/A23.2.

2.2 MATERIALS

.1 Materials: CSA-A3000-18, CSA-A23.1-19/A23.2-19.

.2 Tensioning Steel Strands: ASTM A416/A416M Grade 1720 MPa of sufficient strength commensurate with member design.

.3 Reinforcing Steel: ASTM A615/A615M-18e1, deformed steel bars.

.4 Cement Grout: Minimum compressive strength of 20 MPa at 28 days.

.5 Bearing Pads: neoprene, 70 durometer hardness to ASTM D2240 and 17MPa minimum tensile strength to ASTM D412, moulded to size or cut from moulded sheet (random oriented fibre-reinforced neoprene).

2.3 ACCESSORIES

.1 Connecting and Supporting Devices: Refer to drawing details.

.2 Core Hole End Plugs: Provide as reEnsure water does not enter cores.

.3 Foam backer rod.

.4 Tremco Dymeric flexible polyurethane sealant (hollow core joints).

.5 Shims: Steel

2.4 FABRICATION

.1 To commence upon receipt of approved shop drawings and schedules.

.2 Conform to CSA-A23.4-16.

.3 Embed anchors, inserts, plates, angles, and other items at locations indicated on approved drawings.

.4 Provide openings required by other sections, at locations indicated on approved drawings.

2.5 COMPONENTS

.1 Nominal Thickness: 203 and 305mm

.2 Nominal Plank Width: 1216mm

2.6 FINISHES

.1 Plant Finish: Top surface: as extruded or required by contract documents or roof system design requirements. Rough form finish to receive concrete topping.

.2 Plant Finish: Bottom surface (exposed finish): as extruded. Smooth form finish. Supplier shall submit sample of smooth form finish prior to fabrication for approval and level of acceptance.

.3 Connecting and Supporting Steel Devices: All hot dip galvanized

2.7 FABRICATION TOLERANCES

.1 Conform to CSA-A23.4-16.

2.8 SOURCE QUALITY CONTROL

.1 Provide testing and analysis of site placed concrete and grout as required by contract documents.

.2 Provide shop inspection and testing for stressing strands.

.3 Test samples in accordance with specified standards.

PART 3 Execution

3.1 EXAMINATION

.1 General Contractor to verify that site conditions are ready to receive work and field measurements are as indicated on approved drawings.

.2 Verify supporting structure is ready to receive work.

3.2 ERECTION

.1 Erect members without damage to structural capacity, shape, or finish. Replace or repair damaged members.

.2 Align and maintain uniform horizontal and end joints, as erection progresses.

.3 General Contractor to maintain any temporary bracing if required for the supporting structure [components] [or] to avoid any rotation or excessive deflections of the supporting components.

.4 Install bearing pads at bearing ends of planks [as indicated].

.5 Adjust differential camber between precast members to tolerance before final attachment [and grouting].

.6 Adjust differential elevation between precast members to tolerance before final attachment [and grouting].

.7 Grout plank joints, trowel smooth.

.8 Refer to plans for topping.

.9 Secure units in place according to erection drawings. Perform welding in accordance with CSA W59.

.10 Field cut holes and openings up to 150mm in diameter to be cored or drilled by the trade requiring them, subject to the approval of the hollow core slab manufacturer.

.11 Openings larger than 150mm to be located on shop drawings at time of approval and to be provided in the shop. Contractor responsible to coordinate all slab openings with other trades.

.12 Do not cut any reinforcing without prior approval of the precast slab manufacturer and engineer.

.13 Seal all hollow core joints from the underside using polyurethane sealant (colour grey). Prime and install backer rod per manufacturer requirements.

3.3 ERECTION TOLERANCES

.1 Section 01 73 00: Tolerances.

.2 Erect members level and plumb, within allowable tolerances.

.3 Erect to the tolerances as specified in CSA-A23.4-16.

3.4 CLEANING

.1 Section 01 74 00: Cleaning installed work.

.2 Clean weld marks, dirt, or blemishes from surface of exposed members, caused by the work of this trade.

.3 Clean field welds with wire brush and touch up with [primer] [galvanized] paint.

.4 Upon completion of the work in this section, all surplus materials and debris shall be removed from this site.

3.5 PROTECTION OF FINISHED WORK

.1 Section 01 78 40: Protecting installed work.

.2 Protect members from damage caused by field welding or erection operations performed by the work of this trade.

.3 Provide non-combustible shields during welding operations, as required.

END OF SECTION

DIVISION 4 INDEX

COMMON WORK RESULTS FOR MASONRY

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 04 05 12 - Masonry Mortar and Grout.

.3 Section 04 05 19 - Masonry Anchorage and Reinforcing.

.4 Section 04 05 23 - Masonry Accessories.

.5 Section 04 22 00 - Concrete Unit Masonry.

.6 Section 07 92 00 - Joint Sealants.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CSA-A165 Series, Standards on Concrete Masonry Units.
.2 CSA A179, Mortar and Grout for Unit Masonry.
.3 CSA-A371, Masonry Construction for Buildings.

.2 International Masonry Industry All-Weather Council (IMIAC).

.1 Recommended Practices and Guide Specification for Cold Weather Masonry Construction.

1.3 SUBMITTALS

.1 Product Data.

.1 Submit manufacturer's printed product literature, specifications and data, including product characteristics, performance criteria, limitations and colors.

.2 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) - Material Safety Data Sheets (MSDS).

.3 Samples.

.1 Submit samples:

.1 Two of each type of masonry unit specified including special shapes.
.2 One of each cured and coloured samples of mortar and grout, illustrating mortar colour and colour range.
.3 One of each type of masonry accessory specified.
.4 One of each type of masonry reinforcement and connector proposed for use.

.2 Submit samples tested to laboratories employing technicians certified/trained in procedures for testing masonry units.

.3 Samples used for testing, when accepted, become standard for material used.

.4 Shop drawings.

.1 Provide drawings stamped and signed by professional engineer licensed in Province of Ontario.

.2 Provide confirmation to Owner's Representative that temporary bracing and support has been designed by professional engineer.

.5 Manufacturer's Instructions.

.1 Submit manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

.1 Submit laboratory test reports certifying compliance of masonry units and mortar ingredients with specification requirements.

.2 Submit certified test reports showing compliance with specified performance characteristics and physical properties.

.3 For clay units, in addition to requirements set out in referenced CSA and ASTM Standards include data indicating initial rate of absorption.

.4 Qualifications:

.1 Manufacturer: minimum five (5) years experience in manufacturing components similar to or exceeding requirements of project.

.2 Installer: experienced in performing work of this section who has specialized in installation of work similar to that required for this project.

.3 Masons: company or person specializing in masonry installations with minimum five (5) years documented experience with masonry work similar to this project.

.1 Masons employed on this project must demonstrate ability to reproduce mock-up standards.

1.5 JOB MOCK-UPS.

.1 Construct mock-ups in accordance with Section 01 45 00 - Quality Control.

.2 Construct mock-up panel of exterior masonry wall construction 1200 x 1800 mm showing masonry colours and textures, use of reinforcement, through-wall flashing, jointing, coursing, mortar and workmanship.

.3 Mock-up will be used to judge workmanship, substrate preparation, operation of equipment and material application.

.4 Construct mock-up where directed.

.5 Provide written notice of mock-up completion and allow two (2) working days after completion of mock-up for Owner's Representative review. Commence work only upon receipt of approval of mock-up by Owner's Representative.

.6 When accepted, mock-up will demonstrate minimum standard for this work. Mock-up may remain as part of finished work.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store, handle and protect materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver materials to job site in dry condition.

.3 Keep materials dry until use except where wetting of bricks is specified

.4 Store under waterproof cover on pallets or plank platforms held off ground by means of plank or timber skids.

.5 Replace defective or damaged materials with new.

1.7 SITE CONDITIONS

.1 Cold weather requirements.

.1 In accordance with CSA-A371 and as outlined below.

.1 Maintain temperature of mortar between 5˚C and 50˚C until batch is used or becomes stable.

.2 Maintain ambient temperature of masonry work and it's constituent materials between 5°C and 50°C and protect site from exposure to wind.

.3 Maintain temperature of masonry above 0°C for minimum of 3 days, after mortar is installed.

.4 Preheat unheated wall sections in enclosure for minimum 72 hours about 10°C, before applying mortar.

.2 Hot weather requirements.

.1 In accordance with CSA-A371 and as outlined below.

.1 Protect freshly laid masonry from drying too rapidly, by means of waterproof, non-staining coverings.

.2 Keep masonry dry using waterproof, non-staining coverings that extend over walls and down sides sufficient to protect walls from wind driven rain, until masonry work is completed and protected by flashings or other permanent construction.

.3 Protect masonry and other work from marking and other damage. Protect completed work from mortar droppings. Use non-staining coverings.

.4 Provide temporary bracing of masonry work during and after erection until permanent lateral support is in place.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Masonry materials are specified in related Sections indicated in 1.1.

PART 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 PREPARATION

.1 Provide temporary bracing and support of masonry work during and after erection until permanent lateral support is in place.

.2 Bracing approved by Owner’s Representative.

.3 Establish and protect lines, levels, and coursing.

.4 Protect adjacent materials from damage and disfiguration.

3.3 INSTALLATION

.1 Do masonry work in accordance with CSA-A371, except where specified otherwise.

.2 Build masonry plumb, level, and true to line, with vertical joints in alignment respecting construction tolerances permitted by CAN/CSA-A371.

.3 Layout coursing and bond to achieve correct coursing heights, and continuity of bond above and below openings, with minimum of cutting.

.4 Toothing of masonry is not permitted. Only step back procedures are permitted.

3.4 CONSTRUCTION

.1 Exposed masonry:

.1 Remove chipped, cracked, and otherwise damaged units, in accordance with CSA A-165, in exposed masonry and replace with undamaged units.

.2 Jointing:

.1 Allow exterior and interior exposed joints to set just enough to remove excess water, then tool with round jointer to provide smooth, joints true to line, compressed, uniformly concave joints (no raked joints permitted).

.2 Strike flush joints concealed in walls and joints in walls to receive plaster, tile, insulation, or other applied material except paint or similar thin finish coating.

.3 Provide full head joints by buttering (double buttering) both ends of each unit. Slushing after unit in place not permitted.

.3 Cutting:

.1 Cut out for electrical switches, outlet boxes, and other recessed or built-in objects.

.2 Make cuts straight, clean, and free from uneven edges.

.4 Building-In:

.1 Build in items required to be built into masonry.

.2 Prevent displacement of built-in items during construction. Check plumb, location and alignment frequently, as work progresses.

.3 Brace door jambs to maintain plumb. Fill spaces between jambs and masonry with mortar.

.5 Wetting of bricks:

.1 Except in cold weather, wet bricks having an initial rate of absorption exceeding 1 g/minute/1000 mm^2: wet to uniform degree of saturation, 3 to 24 hours before laying, and do not lay until surface dry.

.2 Wet tops of walls built of bricks qualifying for wetting, when recommencing work on such walls.

.6 Support of loads:

.1 Use 30 MPa concrete to Section 03 30 00 - Cast-in-Place Concrete, where concrete fill is used in lieu of solid units.

.2 Use grout to CSA A179, where grout is used in lieu of solid units.

.3 Install building paper below voids to be filled with grout; keep paper 25 mm back from faces of units.

.7 Provision for movement:

.1 Leave 6 mm space between top of non-load bearing walls and partitions and structural elements. Do not use wedges.

.8 Control joints:

.1 Construct continuous control joints where indicated or detailed.

.9 Expansion joints:

.1 Build-in continuous expansion joints where indicated or detailed.

COMMON WORK RESULTS FOR MASONRY

3.5 SITE TOLERANCES

.1 Tolerances in notes to CSA-A371 apply.

3.6 FIELD QUALITY CONTROL

.1 Inspection and testing will be carried out by Testing Laboratory designated by Owner's Representative.

.2 Owner's Representative will pay costs for testing, as specified in Section 01 29 83 – Payment Procedures for Testing Laboratory Services.

.3 Cost of testing will be paid from cash allowance specified in Section 01 21 00 - Allowances. Re-testing as a result of deficient work will be paid for by contractor, credit change order.

.4 Provide Certificate of Field Quality Inspection and testing to Owner's Representative for inclusion in Commissioning Manual.

3.7 CLEANING

.1 Perform cleaning after installation to remove construction and accumulated environmental dirt.

.2 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

3.8 PROTECTION

.1 Temporary Bracing and Supports:

.1 Provide temporary bracing and supports of masonry work during and after erection until permanent lateral support is in place.

.2 Provide confirmation to Owner's Representative that temporary bracing and support has been designed by professional engineer.

.3 Brace masonry walls as necessary to resist wind pressure and lateral forces during construction.

.2 Moisture Protection:

.1 Keep masonry dry using waterproof, nonstaining coverings that extend over walls and down sides sufficient to protect walls from wind driven rain, until completed and protected by flashing or other permanent construction.

.2 Cover completed and partially completed work not enclosed or sheltered with waterproof covering at end of each work day. Anchor securely in position.

.3 Air Temperature Protection: protect completed masonry as per Part 1 article Site Conditions.

COMMON WORK RESULTS FOR MASONRY

END OF SECTION

MASONRY MORTAR AND GROUT

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures

.2 Section 04 05 00 - Common Work Results for Masonry

.3 Section 04 05 19 – Masonry Anchorage and Reinforcing

.4 Section 04 22 00 – Unit Masonry

.5 Section 04 05 23 – Masonry Accessories

1.2 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CAN/CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.2 CSA A179, Mortar and Grout for Unit Masonry.

.3 CAN/CSA A371, Masonry Construction for Buildings.

.4 CAN/CSA-A3000, Cementitious Materials Compendium; CAN/CSA-A3002, Masonry and Mortar Cement.

1.3 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheet including product characteristics, performance criteria, and limitations.

.2 Submit copy of WHMIS MSDS Material Safety Data Sheets. Indicate VOC's mortar, grout, parging, colour additives and admixtures, expressed as grams per litre (g/L).

.2 Samples:

.1 Submit two samples of mortar showing actual product colour when set.

.3 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

.1 Submit test reports showing compliance with specified performance characteristics and physical properties.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handles masonry mortar and grout materials in accordance with Section 01 61 00 - Common Product Requirements, supplemented as follows:

.1 Deliver prepackaged, dry-blended mortar mix to project site in labelled plastic-lined bags each bearing name and address of manufacturer, production codes or batch numbers, and color or formula numbers.

.2 Maintain mortar, grout and packaged materials clean, dry, and protected against dampness, freezing, traffic and contamination by foreign materials.

1.6 SITE CONDITIONS

.1 Ambient Conditions: maintain materials and surrounding air temperature to:

.1 Minimum 5 degrees C prior to, during, and 48 hours after completion of masonry work.

.2 Maximum 32 degrees C prior to, during, and 48 hours after completion of masonry work.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Use same brands of materials and source of aggregate for entire project.

.2 Cement:

.1 Portland Cement: to CAN/CSA-A3000.

.2 Masonry Cement: to CAN/CSA-A3002 and CAN/CSA A179.

.3 Mortar Cement: to CAN/CSA-A3002 and CAN/CSA A179.

.4 Packaged Dry Combined Materials for mortar: to CAN/CSA A179, using gray color cement.

.3 Aggregate: supplied by one supplier.

.1 Fine Aggregate: to CAN/CSA A179, natural sand.

.2 Course Aggregate: to CAN/CSA A179.

.4 Water: clean and potable.

2.2 COLOR ADDITIVES

.1 Use coloring admixture not exceeding 10% of cement content by mass, or integrally colored masonry cement, to produce colored mortar to match approved sample. Admixtures to be approved prior to use. Use in accordance with the specific manufacturer's recommendations. Mortar color sample as selected from manufacturer’s standard color range.

.2 White mortar: use white masonry cement to produce mortar type specified.

2.3 MORTAR MIXES

.1 Use approved dry pre-mix mortar meeting the types specified below. Submit shop drawings for review and approval prior to construction.

.2 Mortar for exterior masonry above grade:

.1 Loadbearing: Type S.

.2 Non-Loadbearing: Type N based on proportion specifications.

.3 Mortar for interior masonry:

.1 Loadbearing: Type S based on proportion specifications.

.2 Non-Loadbearing: Type N based on proportion specifications.

.4 Mortar for Parapet walls, chimneys, unprotected walls: Type S based on proportion specifications.

.5 Pointing Mortar: CAN/CSA A179, Type N using property specification with maximum 2 percent ammonium stearate or calcium stearate per cement weight.

.6 Stain Resistant Pointing Mortar: one part Portland cement, 1/8 part hydrated lime, and two parts graded (80 mesh) aggregate, proportioned by volume. Add aluminum tristearate, calcium stearate, or ammonium stearate to 2 percent of Portland cement by weight.

.7 Parging mortar: Type N to CAN/CSA A179.

.8 Mortar for foundation walls, manholes, sewers, pavements, walks, patios and other exterior masonry at or below grade: Type M based on proportion specifications.

.9 Following applies regardless of mortar types and uses specified above:

.1 Mortar for calcium silicate brick and concrete brick: Type N based on proportion specifications.

.2 Mortar for grouted reinforced masonry: Type S based on proportion specifications.

2.4 MORTAR MIXING

.1 Add mortar color in accordance with manufacturer's instructions. Provide uniformity of mix and coloration.

.2 Use a batch type mixer in accordance with CAN/CSA A179.

.3 Pointing mortar: prehydrate pointing mortar by mixing ingredients dry, then mix again adding just enough water to produce damp unworkable mix that will retain its form when pressed into ball. Allow to stand for not less than 1 hour no more

than 2 hours then remix with sufficient water to produce mortar of proper consistency for pointing.

.4 Re-temper mortar only within two hours of mixing, when water is lost by evaporation.

.5 Use mortar within 2 hours after mixing at temperatures of 32 degrees C, or 2-1/2 hours at temperatures under 5 degrees C.

2.5 GROUT MIXES

.1 All grout to be ready-mix or approved pre-mix system by Spec Mix or approved alternate only. Maximum size of aggregate to be 10mm. Slump to be 200 to 225mm. Minimum 28 day compressive strength of 20MPa in accordance with CAN/CSA A179.

2.6 GROUT MIXING

.1 Mix grout ingredients in quantities needed for immediate use in accordance with CAN/CSA A179.

.2 Add admixtures in accordance with manufacturer's instructions; mix uniformly.

.3 Do not use calcium chloride or chloride based admixtures.

PART 3 EXECUTION

3.1 EXAMINATION

.1 Verify that conditions of substrate are acceptable for masonry installation in accordance with manufacturer’s written instructions.

.2 Visually inspect substrate in presence of Owner’s Representative.

.3 Inform Owner’s Representative of unacceptable conditions immediately upon discovery.

.4 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Owner’s Representative.

3.2 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.3 CONSTRUCTION

.1 Do masonry mortar and grout work in accordance with CSA A179, except where specified otherwise.

.2 Apply parging in uniform coating of thickness indicated.

3.4 MIXING

.1 All pointing mortar can be mixed using a regular paddle mixer. Only electric motor mixers are permissible. Mixers run on hydrocarbons are not permitted, due to fumes. Mixing by hand must be pre-approved by the Owner's Representative.

.2 Clean all mixing boards and mechanical mixing machine between batches.

.3 Mortar must be weaker than the units it is binding.

.4 Contractor to appoint one individual to mix mortar, for duration of project. In the event that this individual must be changed, mortar mixing must cease until the new individual is trained, and mortar mix is tested.

3.5 MORTAR PLACEMENT

.1 Install mortar to manufacturer's instructions.

.2 Install mortar to requirements of CAN/CSA A179.

.3 Remove excess mortar from grout spaces.

3.6 GROUT PLACEMENT

.1 Install grout in accordance with manufacturer's instructions.

.2 All grouting shall be low lift (1500mm) grouting. High lift grouting will not be accepted.

.3 Install grout in accordance with CAN/CSA A179.

.4 Work grout into masonry cores and cavities to eliminate voids.

.5 Do not install grout in lifts greater than 400 mm, without consolidating grout by rodding.

.6 Do not displace reinforcement while placing grout.

3.7 CLEANING

.1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

.2 Remove droppings and splashings using clean sponge and water.

.3 Clean masonry with low pressure clean water and soft natural bristle brush.

MASONRY MORTAR AND GROUT

END OF SECTION

MASONRY ANCHORAGE AND REINFORCING

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 04 05 00 - Common Work Results for Masonry.

.3 Section 04 05 12 – Masonry Mortar and Grout.

.4 Section 04 05 23 – Masonry Accessories.

.5 Section 04 22 00 – Concrete Unit Masonry.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.2 CSA-A370, Connectors for Masonry.

.3 CSA-A371, Masonry Construction for Buildings.

.4 CSA G30.18, Carbon Steel Bars for Concrete Reinforcement.

.5 CSA S304.1, Design of Masonry Structures.

.6 CSA A179, Mortar and Grout For Unit Masonry.

.7 CSA W186, Welding of Reinforcing Bars in Reinforced Concrete Construction.

.2 Reinforcing Steel Institute of Canada (RSIC).

.1 Reinforcing Steel Manual of Standard Practice.

1.3 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheet .

.2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets. Indicate VOC's for epoxy coatings and galvanized protective coatings and touch-up products illustrating products to be incorporated into project for specified products .

.2 Shop Drawings:

.1 Shop drawings consist of bar bending details, lists and placing drawings. Provide shop drawings detailing bar bending details, anchorage details, lists and placing drawings.

.2 On placing drawings, indicate sizes, spacing, location and quantities of reinforcement and connectors.

.3 Indicate on shop drawings, bar bending details, lists, quantities of reinforcement, sizes, spacings, locations of reinforcement and mechanical splices if approved by Owner's Representative, with identifying code marks to permit correct placement without reference to structural drawings. Indicate sizes, spacings and locations of chairs, spacers and hangers. Prepare reinforcement drawings in accordance with Reinforcing Steel Manual of Standard Practice - by Reinforcing Steel Institute of Canada . ANSI/ACI 315 and ACI 315R, Manual of Engineering and Placing Drawings for Reinforced Concrete Structure.

.3 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions.

1.4 SITE MEASUREMENTS

.1 Make site measurements necessary to ensure proper fit of members.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Bar reinforcement: to CSA-A371, and CAN/CSA G30.18, Grade 400.

.2 Wire reinforcement: to CSA-A371, and CSA S304.1, two wire ladder or truss type, hot-dipped galvanized. Use pre-fabricated corner and intersection pieces.

2.2 FABRICATION

.1 Fabricate reinforcing in accordance with CSA-A23.1/A23.2 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.

.2 Fabricate connectors in accordance with CSA-A370.

.3 Obtain Owner's Representative's approval for locations of reinforcement splices other than shown on placing drawings.

.4 Upon approval of Owner's Representative, weld reinforcement in accordance with CSA W186.

.5 Ship reinforcement and connectors, clearly identified in accordance with drawings.

2.3 SOURCE QUALITY CONTROL

.1 Upon request, provide Owner's Representative with certified copy of mill test report of reinforcement steel and connectors, showing physical and chemical analysis, minimum 5 weeks prior to commencing reinforcement work.

.2 Upon request inform Owner's Representative of proposed source of material to be supplied.

PART 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 INSTALLATION

.1 Install masonry connectors and reinforcement in accordance with CAN3-A370 and CAN3-A371, unless indicated otherwise.

.2 For standard single wythe construction provide reinforcing at 200mm oc (every block joint) unless note otherwise.

3.3 BONDING AND TYING

.1 Bond walls of two or more wythes using metal connectors in accordance with CSA S304.1, CSA-A371, and as indicated.

.2 Tie masonry veneer to backing in accordance with NBC, CSA-S304.1, CSA-A371, and as indicated.

3.4 REINFORCED LINTELS AND BOND BEAMS

.1 Reinforce masonry lintels and bond beams as indicated.

.2 Place and grout reinforcement in accordance with CSA-S304.1, CSA-A371 and CSA-A179.

.3 Support and position reinforcing bars in accordance with CAN/CSA A371.

3.5 GROUTING

.1 Grout masonry in accordance with CSA-S304.1, CSA-A371 and CSA-A179, and as indicated.

3.6 ANCHORS

.1 Supply and install metal anchors as indicated.

3.7 LATERAL SUPPORT AND ANCHORAGE

.1 Supply and install lateral support and anchorage in accordance with CSA-S304.1 and as indicated.

3.8 MOVEMENT JOINTS

.1 Reinforcement will not be continuous across movement joints unless otherwise indicated.

3.9 FIELD BENDING

.1 Do not field bend reinforcement and connectors except where indicated or authorized by Owner's Representative.

.2 When field bending is authorized, bend without heat, applying a slow and steady pressure.

.3 Replace bars and connectors which develop cracks or splits.

3.10 FIELD TOUCH-UP

.1 Touch up damaged and cut ends of galvanized reinforcement and connectors with compatible finish to provide continuous coating.

3.11 CLEANING

.1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

MASONRY ACCESSORIES

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 04 05 00- Common Work Results for Masonry.

.3 Section 04 05 19 - Masonry Anchorage and Reinforcing.

1.2 REFERENCES

.1 American Society for Testing and Materials, (ASTM).

.1 ASTM D2240, Standard Test Method for Rubber Property - Durometer Hardness.

.2 Canadian Standards Association (CSA)

.1 CSA-A371, Masonry Construction for Buildings.

1.3 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data including product characteristics, performance criteria, and limitations.

.2 Submit two copies of WHMIS MSDS - Material Safety Data. Indicate VOC's for joint fillers and lap adhesives.

.2 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle masonry accessories in accordance with, Section 01 61 00 - Common Product Requirements supplemented as follows:

.1 Keep fillers and adhesives dry, protected against dampness, and freezing.

.2 Store packaged materials off ground and in accordance with manufacturer's written instructions.

MASONRY ACCESSORIES

PART 2 PRODUCTS

2.1 MATERIALS

.1 Control joint filler: purpose-made elastomer 70 durometer hardness to ASTM D2240 of size and shape indicated.

.2 Lap adhesive: recommended by masonry flashing manufacturer.

.3 Cavity Wall Flashing:

.1 Self adhering SBS rubberized asphalt compound integrally laminated to cross-laminated polyethylene film, minimum thickness 1.0 mm. Sopraseal Stick 1000 or approved equivalent.

.2 Primer: as per manufacturer's recommendation.

PART 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 INSTALLATION

.1 Install continuous control joint fillers in control joints at locations indicated on drawings.

.2 Lap adhesive: apply adhesive to flashing lap joints.

.3 Reglets: install reglets at locations indicated on drawings.

3.3 CONSTRUCTION

.1 Build in flashings in masonry in accordance with CSA-A371 as follows:

.1 Install flashings at base of exterior masonry and over openings.

.2 In cavity walls and veneered walls, carry flashings from front edge of masonry, under outer wythe, then up backing not less than 300 mm, and as follows:

.1 For masonry backing embed flashing 25 mm in joint.

.2 For concrete backing, insert flashing into reglets.

.3 For wood frame backing, staple flashing to walls behind sheathing paper.

.4 For gypsum board backing, bond to wall using manufacturer's recommended adhesive.

.3 Lap joints 150 mm and seal with adhesive.

.2 Form flashing (end dams) at lintels, sills and wall ends to prevent water from travelling horizontally past flashing ends.

3.4 CLEANING

.1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

UNIT MASONRY

Part 1 General

1.1 RELATED WORK

.1 Comply with Division 1 – General Requirements and all other Specification Divisions.

1.2 REFERENCE STANDARDS

.1 CSA A165 Series-14 – CSA Standards on Concrete Masonry Units.

.2 CAN/CSA A179-14 (R2024) – Mortar and Grout for Unit Masonry

.3 CSA A3000:23 – Cementitious Materials Compendium

.4 CSA A370:14 (R2023) – Connectors for Masonry

.5 CSA A371:14 (R2024) – Masonry Construction for Buildings

.6 CSA S304.1-04 (R2010) – Design of Masonry Structures

1.3 PRODUCT DELIVERY AND STORAGE

.1 Deliver masonry units on skids and store on a dry, level area of the site, cover with tarpaulins and maintain materials always dry.

.2 Protect stored materials from weather and against chipping of edges and corners, soiling and other deterioration.

1.4 INSPECTION

.1 Examine areas to receive the work of this Section and do not proceed until unsatisfactory conditions are corrected.

1.5 COLD WEATHER REQUIREMENTS

.1 No frozen materials or materials containing ice to be used in masonry construction.

.2 When the mean daily temperature is below 5 degrees C, mortar, water and masonry units to be maintained at not less than 5 degrees C during laying. Heat masonry on both sides of walls and maintain wall and air temperature above 5°C for 48 hours after completion of masonry work.

.3 Supplement Clause 5.15.2 of CSA A371 with following requirements:

.1 Heat water to max. 70°C. Heat sand slowly and evenly without scorching.

.2 Protect mortar form rain and snow.

.4 Maintain dry beds for masonry and use dry masonry units only. Do not wet masonry units in cold weather.

.5 Submit method proposed for the protection of the masonry against low temperatures to the Engineer for approval.

1.6 PROTECTION

.1 Always provide and maintain protection for masonry walls when work is interrupted or temporarily ceased to prevent moisture from entering unfinished walls. Provide non-staining, water repellent treated paper, polyethylene sheets or tarpaulins, properly secured in place to prevent lifting due to high winds. Similarly, protect exposed ledges to be covered by flashings or other materials until such materials are to be installed. Ensure protections overhang wall and down sides sufficient to protect walls from wind driven rain.

.2 Protect all masonry walls from staining from any source.

.3 Provide adequate shoring and bracing to masonry wall during and after erection until permanent lateral support is in place.

.4 Stack units on properly cushioned supports to protect the edges. Do not permit units to contact earth or other staining influences or to rest on corners. Protect stockpiles against inclement weather. Protect all holes and reglets against water and ice in freezing weather.

1.7 SAMPLES

.1 Submit 2 samples of each specified masonry unit type for work of this Section.

.2 One of each type of masonry accessory specified.

.3 Reviewed and accepted samples will become standards of workmanship and material against which installed work will be verified.

1.8 SOURCE QUALITY CONTROL

.1 Submit laboratory test reports in accordance with Division 1 – Submittal Procedures Section.

.2 Submit laboratory test reports certifying compliance of masonry units and mortar ingredients with specification requirements.

.3 For clay units, in addition to the requirements set out in referenced CSA and ASTM standards include data indicating initial rate of absorption for units proposed for use.

.4 Upon request, provide Engineer with certified copy of mill test report of reinforcement steel and connectors, showing physical and chemical analysis, minimum 5 weeks prior to commencing reinforcement work.

.5 Upon request inform Engineer of proposed source of material to be supplied.

1.9 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Division 1 – Submittal Procedures Section.

.2 Shop drawings consist of bar bending details, lists and placing drawings.

.3 On placing drawings, indicate sizes, spacing, location and quantities of reinforcement and connectors, with identifying code marks to permit correct placement without reference to structural drawings.

Part 2 Products

2.1 MATERIALS

.1 Concrete Block:

.1 Standard concrete masonry units: Type H/15.0/A/M to CSA A165 series (CSA A165.1 metric modular).

.2 Light weight concrete masonry unit. Type H/15.0/C/M to CSA A165 series (CSA A165.1 metric modular).

.3 Provide plain end blocks, jamb blocks, lintel and bond beam blocks and other special shapes as required. Provide bull-nosed units for exposed corners and at windows and doors and as detailed.

.4 Lineal shrinkage and moisture movement of blocks to not exceed 0.03%. A test certificate to be submitted to the Engineer.

.5 Concrete blocks to be manufactured with normal weight aggregate, conforming to CSA A23.1

.6 Maximum absorption of 150 kg/m^3.

.7 Mortar to be Type S.

.8 Solid and 75% solid concrete masonry units, CSA A165.1 Type S/15/A/M/, S/15/A/M, respectively.

.2 Architectural Veneer Masonry:

.1 Architectural veneer masonry units: to CSA A371.

.2 “Split Face” masonry unit by Brampton Brick size to be 90 mm wide x 190 mm high x 390 mm long.

.3 Color: “Walnut”.

.4 Mortar to be Type N:

.1 1 part Portland cement (CSA 3001, Type GU).
.2 1 part hydrated lime (ASTM C207, Type S, and
.3 6 parts masonry sand (CSA A179).
.4 Conform to ASTM C270 Mortar for masonry unit.

.5 Submit colour and texture samples for review and approval prior to ordering material and commencing work.

.6 Refer drawings for locations.

.3 Cement: grey normal Portland, to CSA 3000.

.4 Sand: CSA A179.

.5 Lime: hydrated, CSA A179.

.6 Water: CSA A179.

.7 Aggregate:

.1 Fine Aggregate to CAN/CSA A179, natural sand.

.2 Coarse Aggregate to CAN/CSA A179.

.8 Horizontal masonry reinforcement: galvanized after fabrication according to ASTM A153 Class B2, manufactured by Blok-Lok Ltd., Dur-O-Wal Ltd. or equal. For corners and intersecting walls use special corner sections and tee-sections such as Corner Lok and Blok-Lok Partition-Lok to match truss/ladder-type-reinforcing. Unless noted otherwise on drawings, reinforcement to be standard truss type fabricated with 3.6 mm thick wires. Refer to drawings for size and spacing.

.9 Vertical reinforcement: Carbon steel, grade 400, deformed bars conforming to CSA G30.12. Refer to drawings for size and spacing.

.10 Masonry Anchors and Veneer Ties:

.1 Connectors and horizontal reinforcement: to CSA A370 and CSA A371 respectively and as follows:

.1 Standard single wythe: Blok-Lok BL-10 (Ladder-type) as noted on the Structural drawings for type and thickness of walls. Comparable products by Dur-O-Wall are acceptable, weight as noted on drawings, hot dipped galvanized steel. Use prefabricated corner and t-sections for wall corners and to anchor
intersecting walls.

.2 Concrete block masonry cavity wall (block, insulation, air space and masonry veneer): Blok-Lok BL-42 and Blok-Lok BL-10 (ladder type). See Structural drawings for type and thickness of walls. Comparable products by Dur-O-Wall are acceptable, weight as noted on the drawings hot dipped galvanized steel. Use prefabricated corner and t-sections for wall corners. Use Blok-Lok Wedge-lok Insulation Retainers.

.3 Concrete cavity wall (concrete, insulation, air space and masonry veneer): Blok-Lok BL-407. Use Blok-Lok Wedge-lok Insulation Retainers. Adjustable Anchor Tie Fasteners: Stainless steel drilled in fastener with minimum tensile pull-out design load of 1.4 kN per anchor (2 anchors per BL-407 tie).

.2 Insulation Support: slotted polyethylene plates manufactured by Fero Corporation.

.3 All masonry veneer tie metal components: type 304 stainless steel.

.11 Compressible Joint Filler: non-staining, non-extruding, resilient cellular material, closed cell PVC “Rodofoam PR Grade” manufactured by Sternson or “Ethafoam” closed cell polyethylene foam manufactured by Dow Chemical Co. Ltd.

.12 Through Wall Flashing and Damp Course Flashing:

.1 Perma-barrier wall flashing manufactured by W.R. Grace & Co.

.2 Adhesive and Lap Sealant: Bituthene Mastic by W.R. Grace & Co.

.3 Primers: type recommended by manufacturer of joint filler and masonry flashing.

.13 Weep hole vents: purpose made PVC vent designed to drain cavities to the exterior.

.14 Mortar Collection Device: Polyester open mesh - ‘Mortar Net’.

.15 Cleaning compound: as recommended by the masonry manufacturer. Material selected to have no harmful after effect or chemical reaction on surface of masonry or mortar.

2.2 MORTAR AND GROUT MIXES

.1 All mortar to be premixed lime cement mortar, “Betomix” manufactured by Daubois Inc. or equal, lime cement mortar manufactured by Jiffy Concrete Products conforming to the following:

.1 Mortar for above grade masonry: conform to CSA A179, Type S based on proportion specifications as follows: 1 part Portland cement, ½ part hydrated lime, 4 parts sand by volume.

.2 Mortar for load bearing masonry: conform to CSA A179, Type S based on proportion specifications as follows: 1 part Portland cement, ½ part hydrated lime, 4 parts sand by volume.

.3 Mortar for non-load bearing masonry: conform to CSA A179, Type N based on proportion specifications as follows: 1 part Portland cement, ½ part hydrated lime, 6 parts sand by volume.

.4 Mortar for grouted, vertically reinforced masonry: conform to CSA A179, Type S based on proportion specifications as follows: 1 part Portland cement, ½ part hydrated lime, 4 parts sand by volume.

.5 Grout: conform to CSA A179M Table 3 Coarse Grout. Maximum size of coarse aggregate 10 mm. Compressive strength of grout 20 MPa at 28 days. Slump to be 200 to 250mm. All grout to be ready-mix or approved pre-mix system by Spec Mix or approved alternate.

.2 Parging Mortar: conform to CSA A179 Type S as specified above.

.3 Use same brands of materials and source of aggregate for entire project.

2.3 MIXING OF MORTARS

.1 Mix cementitious materials, aggregate and water by machine on the job site, according to the mixing procedure recommended by the Manufacturer of the packaged components.

.2 Do not mix in greater quantities than required for immediate use. No tempering will be allowed.

Part 3 Execution

3.1 TOLERANCES

.1 Construct walls straight and true within 3 mm when checked with a 3 m straight edge in any direction.

.2 Walls to receive thinset ceramic tile: plumb within 1:600. All other walls: plumb within 1:500.

.3 Deviation in joint thickness: ±3mm.

3.2 LAYING MASONRY

.1 Do masonry work according to CSA A371. Provide adequate temporary support to unfinished wall at all time.

.2 Lay masonry work to vertical coursing indicated, true to dimensions, plumb, square and properly bonded and anchored. Lay in full beds of mortar with joins of uniform width. Do not shift or tap units after mortar has set. Course back-up material to suit face material.

.3 Maintain vertical joints in alternate courses, or as broken by bond pattern, in line throughout the entire height. Ensure bed joints are level throughout. Fill all vertical and bed joints solidly with mortar.

.4 Keep exposed masonry surfaces clean as the work proceeds, leaving no mortar fins or droppings.

.5 In accordance with CSA A371, keep cavity free of mortar and mortar droppings. Place wood strip on ties or reinforcement to catch all mortar droppings. Remove as work progresses. Backslope mortar beds at cavities just sufficient to minimize mortar projection into cavity. Use mortar collection device at base of wall as per manufacturer's recommendations.

.6 Masonry exposed to view or to receive a brushed or sprayed on finish to be laid carefully and evenly with exposed faces flush and even throughout. No broken corners or spoiled units will be permitted. Remove chipped, cracked, and otherwise damaged units and replace with undamaged units.

.7 Doors and openings in interior exposed masonry partitions to be adjusted to present a uniform appearance with a minimum of cut units.

.8 Tool exposed masonry joints with a non-staining tool, to a smooth, compressed, concave finish. Provide neat flush joints for unexposed masonry. Use stainless steel jointing tools.

.9 Non-bearing partitions to terminate 25 mm below the underside of the floor or roof structure above. Pack 25 mm joint solid with compressible joint filler strip compressed 25%. Set joint filler back 6 mm from each face of the masonry.

.10 Where required, cut exposed masonry with a carborundum saw.

.11 Bond all corners and intersections of walls and partitions with masonry units overlapping a minimum of 100 mm each course.

.12 Moisten shale or clay masonry units before laying, except in freezing or near freezing weather.

.13 Beam fill all voids in structural members where they occur in or over walls.

3.3 CONCRETE BLOCK WALLS

.1 Lay concrete block masonry units in running bond except where indicated otherwise on the drawings. Coursing height: 200 mm for one block and one joint.

.2 Tool joints of exposed concrete block to a neat concave finish free of all cracks and crevices.

.3 Pass conduits and piping through hollow cells of blocks or building around with split blocks. Cut blocks accurately for electrical boxes and recessed equipment. Build chases and openings as required, accurately located and neatly finished, as the work progress.

.4 Use special shaped blocks where required. Use bullnose corner, flat end blocks at all external corners of exposed block wall.

.5 Use solid blocks for at least two courses under point bearing loads except where grouted bond beam occurs below point loads or at grouted bearing ends below masonry beams.. Ensure solid blocks continue 200 mm either side of bearing or noted on the drawings.

3.4 ARCHITECTURAL VENEER MASONRY

.1 Bond: running, except were shown otherwise on drawings.

.2 Coursing height: 200 mm for one block and one joint.

.3 Jointing: concave where exposed

.4 Provide control joints as detailed on drawings.

.5 Lay units in a full bed of mortar. The full bed of mortar must cover the ends of all units as well as the outer and inner walls. Slushing of head joints after the unit is placed to not be permitted. Whenever it is found that this provision is not carried out, walls to be taken down and rebuilt, or, at the Engineer's discretion.

.6 Where blockwork is to be exposed, courses to be level, and alternate vertical joints to be aligned.

.7 Chipped or deformed units to not be used.

.8 The maximum joint thickness to be 10mm.

.9 Use unsawn masonry units at all exterior corners. Do not machine cut units and install at exterior corners. Machine cut with a carborundum saw. Adjust in size and leave straight, clean and even edges.

.10 Build-in all openings, sleeves, fire dampers, or chases required by other trades. Make good around all conduits or pipes that occur in masonry work. Masonry to close tightly around all penetrations in ceiling spaces. Take special care to ensure that final finish of masonry is presentable; secure the cooperation of other trades to ensure this result.

.11 Install horizontal Ties/anchors as specified.

.12 Carry up all walls in a uniform manner without any one wall raised more than 1200mm above another at one time.

.13 Install all walls in accordance with details shown on the drawings.

.14 Cut and make good all openings or chases required by other trades. Where conduits or pipes occur in masonry work, take special care to ensure that final finish of masonry is presentable; secure the cooperation of other trades to ensure this result.

.15 Where mechanical or electrical work occurs in walls, the walls to be thickened to suit and to maintain required fire, smoke, and sound separations. Refer to mechanical and electrical drawings. Do not form horizontal chases.

.16 Build-in sleeves as required.

.17 Where required, conduits that are provided and erected by other trades, to be built-in without breaking bond.

.18 Close masonry walls tightly around all penetrations which occur through them in ceiling spaces. Build in around fire dampers in accordance with the requirements of the Underwriters' Laboratory.

.19 Provide hot dipped galvanized steel angle lintels at all openings in 90mm masonry veneers unless shown otherwise on the drawings.

.20 Build-in steel door frames and fill frames with mortar as walls are brought up.

.21 Provide temporary bracing of walls during and after erection until permanent lateral support is in place.

.22 Where copper piping is in contact with masonry, ensure that piping is wrapped with polyethylene.

.23 Provide unsawn units at any window and/or storefront curtain wall jamb ends. Do not machine cut units and install in any jamb locations. (i.e windows, storefront curtain walls, and louvres).

,24 Construct masonry veneer with an adequate number of elastic movement joints, properly located to accommodate differential movement.

.26 Provide for clear draining air spaces, thru wall flashing membranes and weep hole vents. Keep air spaces clear of debris, protrusions, mortar fins and droppings.

3.5 CUTTING AND FITTING

.1 Do all cutting, fitting and patching of masonry work as required to receive work of other trades. Co-operate fully with other trades to ensure correct size, shape and location.

.2 Cut out neatly for electrical switches, outlet boxes, and other recessed or built-in objects.

.3 Make cuts straight, clean, and free from uneven edges.

3.6 BUILDING-IN WORK

.1 Build-in all items supplied by others including lintels, bearing plates, miscellaneous flashings, sleeves, anchor bolts, anchors, and wood nailers, which are built-in as the masonry work progresses.

.2 Grout built-in items plumb, level, rigid and secure.

.3 Provide and set all necessary galvanized anchors, ties, clamps and other mason's ironwork required for the construction of the work.

.4 Build-in pressed metal door frames to present a rigid, true plumb installation. Keep exposed faces of frames free of mortar. Fill spaces between jambs and masonry with mortar. Install door frames concurrent with laying of masonry.

3.7 CONCRETE BLOCK LINTELS AND BOND BEAMS

.1 Construct concrete block lintels and bond beams with 200 mm deep or 400 mm deep concrete block lintel or low web bond beam units as indicated. Fill voids of units with concrete and reinforce with deformed steel bars. Provide metal lath strips under bond beams between grouted cores to retain bond beam concrete fill.

.2 Concrete for lintels and bond beams to be 20 MPa concrete with 10 mm nominal size coarse aggregate conforming to Section 03 30 00 Cast-in-Place Concrete.

.3 Reinforcing for lintels and bond beams to conform to section 03 20 00 Concrete Reinforcement.

.4 Support and brace block lintels and secure to prevent movement or deflection during curing period. Allow block lintels to cure at least 10 days before applying load. Block lintels to have 200 mm minimum bearing at each end and as noted on drawings.

.5 Install fully grouted concrete masonry bearing blocks with reinforcement as shown on the drawings at the jambs of all concrete block lintels and steel lintels. Provide bearing blocks of same material and appearance as the adjacent wall surface.

3.8 GROUTING

.1 Use grout to CSA A179 where grout is used in lieu of solid units.

.2 Install metal lath strips below voids to be filled with grout; keep strips 25 mm back from faces of units.

.3 Use low lift grouting in accordance with specified standards.

.4 Walls to be at least 12 hours old before grouting commences.

.5 When filling vertical blockwork cores with grout, finished grout level to be 25 mm below top of block except at top of wall or openings where level to be flush with top of block.

3.9 MASONRY REINFORCEMENT AND TIES.

.1 Install horizontal masonry reinforcing in all masonry walls and partitions spaced at 200 mm o/c vertically unless noted otherwise on the drawings.

.2 Reinforce walls where thickness is reduced by a chase by placing horizontal reinforcing in every horizontal course, extending not less than 600 mm on each side of the chase.

.3 Install horizontal masonry reinforcing in two consecutive courses above and below all openings in walls, extending not less than 900 mm on each side of opening.

.4 Do not extend horizontal masonry reinforcement through movement joints.

.5 Tie exterior wythe of cavity walls to masonry backup with slotted block ties (400 mm o.c vertical and horizontal) and to concrete backup with adjustable anchor ties at 800 mm horizontal and 600 mm vertical spacing and 200 mm maximum spacing around openings and ends of walls. Install masonry connectors in accordance with CSA A370 and CSA A371. Locate first ties at 200mm from base of foundation wall and top tie a maximum of 200 from top of wall.

.6 Install vertical reinforcing where indicated on drawings.

.7 Fill voids in block where vertical reinforcing occurs with 20 MPa grout.

3.10 MASONRY VENEER TIES

.1 Install masonry veneer ties in accordance with manufacturer’s written instructions.

.2 Install veneer ties to suit coursing of masonry veneer and at spacings noted above and 200 mm maximum horizontal spacing around openings and ends of walls. Install masonry connectors in accordance with CSA A370 and CSA A371.

3.11 THROUGH WALL FLASHINGS AND COURSE FLASHINGS

.1 Install through wall flashing and damp course flashing where shown on drawings. Install flashing under exterior masonry bearing on concrete walls, slabs, shelf angles and steel angles over openings. Install flashings under weep hole courses and under precast sills.

.2 In all cases extend through wall flashing through full thickness of wall unless indicated otherwise on the drawings.

.3 Embed through wall flashings and damp course flashings in full bed of adhesive; lap joints 150 mm minimum and seal with adhesive.

.4 Provide purpose made grey plastic weep hole vents above through wall flashings and damp-proof courses at bottom of cavities, above shelf angles and beams. Locate at max. 600 mm o/c.

.5 Place 9 mm dia. plastic vent tubes in exterior joints at top of cavities. Provide at 400 mm o.c. Slope to drain out at 1:4.

.6 In double wythe walls and veneered walls, carry flashings from front edge of masonry, under outer wythe, then up backing not less than 150 mm, and adhere to air barrier in accordance with manufacturer's printed instructions.

3.12 MOVEMENT JOINTS

.1 Provide 10 mm wide movement joints in exterior brick masonry veneer and concrete block masonry. Refer to structural drawings for location of movement joints in concrete block.

.2 Extend movement joints for full height of masonry walls, except foundation walls. Horizontal rebar at bearing elevations to be continuous through control joints.

.3 Construct movement joints at distances not to exceed 6 meters or as shown on drawings.

.4 Install compressible joint filler in masonry control joints as detailed on the Drawings. Caulk joints as per Division 7.

.5 Stop horizontal joint reinforcement 25 mm from each side of control joints.

3.13 PROVISION FOR MOVEMENT

.1 Leave 6 mm space below shelf angles.

.2 Leave 25 mm space between top of non-load bearing walls and partitions and structural elements. Do not use wedges.

3.14 FIELD QUALITY CONTROL

.1 Inspection and testing will be carried out by Testing Laboratory designated by Engineer.

.2 Cost of testing will be paid for by Contractor.

3.15 CLEANING

.1 Concrete masonry units:

.1 Allow mortar droppings on unglazed concrete masonry to partially dry then remove by means of trowel, followed by rubbing lightly with small piece of block and finally by brushing.

.2 Unglazed masonry:

.1 Clean 10m^2 area of wall designated by Engineer as directed below and leave for one week. If no harmful effects appear and after mortar has set and cured, protect windows, sills, doors, trim and other work, and clean brick masonry as follows:

.1 Remove large particles with wood paddles without damaging surface. Saturate masonry with clean water and flush off loose mortar and dirt.

.2 Scrub with solution of 25 mL trisodium phosphate and 25 mL household detergent dissolved in 1 L of clean water using stiff fibre brushes, then clean off immediately with clean water using hose. Alternatively, use proprietary compound recommended by brick masonry manufacturer in accordance with manufacturer's directions.

.3 Repeat cleaning process as often as necessary to remove mortar and other stains.

.4 Use acid solution treatment for difficult to clean masonry as described in Technical Note No. 20 published by Brick Institute of America dated Sept./Oct. 1977.

.5 Test acid cleaning method on designated area of wall, followed by waiting period of at least one week, before proceeding with cleaning.

.3 Use only fibre bristled brushes for cleaning.

3.16 CLEANING EXISTING EXTERIOR MASONRY WALLS

.1 **Preparation**: Protect windows, sills, doors, trim, and other work. Remove large particles with wood paddles without damaging the surface

.

.2 **Initial Cleaning**: Saturate the masonry with clean water and flush off loose mortar and dirt.

.3 **Scrubbing**: Use a solution of 25 mL trisodium phosphate and 25 mL household detergent dissolved in 1 L of clean water. Scrub with stiff fiber brushes and clean off immediately with clean water using a hose.

.4 **Repeat Process**: Repeat the cleaning process as often as necessary to remove mortar and other stains.

.5 **Acid Solution Treatment**: For difficult-to-clean masonry, use an acid solution treatment as described in Technical Note No. 20 published by the Brick Institute of America. Test the method on a designated area and wait at least one week before proceeding.

.6 **Final Cleaning**: Use only fiber-bristled brushes for cleaning.

END OF SECTION

DIVISION 5 INDEX

STRUCTURAL STEEL FOR BUILDINGS

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 05 50 00 - Metal Fabrications.

1.2 REFERENCES

.1 Canadian Standards Association (CSA), current editions:

.1 CAN/CSA G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.2 CAN/CSA-G164, Hot Dip Galvanizing of Irregularly Shaped Articles.

.3 CAN/CSA-S16, Limit States Design of Steel Structures.

.4 CAN/CSA-S136, Cold Formed Steel Structural Members.

.5 CSA-S136.1, Commentary on CSA Standard S136.

.6 CSA W47.1, Certification of Companies for Fusion Welding of Steel Structures.

.7 CSA W48, Filler Metals and Allied Materials for Metal Arc Welding of Structural Steel.

.8 CSA W55.3, Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings.

.9 CSA W59, Welded Steel Construction (Metal Arc Welding) Metric.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-85.10, Protective Coatings for Metals.

.3 American Society for Testing and Materials International (ASTM), current editions:

.1 ASTM A36/A36M, Specification for Structural Steel.

.2 ASTM A325M, Specification for High-Strength Bolts for Structural Steel Joints Metric.

.4 Canadian Institute of Steel Construction (CISC)/Canadian Paint Manufacturer's Association (CPMA).

.1 CISC/CPMA 1, Quick-Drying, One Coat Paint for Use on Structural Steel.

.2 CISC/CPMA 2, Quick-Drying, Primer for use on Structural Steel.

.5 The Society for Protective Coatings (SSPC)

.1 SSPC SP 1, Solvent Cleaning.

.2 SSPC SP 7, Brush-Off Blast Cleaning.

1.3 SHOP DRAWINGS

.1 Submit shop drawings including fabrication and erection documents and materials list.

.2 On erection drawings: indicate details and information necessary for assembly and erection purposes such as, description of methods, sequence of erection, type of equipment used in erection and temporary bracings. Show detail of all non-standard connections such as bracing connections, truss connections, moment connections and hanger assemblies and other non-standard connections as requested by the Owner's Representative.

.3 Erections drawings to be stamped by a qualified professional Engineer licensed to practice in the Province of Ontario. The erection drawings are to contain a clause stating that the professional Engineer who stamped the erection drawings is responsible for all fabricator designed assemblies, components and connections required for this project.

.4 Drawings for all fabricator designed assemblies, components and connections are to be stamped and signed by the professional Engineer who stamped the erection drawings.

1.4 SAMPLES

.1 Prepare sample of typical exposed structural connections in accordance with approval of Owner's Representative. Samples to be judged upon alignment of surfaces, uniform contact between surfaces, smoothness and uniformity of finished welds. When approved, sample units will serve as a standard for workmanship, appearance and material acceptable for entire project.

1.5 DESIGN REQUIREMENTS

.1 Design details and connections in accordance with requirements of CAN/CSA-S16 and CAN/CSA-S136 with CSA-S136.1 to resist forces, moments, shears and allow for movements indicated.

.2 Unless noted otherwise on the drawings or in the specification's connection design is the responsibility of the structural steel fabricator. Fully detailed connections shown on the contract drawings including bolt and welded sizes are deemed to have been designed by the Owner's Representative.

.3 If connection for shear only (standard connection is required):

.1 Select framed beam shear connections from an industry accepted publication such as "Handbook of the Canadian Institute of Steel Construction".

.2 If shears are not indicated, select or design connections to support reaction from maximum uniformly distributed load that can be safely supported by beam in bending, provided no point loads act on beam.

.4 For non-standard connections, submit sketches and design calculations stamped and signed by qualified professional Engineer licensed in the Province of Ontario.

1.6 SOURCE QUALITY CONTROL

.1 If requested submit on certified copy of mill reports covering chemical and physical properties of steel used in this work.

1.7 QUALITY ASSURANCE

.1 At least 2 weeks prior to fabrication of structural steel submit to Owner's Representative a letter from the fabricators Welding engineer stating the Welding engineer is responsible for welding procedures and practices for this project as outlined in CSA S47.1

.2 Provide certificate of Quality Compliance from steel fabricator upon completion of structural steel fabrication stating that the work has been designed and fabricated in accordance with the requirements of the contract documents.

.3 If requested, submit to the Owner's Representative one copy of all approved welding procedures for this project.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Structural steel: Grades as indicated on structural drawings.

.2 Cold formed structural members: to CAN/CSA S-136.

.3 Anchor rods: to CAN/CSA-G40.20/G40.21, Grade 300W.

.4 Bolts, nuts and washers: to ASTM A325M

.5 Welding materials: to CSA W59 and certified by Canadian Welding Bureau.

.6 Shop paint primer:

.1 To CISC/CPMA 1 for interior steel without finish painting.

.2 To CISC/CPMA 2 for interior steel to be finish painted and all exterior steel.

.7 Hot dip galvanizing: galvanize steel for exterior steel to CAN/CSA-G164 and ASTM A123 minimum zinc coating of 600 g/m^2 except where noted as aluminum members on the structural drawings.

2.2 FABRICATION

.1 Fabricate structural steel in accordance with CAN/CSA-S16 and in accordance with approved reviewed shop drawings.

.2 Install shear studs in accordance with CSA W59.

.3 Continuously seal members by continuous welds where indicated.

.4 Provide holes in top bottom flanges for attachment of wood nailers.

2.3 SHOP PAINTING

.1 Clean, prepare surfaces and shop prime structural steel in accordance with CAN/CSA-S16 except where members to be encased in concrete.

.2 Clean members, remove loose mill scale, rust, oil, dirt and other foreign matter. Prepare surface by solvent cleaning to SSPC SP 1, followed by brush-off blast cleaning to SSPC SP 7.

.3 Apply one coat of primer in shop to steel surfaces except:

.1 Surfaces to be encased in concrete.
.2 Surfaces to receive field installed stud shear connections.
.3 Surfaces and edges to be field welded.
.4 Faying surfaces of friction-type connections.
.5 Below grade surfaces in contact with soil.

.4 Apply paint under cover, on dry surfaces when surface and air temperatures are above 5˚ C.

.5 Maintain dry condition and 5˚C minimum temperature until paint is thoroughly dry.

.6 Strip paint from bolts, nuts, sharp edges and corners before prime coat is dry.

PART 3 EXECUTION

3.1 GENERAL

.1 Structural steel work: in accordance with CAN/CSA-S16.

.2 Welding: in accordance with CSA W59.

.3 Companies to be certified under Division 1 or 2.1 of CSA W47.1 for fusion welding of steel structures and/or CSA W55.3 for resistance welding of structural components.

3.2 CONNECTION TO EXISTING WORK

.1 Verify dimensions and condition of existing work, report discrepancies and potential problem areas to Owner's Representative for direction before commencing fabrication.

3.3 MARKING

.1 Mark materials in accordance with CAN/CSA G40.20/G40.21. Do not use die stamping. If steel is to be left in unpainted condition, place marking at locations not visible from exterior after erection.

.2 Match marking: shop mark bearing assemblies and splices for fit and match.

3.4 ERECTION

.1 Erect structural steel, as indicated and in accordance with CAN/CSA-S16 and in accordance with approved reviewed erection drawings.

.2 Field cutting or altering structural members: to approval of Owner's Representative.

.3 Clean with mechanical brush and touch up shop primer to bolts, rivets, welds and burned or scratched surfaces at completion of erection.

.4 Continuously seal members by continuous welds where indicated. Grind smooth.

3.5 FIELD PAINTING

.1 Paint in accordance with Section 09 91 23 – Interior Painting.

.1 Touch up damaged surfaces and surfaces without shop coat with primer to SSPC SP 7 except as specified otherwise. Apply in accordance with CAN/CGSB 85.10.

3.6 FIELD QUALITY CONTROL

.1 Inspection and testing of materials and workmanship will be carried out by an Inspection and Testing company designated by Owner's Representative.

.2 The Inspection and Testing Company will carry out vertical and horizontal alignment checks, torque testing and inspection of representative connection welds.

.3 Provide safe access and working areas for testing on site, as required by testing agency and as authorized by Owner's Representative.

.4 Submit test reports to Owner's Representative within 2 weeks of completion of inspection.

.5 Owner will pay costs of inspection and testing. Costs for any reinspection and/or re-testing as a result of deficient work will be paid for by the contractor, by credit change order

.6 Prior to inspection & testing by the Inspection and Testing company the structural steel erection contractor will carry out an inspection of the work and make the inspection results available to the Owner's Representative and the Inspection and Testing company. The inspection report will identify the areas of work inspected, deficiencies identified, and measures taken to correct the deficiencies.

.7 Test shear studs in accordance with CSA W59 (not applicable).

.8 Copies of test reports and inspections to be included in Commissioning Manual

END OF SECTION

EXPOSED STRUCTURAL FRAMING

Part 1 General

1.1 RELATED SECTIONS

.1 Section 05 50 00 – Metal Fabrications.
.2 Section 05 51 29 – Metal Stairs

1.2 REFERENCES

.1 CSA S157-17/S157.1-17 (R2022), Strength Design in Aluminum / Commentary on CSA S157-17, Strength Design in Aluminum to Register for.

.2 CSA W59-2024, Welded Steel Construction (Metal Arc Welding).

.3 CSA W59.2-18 (R2023), Welded Aluminum Construction.

.4 MPI #35, Bituminous Coating.

.5 Occupational Health and Safety Act, R.S.O. 1990, c. O.1 (2020).

1.3 QUALITY ASSURANCE

.1 Welding to only be undertaken by a company Certified by the Canadian Welding Bureau to the requirements of CSA Standard W59.2, Certification of Companies for the Fusion Welding of Aluminum.

1.4 SHOP DRAWINGS

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

.2 Indicate materials, thicknesses, weld symbols, reinforcement, details, accessories and grating panel layouts.

.3 Manufacturer to supply installation drawings and instructions.

.4 All submitted drawings to bear signature of a Professional Engineer registered in the Province of Ontario for all fabricated designed assemblies, components, and connections.

1.5 DESIGN CRITERIA

.1 Design aluminum and galvanized steel stair, balustrades and landing construction to Ontario Building Code vertical and horizontal live load requirements. Ladders and platforms to conform to latest Standards and Requirements of the Occupational Health and Safety Act.

Part 2 Products

2.1 MATERIALS

.1 Aluminum Extruded Shapes: to CSA S157/S157.1, Alloys 6061-T6 or better.

.2 Steel Sections to CAN/CSA-G40.20/G40.21, Grade 300W.

.3 Fasteners: to 304 stainless steel.

.4 Aluminum tread plate: to CSA S157/S157.1, Alloy 6061-T6.

.5 Aluminum welding wire: Alcan 403.

.6 Bituminous paint: to MPI #35.

2.2 FABRICATION

.1 Fabricate square, true and accurate to required size, with joints closely fitted. Remove all burrs and sharp edges.

.2 Provide 1.58 mm thick 80 durometer neoprene isolation pads for all aluminum in contact with concrete.

2.3 ACCESS FLOOR HATCH

.1 Hatches to be aluminum access floor hatch complete with slam lock or approved alternate. For size and location, refer to drawings.

.2 Covers: thickness per design, reinforced on underside to eliminate warpage, limit deflection to 1/150 of span. Design for a minimum live load of 7.2kPa.

.3 Angle frames: fabricate from stainless steel with a minimum thickness of 6.35 mm complete with welded 100 mm long SS strap anchors located at 250 mm on centres.

.4 Access Hatches: provide access hatch for interior application as noted on the drawings. Equip hatch with the following:
- .1 Recessed butt hinges.
- .2 90 degree Hold Open Arm.
- .3 Flush lift handle.
- .4 All 304 Stainless Steel hardware.
- .5 Perimeter sealing gasket.
- .6 Aluminum removable sealing plug and opening tool.
- .7 Automatic closer
- .8 Gas-spring assist cylinder.
- .9 Safety chain and pull up bars around opening when door leafs are in open position (alternative is temporary guards in floor sockets – see S3104).
- .10 Hatch centre bar (if applicable) shall be removeable to provide clear opening.

.5 Product: MSU Model CKD, aluminum, double door, 2150x2150 or approved equivalent.

2.4 ACCESS LADDER (INTERIOR) – HEADWORKS BUILDING

.1 Access ladder: Aluminum flat bar access ladder to OPSD 406.010, 406 mm standard width, with single safety cage. Brackets with stainless steel bolt-on-style (for Hilti-Hit kit). Provide CSA approved fall arrest mechanism on access ladder. Fall arrest system to consist of stainless steel safety Saf-T-Notch (slide) Rail, rung clamps, dismount extension, Saf-T-Grip Shuttle, and Saf-T-Climb Harness, as per Miller Saf-T-Climb c/w Safe-T-Grip units.

2.5 ACCESS LADDER (EXTERIOR) – AERATION (Not Applicable)

.1 Access ladder: Stainless steel access ladder, type 316, 406 mm standard width c/w stainless steel ladder brackets bolt-on-style (for Hilti-Hit kit). Provide CSA approved fall arrest mechanism on access ladder. Fall arrest system to consist of stainless steel safety Saf-T-Notch (slide) Rail, rung clamps, dismount extension, Saf-T-Grip Shuttle, and Saf-T-Climb Harness, as per Miller Saf-T-Climb c/w Safe-T-Grip units.

2.6 WALKWAYS, LANDINGS, STAIRS AND HANDRAILS (EXTERIOR)

.1 Fabricate walkways, intermediate landings, stairs and handrails including supports as detailed on the drawings and reviewed shop drawings, using aluminum or galvanized steel sections as specified.

.2 Secure supports to concrete walls and beams with 19 x 150 mm stainless steel adhesive anchors by Hilti.

.3 Grating: Borden type DA, size as per structural drawings, banded aluminum or galvanized steel grating. Provide manufacturers standard hold down clips and side connectors between adjacents panels of gratings.

.4 Stair treads: Borden Safety Steps, aluminum or galvanized steel grating, 38 x 4.8 serrated bearing bars cast abrasive nosing, minimum tread width is 278 mm.

.5 Handrails: 48 mm OD aluminum or galvanized sttel handrails, all welded construction. Provide posts at centres required to meet horizontal live loads. Construction to be fully welded and ground smooth design to applicable OBC standards. Refer to drawings.

.6 All aluminum handrails and guardrails to have clear anodized coating.

2.7 ISOLATION COATING

.1 Isolate aluminum from concrete, mortar or masonry and dissimilar metals with two coats of bituminous paint.

Part 3 Execution

3.1 INSTALLATION

.1 Erect metalwork square, plumb, straight and true, accurately fitted, with tight joints and intersections.

.2 Provide suitable means of anchorage acceptable to the Consultant. Anchorages to be stainless steel.

3.2 ACCESS HATCHES AND COVER PLATES

.1 Install access hatches as detailed and in accordance with reviewed show drawings.

.2 Adjust operable parts for correct function.

3.3 ACCESS LADDERS

.1 Install access ladders as noted and in accordance with reviewed shop drawings.

3.4 WALKWAYS, STAIRS AND HANDRAILS

.1 Install aluminum and galvanized steel handrails, guards, walkways and stairs as noted and in accordance with reviewed shop drawings. Minimum width of grating panel to be 600 mm.

.2 Bolt or weld handrail support brackets to structural sections and anchor posts to meet design criteria.

EXPOSED STRUCTURAL FRAMING

END OF SECTION

STEEL DECKING

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 20 –Waste Management and Disposal.

.3 Section 05 12 23 - Structural Steel for Buildings.

.4 Section 05 21 00 - Steel Joist Framing.

.5 Section 05 50 00 – Metal Fabrications.

.6 Section 07 92 00 – Joint Sealants.

.7 Section 09 91 00 - Painting.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)

- .1 CSA C22.2 No.79, Cellular Metal and Cellular Concrete Floor Raceways and Fittings.
- .2 CAN/CSA-S16, Design of Steel Structures.
- .3 CSA-S136, North American Specification for the Design of Cold Formed Steel Structural Members.
- .4 CSA W47.1, Certification of Companies for Fusion Welding of Steel Structures.
- .5 CSA W55.3, Certification for Companies for Resistance Welding of Steel and Aluminum.
- .6 CSA W59, Welded Steel Construction, (Metal Arc Welding) Metric.

.2 Canadian General Standards Board (CGSB)

- .1 CAN/CGSB-1.181, Ready-Mixed Organic Zinc-Rich Coating.

.3 American Society for Testing and Materials, (ASTM)

- .1 ASTM A653/A653M, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.4 Canadian Sheet Steel Building Institute (CSSBI)

- .1 CSSBI 10M, Standard for Steel Roof Deck.
- .2 CSSBI 12M, Standard for Composite Steel Deck.

STEEL DECKING

1.3 DESIGN REQUIREMENTS

.1 Design steel deck using limit states design in accordance with CSA S136 and CSSBI 10M and CSSBI 12M.

.2 Steel deck and connections to steel framing to carry dead, live and other loads including lateral loads, diaphragm action, composite deck action, and uplift as indicated.

.3 Deflection under specified live load not to exceed 1/240 of span, except that when gypsum board ceilings are hung directly from deck, live load deflection not to exceed 1/360 of span.

.4 Where vibration effects are to be controlled as indicated, dynamic characteristics of decking system to be designed to be in accordance with CAN/CSA-S16.

1.4 SHOP DRAWINGS

.1 Submit drawings stamped and signed by qualified professional Engineer registered or licensed in the Province of Ontario, Canada.

.2 Submit design calculations if requested by Owner's Representative.

.3 Indicate deck plan, profile, dimensions, base steel thickness, metallic coating designation, connections to supports and spacings, projections, openings, reinforcement details and accessories.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Galvanized coated steel sheet to ASTM A653/A653M structural quality Grade 275 (40 ksi), with Z275 coating. Use ZF75 coating for interior surfaces only if deck will be painted.

.2 Decks to be painted: zinc-iron alloy coated decks suitable for finish painting.

.3 Acoustic insulation: fibrous glass 17.5 kg/m^3 density profiled to suit deck flutes.

.4 Closures: as indicated in accordance with manufacturer's recommendations.

.5 Cover plates, cell closures and flashings: steel sheet with minimum base steel thickness of 0.76 mm. Metallic coating same as deck material.

.6 Primer: zinc rich, ready mix to CAN/CGSB-1.181.

.7 Caulking: to Section 07 92 00 – Joint Sealants.

.8 Painting: to Section 09 91 00 – Painting.

.9 Shear studs: to CSA W59.

2.2 TYPES OF DECKING

.1 Steel roof deck: 38mm, 0.91 mm minimum base steel thickness, non-cellular, Canam P3606 or consultant approved alternate. Refer to drawings.

.2 Composite steel floor deck: non-cellular, upright embossed fluted profile, interlocking side lap, base steel thickness, depth & profile as shown on the drawings. 38mm, Flat sheet for cellular deck, 0.76 mm minimum base steel thickness. Canam P3606 Composite or consultant approved alternate. Refer to drawings.

.3 Cellular roof deck for electrical raceway: to CSA C22.2No.79.

PART 3 EXECUTION

3.1 GENERAL

.1 Structural steel work: in accordance with CAN/CSA-S136 and CSSBI 10M and CSSBI 12M.

.2 Welding: in accordance with CSA W59, except where specified otherwise.

.3 Companies to be certified under Division 1 or 2.1 of CSA W47.1 for fusion welding of steel and/or CSA W55.3 for resistance welding.

3.2 ERECTION

.1 Erect steel deck as indicated and in accordance with CSA S136, CSSBI 10M and CSSBI 12M and in accordance with reviewed erection drawings.

.2 Lap ends: to 50 mm minimum.

.3 Fasten roof deck to the top flange of open web steel joists or beams with the Hilti HSN24 fastener where the top flange or chord thickness are between 1/8" - 3/8" (3-10mm). For top flanges equal to or thicker than 1/4" (6mm), use the Hilti X-ENP-19L15 fastener.

Sidelap connectors to connect steel deck units at overlaps: Use Hilti SLC 01.

The installer that will be using the tools to attach the deck fasteners shall be trained and certified by fastener manufacturer's representative on the general use of powder
actuated technology and fastening guidelines for the attachment of steel deck.

Locate fasteners so that clearances to edge of steel, end of decking panels, and the side of deck troughs meet fastener and deck manufacturers installation guidelines.

Ensure fastener head standoffs measurements meet fastener manufacturer's recommendations.

.4 Unless noted otherwise on structural drawings, minimum deck fastening shall be as follows:
- .1 Fasten deck to all supporting steel with fasteners through low ribs at maximum 300mm o.c. (4 per 900mm wide unit).
- .2 Fasten at Perimeter and over interior block walls with fasteners at maximum 150mm o.c.
- .3 Mechanically fasten side laps at maximum 300 o.c.
- .4 Fasten to intermediate steel between OWSJ with 2 fasteners.
- .5 If present, fasten to steelwork parallel to flutes with fasteners at maximum 300mm o.c.

.5 Place and support reinforcing steel as indicated.

3.3 CLOSURES

.1 Install closures in accordance with approved details.

3.4 OPENINGS AND AREAS OF CONCENTRATED LOADS

.1 No reinforcement required for openings cut in deck which are smaller than 150 mm square.

.2 Frame deck openings with any one dimension between 150 to 300 mm across flutes with 2 L50 x 50 x 6 extending 300 each side. Fasten deck to angles with Hilti HSN24 at 150mm o.c. Openings must be greater than 900mm o.c.

.3 For deck openings with any one dimension greater than 300 mm and for areas of concentrated load, reinforce in accordance with structural framing details, except as otherwise indicated.

3.5 CONNECTIONS

.1 Install connections in accordance with CSSBI recommendations as indicated on the drawings whichever is the most stringent.

3.6 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by steel decking installation.

END OF SECTION

STRUCTURAL METAL STUD FRAMING

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 07 27 00 - Air Barriers – Descriptive or Proprietary.

.3 Section 09 21 16 - Gypsum Board Assemblies.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.2 ASTM A653/A653 M- Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.3 ASTM A792/A792M- Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.

.2 Canadian Standards Association (CSA)

.1 CSA W55.3, Certification of Companies for Resistance Welding of Steel and Aluminum.

.2 CSA W59, Welded Steel Construction (Metal Arc Welding) (Metric Version).

.3 CAN/CSA S136, North American Specification for the Design of Cold-Formed Steel Structural Members.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.181-Ready-Mixed Organic Zinc-Rich Coating.

.4 Canadian Sheet Steel Building Institute (CSSBI)

.1 CSSBI 50M- Lightweight Steel Framing Binder.

.2 CSSBI S5, Guide Specification for Wind Bearing Steel Studs.

.3 CSSBI Fact Sheet #3, Care and Maintenance of Prefinished Sheet Steel Building Products.

.4 CSSBI Technical Bulletin Vol. 7, No. 2, Changing Standard Thicknesses for Canadian Lightweight Steel Framing Applications.

1.3 SUBMITTALS

.1 Submit P. Eng Ontario stamped shop drawing of all steel studs. Indicate design loads, member sizes, materials, design thickness exclusive of coatings, coating specifications, connection and bracing details, screw sizes and spacing, and anchors.

.2 Indicate locations, dimensions, openings and requirements of related work.

.3 Indicate welds by welding symbols as defined in CSA W59.

.4 Submit samples of framing components and fasteners to Owner's Representative.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Protect steel studs during transportation, site storage and installation in accordance with CSSBI Sheet Steel Facts #3.

.2 Handle and protect galvanized materials from damage to zinc coating.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Steel: to CSA S136, fabricated from ASTM A653/A653M, Grade 230 steel.

.2 Zinc coated steel sheet: quality to A653M, with Z275 designation zinc coating.

.3 Aluminum-zinc alloy coated steel sheet: to ASTM A792M, commercial quality, grade 37 with AZ180 coating, regular spangle surface, chemically treated for unpainted finish.

.4 Welding materials: to CSAW59 and certified by Canadian Welding Bureau.

.5 Screws: pan head, self-drilling, self-tapping sheet metal screws, corrosion protected to minimum requirements of CSSBI, (minimum coating thickness of 0.008 mm of zinc), length to suit application, but not less than 5.0 mm longer than twice the thickness of steel.

.6 Anchors: concrete expansion anchors or other suitable drilled type fasteners.

.7 Bolts, nuts, washers: hot dipped galvanized to ASTM A123/A123M, 600 g/m^2 zinc coating.

.8 Touch up primer to repair damaged or cut metallic coatings: zinc rich, to CAN/CGSB 1-GP-181.

2.2 STEEL STUD DESIGNATIONS

.1 Colour code steel studs in accordance with CSSBI Technical Bulletin Vol. 7, No.2.

2.3 METAL FRAMING

.1 Steel studs: to CSA S136, fabricated from zinc coated steel, depth as indicated. Minimum steel thickness of 1.52 mm.

.2 Stud tracks : fabricated from same material and finish as steel studs, depth to suit.

.1 Bottom track: single piece.

.2 Top track: single piece track **or** double track **or** slotted single top track. (double track or slotted single top track to accommodate deflection).

.3 Bridging: fabricated from same material and finish as studs, 38 x 12 x 1.22 mm minimum thickness.

.4 Angle clips: fabricated from same material and finish as studs, 38 x 38mm x depth of steel stud, 1.22 mm minimum thickness.

.5 Tension straps and accessories: as recommended by manufacturer.

2.4 SOURCE QUALITY CONTROL

.1 Prior to commencement of work, submit:

.1 Two certified copies of mill reports covering material properties.

PART 3 EXECUTION

3.1 GENERAL

.1 Do welding in accordance with CSA W59.

.2 Companies to be certified under Division 1 or 2.1 of CSA W47.1 for fusion welding of steel structures and/or CSA W55.3 for resistance welding of structural components.

.3 Do work in accordance with CSSBI S5.

3.2 ERECTION

.1 Erect components to requirements of reviewed shop drawings.

.2 Anchor tracks securely to structure at 800 mm oc maximum, unless lesser spacing prescribed on shop drawings.

.3 Erect studs plumb, aligned and securely attached with two screws minimum, or welded in accordance with manufacturer's recommendations.

.4 Seat studs into bottom tracks and top track. Gap between end of stud and web of track not to exceed 4.0 mm. Secure studs with two (2) screws minimum (in top and bottom tracks), or in accordance with manufacturer’s recommendations.

.5 Allow minimum deflection gap of 16.5 mm for double track **or** slotted single top track.

.6 Install studs at not more than 50.0 mm from abutting walls, openings, and each side of corners and terminations with dissimilar materials.

.7 Brace steel studs with horizontal internal bridging at 1200 mm maximum. Fasten bridging to steel clips fastened to steel studs with screws or by welding.

.8 Frame openings in stud walls to adequately carry loads by use of additional framing members and bracing as detailed on shop drawings.

.9 Touch up welds with coat of zinc rich primer.

3.3 ERECTION TOLERANCES

.1 Plumb: not to exceed 1/500th of member length.

.2 Camber: not to exceed 1/1000th of member length.

.3 Spacing: not more than 3.0 mm from design spacing.

.4 Gap between end of stud and track web: not more than 4.0 mm.

3.4 CUTOUTS

.1 Maximum size of cutouts for services as follows:

Member Depth	Across Member Depth	Along Member Length	Centre to Centre Spacing (mm)
92	40 max.	105 max.	600 min.
102	40 max.	105 max.	600 min.
152	65 max.	115 max.	600 min.

.2 Limit distance from centerline of last unreinforced cutout to end of member to less than 300 mm.

END OF SECTION

METAL FABRICATIONS

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 03 30 00 – Cast-in-Place Concrete.

.2 Section 05 12 23 – Structural Steel.

.3 Section 05 14 10 – Exposed Structural Framing

.4 Section 08 36 20 – Sectional Metal Overhead Doors.

.5 Section 09 91 00 – Painting.

1.2 REFERENCE STANDARDS

.1 American Society for Testing and Materials (ASTM).
- .1 ASTM A53/A53M-24, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
- .2 ASTM A307-21, Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength.

.2 Canadian Standards Association (CSA).
- .1 CSA G40.20-13/G40.21-13 (R2023). General Requirements for Rolled or Welded Structural Quality Steel / Structural Quality Steel.
- .2 CAN/CSA G164-18 (R2023), Hot Dip Galvanizing of Irregularly Shaped Articles.
- .3 CSA S16:24, Design and Construction of Steel Structures.
- .4 CSA W48:23, Filler Metals and Allied Materials for Metal Arc Welding.
- .5 CSA W59-2024, Welded Steel Construction (Metal Arc Welding).

.3 CISC/CPMA 2-75 a quick-drying Primer for Structural Steel.

1.3 SUBMITTALS

.1 Product Data:
- .1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit two copies of WHMIS SDS - Safety Data Sheets in accordance with Section 01 33 00 – Submittal Procedures. Indicate VOC's:
  - .1 For finishes, coatings, primers and paints.

.2 Shop Drawings
- .1 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.
- .3 The VOC content of paints and coatings used in the interior of the building envelope not to exceed 250 grams per litre (g/L) for flat finishes and 380 g/L for other finishes (low-luster, semi-gloss).
  - .1 Contractor to provide cut sheets, Safety Data Sheets, signed attestations or other official literature form manufacturers clearly identifying product emission rates. Documentation showing amount (in litres) of each material used should also be provided.
- .4 Shop drawings for all wall mounted ladders identified under this Section to be stamped by a professional engineer licensed in the Province of Ontario.

.3 Samples
.1 Submit samples in accordance with Section 01 33 00 – Submittal Procedures.
.2 Submit single samples of any type of supports, including but not limited to; shelf, bench, vanity, and desk supports for review and comment before fabrication.

1.4 QUALITY ASSURANCE

.1 Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.

.2 Certificates: Upon request, submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Packing, Shipping, Handling and Unloading: Deliver, store, handle and protect materials in accordance with good construction standard practices.

Part 2 Products

2.1 MATERIALS

.1 Steel sections and plates: to CSA G40.20/G40.21, Grade 300W.

.2 Steel pipe: to ASTM A53/A53M standard weight black finish.

.3 Welding materials: to CSA W59.

.4 Welding electrodes: to CSA W48 Series.

.5 Bolts and anchor bolts: to ASTM A307.

.6 Grout: non-shrink, non-metallic, flowable, 15 MPa at 24 hours.

2.2 FABRICATION

.1 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.

.2 Use self-tapping shake-proof flat headed screws on items requiring assembly by screws or as indicated.

.3 Where possible, fit and shop assemble work, ready for erection.

.4 Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush.

2.3 FINISHES

.1 Galvanizing: hot dipped galvanizing with zinc coating 600 g/m² to CAN/CSA-G164.

.2 Shop coat primer: to CISC/CPMA 2-75 quick drying primer, low VOC.

2.4 SHOP PAINTING

.1 Apply one shop coat of primer to metal items, with exception of galvanized or concrete encased items.

.2 Use primer unadulterated, as prepared by manufacturer. Paint on dry surfaces, free from rust, scale, grease. Do not paint when temperature is lower than 7 degrees C.

.3 Clean surfaces to be field welded; do not paint.

2.5 MISCELLANEOUS METAL FABRICATIONS

.1 Construct supports for all millwork items such as vanity supports, valence supports, shelf supports, bench supports, etc. as detailed.

.2 Provide all stairs and ladders where indicated.

Part 3 Execution

3.1 ERECTION

.1 Do welding work in accordance with CSA W59 unless specified otherwise.

.2 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.

.3 Provide suitable means of anchorage acceptable to the Departmental Representative such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.

.4 Exposed fastening devices to match finish and be compatible with material through which they pass.

.5 Provide components for building by other sections in accordance with shop drawings and schedule.

.6 Make field connections with bolts to CSA S16, or weld. Cut exposed bolts flush with nuts and grind to smooth even appearance before touching up with primer.

.7 Hand items over for casting into concrete or building into masonry to appropriate trades together with setting templates.

.8 Touch-up field welds, bolts and burnt or scratched surfaces after completion of erection with primer.

.9 Touch-up galvanized surfaces with zinc rich primer where burned by field welding.

3.2 MISCELLANEOUS FABRICATIONS

.1 Install millwork supports for items such as vanity supports, bench supports, valance supports and similar items from steel angle construction where indicated.

.2 Install stairs and ladders for items such as guardrails, railings, handrail brackets, bench supports, door sill supports and similar items from steel angle construction where indicated.

METAL FABRICATIONS

END OF SECTION

METAL STAIRS

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 29 83 – Payment Procedures for Testing Laboratory Services.

.2 Section 01 33 00 - Submittal Procedures.

.3 Section 05 12 23 – Structural Steel for Buildings.

.4 Section 05 14 10 – Exposed Structural Framing.

.5 Section 05 50 00 - Metal Fabrications.

.6 Section 09 91 13 - Exterior Painting.

.7 Section 09 91 23 - Interior Painting.

1.2 REFERENCES

.1 American National Standards Institute/National Association of Architectural Metal Manufacturers (ANSI/NAAMM)

.1 ANSI/NAAMM MBG531, Metal Bar Grating Manual.

.2 American Society for Testing and Materials,(ASTM)

.1 ASTM A53/A53M, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.

.2 ASTM A307, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.3 ASTM A325M, Specification for Structural Bolts, Steel, Heat Treated, 830 MPa Minimum Tensile Strength.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.40, Anti-corrosive Structural Steel Alkyd Primer.

.2 CAN/CGSB-1.181, Ready-Mixed Organic Zinc-Rich Coating.

.4 Canadian Standards Association (CSA)

.1 CAN/CSA-G40.20/G40.21, General Requirements for Rolled or welded Structural Quality Steel.

.2 CAN/CSA-G164, Hot Dip Galvanizing of Irregularly Shaped Articles.

.3 CSA W59,Welded Steel Construction (Metal Arc Welding/Imperial Version).

.5 National Association of Architectural Metal Manufactures (NAAMM)

.1 AMP 510, Metal Stair Manual.

.6 Steel Structures Painting Council (SSPC)

.1 Systems and Specifications Manual, Volume 2.

1.3 SYSTEM REQUIREMENTS

.1 Design metal stair, balustrade and landing construction and connections to NBC vertical and horizontal live load requirements.

.2 Detail and fabricate stairs to NAAMM Metal Stairs Manual.

1.4 SUBMITTAL PROCEDURES

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheet.

.2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets. Indicate VOC's:

.1 For finishes, coatings, primers and paints.

.2 Shop Drawings

.1 Indicate construction details, sizes of steel sections and thickness of steel sheet.

.2 Submit shop drawing bearing stamp of a qualified professional Engineer registered or licensed in the Province of Ontario.

1.5 QUALITY ASSURANCE

.1 Test Reports: Submit Certified test reports showing compliance with specified performance characteristics and physical properties.

.2 Certificates: Submit Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Steel sections: to CAN/CSA-G40.20/G40.21 Grade 300 W.

.2 Floor plate: to CAN/CSA-G40.20/G40.21, Grade 260 W.

.1 Thickness: 3 mm.

.3 Steel pipe: to ASTM A53/A53M, standard weight, schedule 40 seamless black or HSS (A500) as indicated on drawings.

.4 Steel tubing: to CAN/CSA-G40.20/G40.21, Grade 300W, square, wall thickness, sizes and dimensions as indicated.

.5 Steel bars to CAN/CSA-G40.21, 20 mm diameter.

.6 Welding materials: to CSA W59.

.7 Bolts: to ASTM A307.

.8 High strength bolts: to ASTM A325M.

2.2 FABRICATION

.1 Fabricate to NAAMM, Metal Stair Manual.

.2 Weld connections where possible, otherwise bolt connections. Countersink exposed fastenings, cut off bolts flush with nuts. Make exposed connections of same material, colour and finish as base material on which they occur.

.3 Accurately form connections with exposed faces flush; mitres and joints tight. Make risers of equal height.

.4 Grind or file exposed welds and steel sections smooth.

.5 Shop fabricate stairs in sections as large and complete as practicable.

.6 Refer to structural drawings for exterior stairs. All components hot dip galvanized.

2.3 STEEL PAN STAIRS

.1 Fabricate stairs with closed riser steel pan construction.

.2 Form treads and risers from 3 mm thick steel plate. Secure treads and risers to L 35 x 35 x 5 horizontal and vertical welded to stringers.

.3 Form wall stringers from C 310 x 31.

.4 Form outer stringers from C 310 x 31 with 5 mm thick plate fascia welded on.

.5 Form landings from 3 mm thick steel plate, reinforced by L 55 x 55 x 6 mm spaced at 400 mm on centre.

.6 Provide clip angles for fastening of furring channels, where applied finish is indicated for underside of stairs and landings.

.7 Extend stringers around mid landings to form steel base.

.8 Close ends of stringers where exposed.

2.4 PIPE/TUBING BALUSTRADES

.1 Construct balusters and handrails from steel pipe or steel tubing.

.2 Cap and weld exposed ends of balusters and handrails.

.3 Terminate at abutting wall with end flange.

2.5 BAR BALUSTRADES

.1 Reference typical details on design drawings.

2.6 FINISHES

.1 Shop coat primer: to CAN/CGSB-1.40.

2.7 SHOP PAINTING

.1 All steel components to be hot dipped galvanized. Exception is the exterior stair flight at the northwest corner of Headworks landing down to existing Aeration Tank (aluminum).

PART 3 EXECUTION

3.1 INSTALLATION OF STAIRS

.1 Install in accordance with NAAMM, Metal Stair Manual.

.2 Install plumb and true in exact locations, using welded connections wherever possible to provide rigid structure. Provide anchor bolts, bolts and plates for connecting stairs to structure.

.3 Hand items over for casting into concrete or building into masonry to appropriate trades together with setting templates.

.4 Do welding work in accordance with CSA W59 unless specified otherwise.

.5 Touch up shop primer to bolts, welds, and burned or scratched surfaces at completion of erection.

3.2 CLEANING

.1 Perform cleaning as soon as possible after installation to remove construction and accumulated environmental dirt.

.2 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

3.3 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by metal stairs and ladders installation.

METAL STAIRS

END OF SECTION

DIVISION 6 INDEX

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 07 52 00 – Modified Bituminous Membrane Roofing.

.2 Section 07 72 33 – Roof Hatches.

.3 Section 08 11 00 – Metal Doors and Frames.

.4 Section 09 22 16 – Non-Structural Metal Framing.

1.2 REFERENCE STANDARDS

.1 American Society for Testing and Materials International (ASTM).

.1 ASTM A153/A153M-23, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

.2 ASTM A653/A653M-23, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.3 ASTM D5456-24, Standard Specification for Evaluation of Structural Composite Lumber Products.

.4 ASTM D7032-21, Standard Specification For Establishing Performance Ratings For Wood-Plastic Composite Deck Boards And Guardrail Systems (Guards Or Handrails).

.5 ASTM E84-25, Standard Test Method for Surface Burning Characteristics of Building Materials.

.6 ASTM F593-24, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.

.7 ASTM F1667/F1667M-21a, Standard Specification for Driven Fasteners: Nails, Spikes, and Staples

.8 ASTM F2329/F2329M-15R23, Standard Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners.

.2 Canadian Standards Association (CSA International).

.1 CAN/CSA-Z809-16, Sustainable Forest Management (SFM).

.2 CAN/CSA-O80 Series-15(R2020), Wood Preservation, Includes Update No.1 (2017) and Update No. 2 (2019).

.3 CSA O112.9:21, Evaluation of Adhesives for Structural Wood Products (Exterior Exposure).

.4 CSA O121:17 (R2023), Douglas Fir Plywood.

.5 CSA O141-2023, Canadian Standard Lumber.

.6 CSA O151:17 (R2022), Canadian Softwood Plywood.

.7 CSA O325:21, Construction Sheathing.

.3 Forest Stewardship Council (FSC).

.1 FSC-STD-01-001 V5-2, FSC Principles and Criteria (P&C) for Forest Stewardship.

.4 National Research Council Canada (NRC).

.1 National Building Code of Canada 2020 (NBCC).

.5 National Lumber Grades Authority (NLGA GR).

.1 Standard Grading Rules for Canadian Lumber 2022.

.6 Underwriters Laboratories Canada (ULC).

.1 CAN/ULC S102, latest edition, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.7 American National Standards Institute (ANSI).

.1 ANSI A208.1-2022, Particleboard.

1.3 SUBMITTALS

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

.2 Sustainable Design

.1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

.2 Submit calculations on end-of-project recycling, salvaging, and landfill, demonstrating that 50 percent of construction wastes were recycled or salvaged.

.3 Regional Materials: submit evidence project incorporates required percentage 50 percent of regional materials and products, showing their distance from project to furthest site of extraction or manufacture for project.

.4 Submit evidence that:

.1 Engineered wood products contain specified percentage of recycled content.

.2 Recovered lumber sources or salvaged wood products.

.5 Submit vendor’s Chain-of-Custody Certificate number for CAN/CSA-Z809 or FSC certified wood.

.3 Low-Emitting Materials:

.1 Submit listing of adhesives and sealants used in building, showing compliance with VOC and chemical component limits or restriction requirements.

.2 Submit listing of composite wood products used in building, stating that they contain no added urea-formaldehyde resins, and laminating adhesives used in building, stating that they contain no urea-formaldehyde.

.3 Include SDS sheets indicating resin type for structural composite lumber and mineral-free materials.

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

.1 Provide manufacturers operating and maintenance manuals for each item comprising the complete door opening installation. Include the name, address, and contact information of the manufacturers providing the hardware and the nearest service representatives.

.2 Submit manufacturer's parts lists. Include servicing frequencies, instructions for adjustment and operation applicable to each type of component or hardware, and name, address and telephone number of nearest authorized service representative.

.3 Provide PDF file format for all documents. Provide separate files for each document.

1.4 QUALITY ASSURANCE

.1 Lumber by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.

.2 Plywood, particleboard, OSB, and wood based composite panels in accordance with CSA standards.

.3 Fire Retardant Treated Plywood by grade stamps in accordance with CAN/ULC-S102.

.4 Fire Retardant Treated Lumber: equipped with label and grade stamps in accordance with CAN/ULC-S102.

.5 Panel materials to be free of urea-formaldehyde substances.

.6 Lumber by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.

.7 Plywood, particleboard, OSB and wood based composite panels in accordance with CSA and ANSI standards.

1.5 DELIVERY, STORAGE, AND HANDLING

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

.2 Deliver materials in original packages, containers or bundles bearing manufacturers brand name and identification.

.3 Store materials inside, level, under cover. Keep dry. Protect from weather, other elements and damage from construction operations and other causes.

.4 Handle gypsum boards to prevent damage to edges, ends or surfaces. Protect metal accessories and trim from being bent or damaged.

.5 Protect gypsum board from nicks, scratches, and blemishes.

.6 Replace defective or damaged materials with new.

1.6 WASTE MANAGEMENT AND DISPOSAL

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

.2 Separate wood waste in accordance with the Waste Management Plan and place in designated areas in the following categories for recycling: Solid wood / softwood / hardwood, treated, painted, or contaminated wood, sheet materials, off-cuts.

.3 Separate metal, plastic, wood and corrugated cardboard packaging in accordance with the Waste Management Plan.

.4 Do not burn scrap at the project site.

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

Part 2 Products

2.1 MATERIALS

.1 Lumber: unless specified otherwise, softwood, S4S, moisture content 19% (S-dry) or less in accordance with following standards:

.1 CSA O141.

.2 NLGA Standard Grading Rules for Canadian Lumber.

.2 Furring, blocking, nailing strips, grounds and rough bucks:

.1 S2S is acceptable.

.2 Board sizes: "Standard" or better grade.

.3 Dimension sizes: "Standard" light framing or better grade.

.4 Post and timbers sizes: "Standard" or better grade.

.3 Douglas fir plywood (DFP): to CSA O121, standard construction, exterior grade and marine grade.

.4 Laminated Veneer Lumber: to ASTM D5456. Pressure bonded, lap jointed wood veneers with grain of veneers running parallel in the long direction. Waterproof phenol resorcinol resin adhesive. Cured under pressure and heat. Provide in single thickness lamination as detailed.

2.2 PANEL MATERIALS

.1 Plywood, OSB and wood based composite panels: to CSA O325.

.2 Douglas fir plywood (DFP): to CSA O121, standard construction.

.3 Canadian softwood plywood (CSP): to CSA O151, standard construction.

.4 No added urea-formaldehyde in panel materials.

2.3 WOOD PRESERVATIVE

.1 Pressure-preservative:

.1 Treat material to CAN/CSA-O80 using alkaline copper quaternary (ACQ) Type C or D.

.2 Materials: dried after treatment to moisture content of 19% or less.

.3 Identify each piece of treated material with tag or ink mark bearing Canadian Wood Preservers' Bureau quality mark.

.2 Pressure preservative treated materials as follows:

.1 Wood nailers, curbs, equipment support bases, blocking, stripping, and similar members related to roofing, flashing, vapour barriers, and waterproofing, except for wood that comes in direct contact with roofing membrane.

.2 Wood sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.

.3 Wood components indicated for garbage enclosure.

.4 Other material as indicated.

.3 Surface-applied wood preservative:

.1 Copper naphthenate or pentachlorophenol base water repellent preservative. Use clear for materials exposed in final assembly, coloured elsewhere.

.2 Maximum VOC Content: 350 g/L (less water)

2.4 FIRE-RETARDANT-TREATED MATERIALS

.1 General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article, that are acceptable to authorities having jurisdiction, and

with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

.2 Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with flame spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when test is extended additional 20 minutes, and with flame front not extending more than 3.2 m beyond centreline of burners at any time during test.

.1 Use treatment that does not promote corrosion of metal fasteners.

.3 Maximum VOC Content: 650 g/L (clear coatings); 350 g/L (pigmented coatings).

.4 Fire-retardant-treated plywood: 1220 x 2440 x 19mm sheet size used for backing at electrical and IT rooms, Douglas Fir plywood to CSA O121, standard construction. Treat plywood by pressure impregnation with fire-retardant chemicals in accordance with CSA O80.27. Following treatment, kiln-dry material to maximum moisture content of 15 percent. Surface Burning classification to CAN/ULC-S102. Flame Spread: 25 to ASTM E84. Each sheet of fire-retardant treated plywood to bear ULC label indicating classification.

2.5 ACCESSORIES

.1 General purpose adhesive: to CSA O112 Series. Maximum allowable VOC limit 30 g/L.

.2 Nails, spikes and staples: to ASTM F1667/F1667M.

.3 Bolts: 12.5 mm diameter unless indicated otherwise, complete with nuts and washers.

.4 Carriage Bolts: 10 mm UNC bolts, Grade 2, with 10 mm steel plate washer and hexagon nuts Grade 2 UNC.

.1 Finish: hot dipped galvanized, to ASTM A653/A653M.

.5 Proprietary fasteners: toggle bolts, expansion shields and lag bolts, screws and lead or inorganic fibre plugs, recommended for purpose by manufacturer.

.6 Explosive actuated fastening devices not permitted.

.7 Galvanizing: to CAN/CSA-G164, use Z275 Hot-Dipped Zinc coated galvanized fasteners for all work.

.8 Fasteners for Fire Retardant Treated Lumber and Plywood: Hot-Dipped zinc coated galvanized steel. Provide corrosion resistant fasteners as approved by lumber or plywood manufacturer. Minimum Hot Dip galvanized to ASTM A153/A153M. Hardware to ASTM A653/A653M, Class G185 galvanized.

.9 All fasteners must be designed and approved for use with ACQ/CCA Pressure-Treated Lumber

.10 Roof curbs and parapets assembly fasteners:

.1 Wood Construction: Construction screws #10 or greater carbon steel with duradize treating and approved for use with ACQ/CCA (Pressure-Treated) Lumber. Standard of Acceptance: T-Star plus Wafer Head HCR-X, 65mm Deep by SPAX or approved equivalent. Refer to drawings for location of spacings required.

.2 Concrete Deck Attachment: Construction screws #10 or greater carbon steel with duradize treating and approved for use with ACQ/CCA (Pressure-Treated) Lumber. Fasteners designed to securely anchor to the concrete deck approved for use with ACQ/CCA (Pressure-Treated) lumber. Pre-drill existing concrete deck subsurface as per fastener's manufacturers specifications. Standard of Acceptance: T-Star plus Wafer Head HCR-X, 65mm Deep by SPAX or approved equivalent. Refer to drawings for location of spacings required.

.3 Metal Deck: Construction screws #10 or greater carbon steel with duradize treating and approved for use with ACQ/CCA (Pressure-Treated) Lumber. Fasteners designed to securely anchor into the metal deck approved for use with ACQ/CCA (Pressure-Treated) lumber. Pre-drill existing metal deck subsurface as per fastener's manufacturers specifications. Standard of Acceptance: T-Star plus Wafer Head HCR-X, 65mm Deep by SPAX or approved equivalent. Refer to drawings for location of spacings required.

Part 3 Execution

3.1 PREPARATION

.1 Treat surfaces of material with wood preservative, before installation.

.2 Apply preservative by dipping, or by brush to completely saturate and maintain wet film on surface for minimum 3-minute soak on lumber and one-minute soak on plywood.

.3 Re-treat surfaces exposed by cutting, trimming or boring with liberal brush application of preservative before installation.

3.2 INSTALLATION

.1 Comply with requirements of OBC 2012 supplemented by following paragraphs.

.2 Install members true to line, levels and elevations, square and plumb.

.3 Construct continuous members from pieces of longest practical length.

.4 Install spanning members with "crown-edge" up.

.5 Select exposed framing for appearance. Install materials so that grade-marks and other defacing marks are concealed or are removed by sanding where materials are left exposed.

.6 Install furring and blocking as required to space-out and support casework, cabinets, electrical equipment mounting boards, and other work as required.

.7 Install rough bucks, nailers and linings to rough openings as required to provide backing for frames and other work.

.8 Install pressure treated timber with galvanized fasteners and bolts to ASTM A153/A153M, Class D, and ASTM F2329/F2329M.

.9 Use dust collectors and high-quality respirator masks when cutting or sanding wood panels.

3.3 ERECTION

.1 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.

.2 Countersink bolts where necessary to provide clearance for other work.

.3 Use nailing disks for soft sheathing as recommended by sheathing manufacturer.

3.4 SCHEDULE OF BLOCKING

.1 Provide blocking in stud framed walls for surface mounted equipment and accessories as specified below and as indicated. Refer to drawings for specific details relating to nailing strips and blocking to be provided in wall assemblies. Install blocking in Non-Structural Metal Framing and as described below:

.1 TYPE 1: continuous layer of 16 mm G1S DFP plywood, installed between studs, full height, secured through studs from both sides unless otherwise noted (u.o.n.).

.2 TYPE 2: continuous layer of 16 mm G1S DFP plywood, 1200 mm high (u.n.o.), installed between studs, secured through studs from both sides.

.3 TYPE 3: 38 mm x 235 mm SPF solid blocking, between studs, secured through web members from both ends, height as indicated on drawings.

.2 Washroom Accessories:

.1 Support for Grab bars: Type: 3. Refer to drawings for locations and mounting heights.

.2 Support for all other surface mounted washroom equipment or accessories: Type: 2. Refer to drawings for locations and mounting heights.

.3 Provide in all washroom where there are any surface mounted washroom equipment or accessories are indicated on drawings.

.4 Mirrors: support for surface mounted mirrors: Type: 1, 300 mm to 2100 mm AFF. Refer to drawings for locations.

.5 Hooks: refer to standard blocking types.

.6 Bulletin Boards / White Boards: refer to standard blocking types.

.3 Electrical Equipment: provide equipment backboards for all surface mounted electrical, telecommunication and security equipment. Provide layer of 19 mm thick G1S, fire retardant treated plywood. Extend layer of plywood from floor to ceiling or +/- 2440 mm AFF and install over top of the finished surface. In rooms with baseboards, extend plywood from baseboard to ceiling or +/- 2440 mm AFF. Extend plywood full width of the wall on which it occurs. Provide 19 x 38 mm strapping to support backboard from face of wall. Install strapping continuously around perimeter and at maximum 300 mm OCV intermediate. Refer to electrical drawings for locations.

.4 Mechanical Terminal Units: provide continuous layer of 16 mm thick GIS DFP installed behind the gypsum wallboard. Extend layer of plywood from floor to ceiling and install over top of the steel studs. Extend plywood full width of the wall on which it occurs. Refer to drawings for locations and mounting heights.

.5 At all New Parapet Locations: Provide 16 mm thick, pressure impregnated plywood along perimeter of roof as indicated on Drawings.

END OF SECTION

SHOP FABRICATED WOOD TRUSSES

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 01 61 00 – Common Product Requirements.

.3 Section 06 10 00 – Rough Carpentry.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CAN/CSA-O80 Series, Wood Preservation.
.2 CAN/CSA-O86.1, Engineering Design in Wood.
.3 CAN/CSA-O141, Softwood Lumber.
.4 CSA S307-, Load Test Procedure for Wood Roof Trusses for Houses and Small Buildings.
.5 CSA S347, Method of Test for Evaluation of Truss Plates Used in Lumber Joints.
.6 CSA W47.1, Certification of Companies for Fusion Welding of Steel.

.2 National Lumber Grades Authority (NLGA)

.1 NLGA, Standard Grading Rules for Canadian Lumber.

.3 Truss Plate Institute of Canada (TPIC)

.1 TPIC, Truss Design Procedures and Specifications for Light Metal Plate Connected Trusses (Limit States Design)

1.3 DESIGN REQUIREMENTS

.1 Design light metal plate connected wood trusses in accordance with TPIC truss design procedures for wood truss chords and webs in accordance with engineering properties in CSA O86.

.2 Design light metal plate connected wood trusses in accordance with TPIC truss design procedures for truss joint designs to test engineering properties in accordance with CSA S347 and listed in CCMC Registry of Product Evaluations.

.3 Design trusses, bracing and bridging in accordance with CAN/CSA-O86.1 for loads indicated and minimum uniform and minimum concentrated loadings stipulated in NBC commentary.

.4 Limit live load deflection to 1/360th of span where plaster gypsum board ceilings are hung directly from trusses.

.5 Limit live load deflections to 1/240th of span unless otherwise specified or indicated.

.6 Provide camber for trusses as indicated.

1.4 SOURCE QUALITY CONTROL

.1 Identify lumber by grade stamp of an agency certified by Canadian Lumber Standards Administration Board.

.2 Certify preservative and fire retardant treated wood in accordance with CAN/CSA-O80 Series.

1.5 QUALIFICATION OF MANUFACTURERS

.1 Fabricator for welded steel connections to be certified in accordance with CSA W47.1.

1.6 QUALITY ASSURANCE

.1 Provide Certificate of Quality Compliance from truss manufacturer upon completion of fabrication.

.2 Provide Certificate of Quality Compliance upon satisfactory completion of installation.

1.7 SUBMITTALS

.1 Each shop drawing submission shall bear signature and stamp of professional Engineer registered or licensed in Province of Ontario, Canada.

.2 Indicate TPIC Truss Design Procedure and CSA O86 Engineering Design in Wood and specific CCMC Product Registry number of the truss plates.

.3 Indicate species, sizes, and stress grades of lumber used as truss members. Show pitch, span, camber, configuration and spacing of trusses. Indicate connector types, thicknesses, sizes, locations and design value. Show bearing details. Indicate design load for members.

.4 Submit stress diagram or print-out of computer design indicating design load for truss members. Indicate allowable load and stress increase.

.5 Indicate arrangement of webs or other members to accommodate ducts and other specialties.

.6 Show lifting points for storage, handling and erection.

.7 Show location of lateral bracing for compression members.

SHOP FABRICATED WOOD TRUSSES

1.8 DELIVERY AND STORAGE

.1 Deliver, handle, store and protect materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Store trusses on job site in accordance with manufacturer's instructions. Provide bearing supports and bracings. Prevent bending, warping and overturning of trusses.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Lumber: Spruce (S-P-F) species, No. 1 grade, softwood, S4S, with maximum moisture content of 19% at time of fabrication and to following standards:

.1 CAN/CSA-O141.

.2 NLGA (National Lumber Grading Association), Standard Grading Rules for Canadian Lumber.

.2 Fastenings: to CAN/CSA-O86.1.

2.2 FABRICATION

.1 Fabricate wood trusses in accordance with reviewed shop drawings.

.2 Provide for design camber and roof slopes when positioning truss members.

.3 Connect members using metal connector plates.

PART 3 EXECUTION

3.1 ERECTION

.1 Erect wood trusses in accordance with reviewed erection drawings.

.2 Indicated lifting points to be used to hoist trusses into position.

.3 Make adequate provisions for handling and erection stresses.

.4 Exercise care to prevent out-of-plane bending of trusses.

.5 Install temporary horizontal and cross bracing to hold trusses plumb and in safe condition until permanent bracing and decking are installed.

.6 Install permanent bracing in accordance with reviewed shop drawings, prior to application of loads to trusses.

.7 Do not cut or remove any truss material without approval of Owner’s Representative.

.8 Remove chemical and other surface deposits on treated wood, in preparation for applied finishes.

3.2 CLEANING

.1 Remove surplus materials, excess materials, rubbish, tools and equipment on completion of installation.

END OF SECTION

DIVISION 07 THERMAL AND MOISTURE PROTECTION

PART 1 – GENERAL

1.1 Related Work

.1 Section 33 Site Works.
.2 Section 03 Cast-in-Place Concrete.
.3 Section 07 Board Insulation.

1.2 References

.1 Specification American Society for Testing and Materials (ASTM):
.1 ASTM D412-16R21, Standard Test Method for Vulcanized Rubber and Thermoplastic Elastomers – Tension.
.2 ASTM D570-22, Standard Test Method for Water Absorption of Plastics.
.3 ASTM D882-18, Standard Test Method for Tensile Properties of Thin Plastic Sheeting.
.4 ASTM D903-98R25, Standard Test Method for Peel or Stripping Strength of Adhesive Bonds
.5 ASTM D1876-08R15E01, Standard Test Method for Peel Resistance of Adhesives (T-Peel Test).
.6 ASTM D1970/D1970M-21, Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.
.7 ASTM D2243-20, Standard Test Method for Freeze-Thaw Resistance of Water-Borne Coatings.
.8 ASTM D5385-93R06, Standard Test Method for Hydrostatic Pressure Resistance of Waterproofing Membranes
.9 ASTM E84-25, Standard Test Method for Surface Burning Characteristics of Building Materials.
.10 ASTM E96-00e1, Standard Test Methods for Water Vapor Transmission of Materials.
.11 ASTM E154/E154M-08aR19, Standard Test Methods for Water Vapour Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.
.12 Canadian Construction Materials Centre (CCMC): CCMC 13297-R

1.3 Submittals

.1 Before commencing the Work, submit copies of manufacturers current certification to ISO 9000. Membrane, primers, sealants, adhesives and associated auxiliary materials to be included.

.2 Before commencing the Work, submit references clearly indicating that the materials proposed have been installed for not less than fifteen years on projects of similar scope and nature. Submit references for a minimum of ten projects.

.3 Before commencing the Work submit manufacturers complete set of standard details for waterproofing systems.

1.4 Quality Assurance

.1 Perform Work in accordance with the printed requirements of the membrane manufacturer and this specification. Advise designer of any discrepancies prior to commencement of the Work.

.2 Maintain one copy of manufacturers literature on site throughout the execution of the Work.

.3 At the beginning of the Work and always during the execution of the Work, allow access to site by the waterproofing membrane manufacturers representative.

.4 Materials used in this Section, including, primers, mastics and membranes, asphaltic protection boards, composite drainage boards and expansion joint membranes to be fully compatible and to be sourced and or produced by one manufacturer.

.5 Submit copies of the membrane manufacturers current ISO certification including the manufacturing of the membrane, primer, mastics, adhesives and asphaltic protection board.

1.5 Delivery, Storage and Handling

.1 Deliver materials to the job site in undamaged and original packaging indicating the name of the manufacturer and product.

.2 Cold applied elastomeric membrane should be stored in closed containers outdoors.

.3 Store membrane at temperature of 5 degrees C (40 degrees F) and above to facilitate handling.

.4 Membrane contain petroleum solvents and are flammable. Do not use near open flame.

.5 Store role materials horizontally in original packaging.

.6 Store adhesives and primers at temperatures of 5 degrees C and above to facilitate handling.

.7 Keep solvents away from open flame or excessive heat.

1.6 Co-ordination

.1 Ensure continuity of the waterproofing membrane throughout the scope of this section.

.2 Work to be so scheduled as to provide a watertight seal at the end of each working day on the areas worked upon during the day.

1.7 Site Conditions

.1 Environmental Requirements

.1 No installation work to be performed during rainy or inclement weather and on frost or wet covered surfaces.

.2 Protection

.1 Provide adequate protection of materials and work of this section from damage by weather backfilling operations and other causes.

.2 Protect work of other trades from damage resulting from work of this section. Make good such damage at own expense to satisfaction of the Engineer.

.3 Apply protection board as soon as possible after installation of membrane.

1.8 Membrane Manufacturer Qualification

.1 Manufacturer to demonstrate qualifications to supply materials of this section by certifying the following:

.1 Membrane Manufacturer must show evidence that the specified waterproofing materials has been manufactured by the same source for fifteen (15) years and successfully installed on a yearly basis for a minimum of fifteen (15) years on projects of similar scope and complexity.

1.9 Warranty

.1 For the Work of this Section, provide 5 year warranty period prescribed in General Conditions.

.2 Contractor hereby warrants the waterproofing membrane for leak coverage for two years.

.3 Waterproofing membrane manufacturer hereby warrants the waterproofing membrane for leak coverage because of faulty materials for a period of ten years. Scope of warranty to include materials required to return the membrane to a watertight condition.

2.0 Mock-Up

.1 Install Self-Adhering Sheet Waterproofing membrane to one area as a mock-up of erected example of work complete with specified materials and workmanship.

.2 Before commencing work, Manufacturer representative to examine and inspect the mock-up test area and report in writing to Engineer any conditions which would adversely affect the installations and / or warranties. In addition, submit letter to denote that the mock-up test area is acceptable prior to any further installations.
Any extra work required is not to be paid by owner. Commencement of the work to imply acceptance of the installation. Upon written approval from Manufacturer, work can proceed. Commencement of the work to imply acceptance of the installation.

2.1 Summary

.1 This Section includes requirements for supply and installation of the following, as required for complete and proper installation:
- .1 Adhesives/Primers.
- .2 Sheet Applied Waterproofing Membrane.
- .3 Termination Sealant.
- .4 Protection Board.
- .5 Drainage Board.
- .6 Insulation Adhesive.
- .7 Accessories.

PART 2 - PRODUCTS

2.1 MATERIALS MANUFACTURER

.1 Components and auxiliary materials must be obtained as a single source from the assembly manufacturer to ensure total system compatibility and integrity.

.2 Materials and accessories specified herein are manufactured by: Henry Company, 15 Wallsend Drive, Scarborough, Ontario, Canada, M1E 3X6
(800) 387 9598, www.ca.henry.com.

.3 "Mel-Rol Rolled, Self-Adhering Waterproofing Membrane system" by W.R. Meadows is an approved alternate on the proviso all materials meet or exceed "2.2 MATERIALS" listed including "Part 3, Execution.

2.2 MATERIALS

.1 Sheet Applied Waterproofing Membrane:

.1 Self-adhering waterproofing membrane consisting of SBS modified bitumen and a cross-laminated polyethylene film, having the following properties:

.1 Colour: Blue.
.2 Thickness: 1.5mm (60 mils).
.3 Water Vapour Transmission (ASTM E96): 1.14 ng/Pa.m^2.s., (0.02 perms).
.4 Peel Strength (ASTM D903): 1576N/m.
.5 Minimum Puncture Resistance – Membrane (ASTM E154): 222 N/m.
.6 Hydrostatic Head (ASTM D1876): 70m of Water.
.7 Moisture Absorption (ASTM D570): 0.1% Maximum.
.8 Tensile Strength (ASTM D412-modified): 2.24 MPa.
.9 Elongation (ASTM D412-modified): 300%.
.10 Basis of Design Product: Blueskin WP200 by Henry Company.

.2 Adhesives and Primers

.1 Adhesive for Self-Adhering Membranes (at temperatures above -12 deg C): Synthetic rubber based adhesive type, quick setting, having the following physical properties:

.1 Colour: Blue.
.2 Weight: 0.8 kg/l.
.3 Solids by weight: 35%.
.4 Drying time (initial set): 30 minutes.
.5 Application Temperature: between -12 deg C and 40 deg C.
.6 Basis of Design Product: Blueskin Adhesive by Henry Company.

.2 Warm Weather Application Adhesive for Self-Adhering Waterproofing Membranes (at temperatures above –4 deg C): Polymer emulsion based adhesive type, quick setting, low VOC content, having the following physical properties:

.1 Colour: Aqua.
.2 Weight: 1.0 kg/l.
.3 Solids (by weight): 58% (approx.)
.4 Water based, no solvent odours.
.5 Drying time (initial set): 30 minutes at 50% RH and 20 deg C.
.6 Application Temperature: between -4 deg C and 40 deg C.
.7 Basis of Design Product: Aquatac Primer by Henry Company.

.3 Cold Weather Application Adhesive for Self-Adhering Waterproofing Membranes (at temperatures above -12 deg C): Rubber-based adhesive, quick setting, having the following physical properties:

.1 Colour: Yellow.
.2 Weight: 0.8 kg/l.
.3 Solids by weight: 35%.
.4 Drying time (initial set): 30 minutes.
.5 Application Temperature: between -12 deg C and 25 deg C.
.6 Adhesive Application over Insulated Concrete Forms (ICF): Pass.
.7 Basis of Design Product: Blueskin Hi-Tac Adhesive by Henry Company.

.3 Mastics & Termination Sealants

.1 Insulation and Protection Board Adhesive: Synthetic rubber base compound having the following characteristics:

.1 Colour: Cream.
.2 Compatible with sheet applied waterproofing membrane, substrate and

insulation materials.
.3 Long term flexibility: Pass CGSB 71-GP-24M.
.4 Chemical resistance: Alkalis, mild acid and salt solutions.
.5 Application Temperature: between -12 deg C and 40 deg C.
.6 Basis of Design Products: 230-21 Insulation Adhesive by Henry Company.

.2 Termination and Joint Sealant: Polymer modified sealing compound having the following characteristics:
.1 Colour: Black.
.2 Compatible with sheet applied waterproofing membrane and substrate.
.3 Solids by volume: 70%.
.4 Vapour permeance: 2.9 ng/Pa.m².s, ASTM E96.
.5 Complies with CGSB 37.29.
.6 Remains flexible with ageing.
.7 Adheres to wet surfaces.
.8 Chemical resistance: Alkalis, calcium chloride, mild acid and salt solutions.
.9 Basis of Design Product: POLYBITUME 570-05 Polymer Modified Sealing Compound by Henry Company.

.4 Protection Board
.1 Extruded flexible twin wall board made of polypropylene copolymer and having the following physical properties:
.1 Thickness 2mm (80 mils)
.2 Tensile Strength Yield Point: 32 kg/cm²
.3 Tensile Strength Point of Failure: 242 kg/cm²
.4 Elongation: 167%
.5 Compression Strength (ASTM D695): 0.54 kg/cm²
.6 Impact Strength at 0 degrees C (32 degrees F): 8.9 kg/cm
.7 Basis of Design Product: 990-31 Polypropylene Protection Board by Henry Company.

.5 Drainage Boards
.1 Henry DB Drainage Composite two-part prefabricated geo-composite drain board consisting of a formed polystyrene core covered on one side with a woven or non-woven polypropylene filter fabric.
.1 Vertical Applications: Designed for vertical installations requiring a high compressive strength and moderate flow capacity:
.1 Basis of Design Product: Bakor DB 6000 by Henry Company.

.2 Horizontal Applications: Designed for demanding horizontal applications in plaza deck, split slab and horizontal flatwork and pavement construction:
.1 Basis of Design Product: Bakor DB 9000 by Henry Company.

.6 Auxiliary Materials
.1 Securement Bars (By Others): Continuous aluminum, stainless steel or galvanized metal, 3mm x 25mm x 25mm (1/8" x 1" x 1") in size and to be pre-drilled for non-corrosive screw attachment on a maximum of 200mm (8") centers.
.2 Insulation: Extruded Polystyrene rigid board as indicated in Section 07 21 13 Board Insulation.

PART 3: EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions:

.1 Examine substrates to receive work and surrounding adjacent surfaces for conditions affecting installation.
.2 Strike masonry joints flush. Concrete surfaces to be smooth and without large voids, spalled areas or sharp protrusions.
.3 New concrete should be cured for a minimum of 7 days after forms are removed. Structural lightweight concrete must be cured 14 days.
.4 Notify [engineer] [architect] [consultant] in writing of any discrepancies. Commencement of the work or any parts thereof to mean acceptance of the prepared substrate.

.2 Notify Contractor in writing of any conditions that are not acceptable.

.3 The installing contractor to examine and determine that surfaces and conditions are ready to accept the Work of this section in accordance with published literature. Commencement of Work or any parts thereof to mean installers acceptance of the substrate.

3.2 PREPARATION

.1 All surfaces must be sound, dry, clean and free of oil, grease, dirt, excess mortar or other contaminants.

.2 Provide adequate protection of materials and work of this section from damage by weather, backfilling operations and other causes.

.3 Protect adjacent surfaces and Work of other trades from damage resulting from Work of this section. Make good such damage at no additional cost to the Owner.
.1 Provide sound handling and installation procedures to prevent and protect against spillage and overspray of materials specified in this Section.

.4 Use appropriate waterproofing membrane adhesive as recommended by manufacturer based on air and surface temperature at time of application.

3.3 INSTALLATION

.1 Non-Moving Substrate Crack Treatment and Corner Treatment:
.1 Gaps up to 3mm (1/8”) wide:
.1 Sealant Method: Apply 1.5mm (60 mil) coating of termination and crack sealant, 50mm (2”) wide, centered on the gap and strike smooth. Allow to dry prior to application of sheet applied waterproofing membrane.
.2 Sheet Applied Method: Apply adhesive and allow to dry. Apply 150mm (6”) wide strip of sheet applied waterproofing membrane, centered over gap and roll in place. Provide 75mm (3”) end laps.

.2 Horizontal to Vertical Inside Corners: Pre-treated with termination and crack sealant, fillet extending 19mm (3/4”) vertically and horizontally from the corner. Apply a minimum 225mm (8-3/4”) strip of sheet applied waterproofing membrane centred at the joint and roll in place.
.3 Outside Corners: Apply adhesive and allow to dry. Apply a minimum 225mm (8-3/4”) strip of sheet applied waterproofing membrane centred at the joint and roll in place.
.4 Three or more planes come into contact, reinforce with cut sections of sheet applied waterproofing membrane as per manufacturer’s instructions.
.5 Projections: Extend sheet applied waterproofing membrane tight to projection and seal with termination and crack sealant extending 65mm (2-1/2”) along projection and 65mm (2-1/2”) onto sheet applied waterproofing membrane.
.6 Drains: Install sheet applied waterproofing membrane collar centred on drain and extend 150mm (6”) beyond flange onto substrate. Install sheet applied waterproofing membrane in full width centred over drain and apply clamping ring in

1.5mm (60 mil) bed of termination and crack sealant.

.2 Adhesive or Primer for Sheet Applied Waterproofing Membrane:
- .1 Apply adhesive or primer for sheet applied waterproofing membrane at rate recommended by manufacturer.
- .2 Apply adhesive or primer to all areas to receive sheet applied waterproofing membrane, as indicated on drawings by roller or spray and allow minimum thirty (30) minute open time. Surfaces not covered by sheet applied waterproofing membrane during the same working day must be re-applied.

.3 Sheet Applied Waterproofing Membrane – Vertical Application:
- .1 Align and position sheet applied waterproofing membrane, to prepared and primed substrate in lengths of 2400mm (8') or less.
- .2 Provide 65mm (2-1/2") laps at both sides and ends. Position for alignment and remove protective film.
- .3 Press firmly into place and promptly roll all laps to affect seal.
- .4 Overlap additional sheets in shingle fashion, staggering all vertical joints, and in accordance with manufacturer's recommendations.
- .5 Terminate sheet applied waterproofing membrane using termination sealant or termination bar, reglet or counter flashing as indicated. Refer to manufacturers standard details.
- .6 Seal all laps within 305mm (12") of a 90 degrees change in plane with termination sealant. Trowel apply a feathered edge to all horizontal termination sealant applications to allow shedding of water.

.4 Sheet Applied Waterproofing Membrane – Horizontal Application:
- .1 Apply 2 plies of sheet applied waterproofing membrane to prepared substrate in lengths of 2400mm (8') or less.
- .2 Provide 65mm (2-1/2") laps at both sides and ends. Position for alignment and remove protective film.
- .3 Press firmly into place. Promptly roll all laps to affect seal.
- .4 Overlap additional sheets in shingle fashion, staggering all vertical joints, and in accordance with manufacturer's recommendations.
- .5 Terminate sheet applied waterproofing membrane using termination sealant or termination bar, reglet or counter flashing as indicated. Refer to manufacturers standard details.
- .6 Seal all laps within 305mm (12") of a 90 degrees change in plane with termination sealant.

.5 Protection Board Installation:
- .1 Install protection board over the sheet applied waterproofing membrane to prevent damage from backfilling.
- .2 Apply protection board adhesive in 13mm (1/2") wide strips spaced at 457mm (18") o/c to sheet applied waterproofing membrane.
- .3 Immediately embed protection board and press into adhesive to ensure full contact.
- .4 Backfill once protection board adhesive has fully cured.

.6 Drainage Board Installation:
- .1 Attach drainage board to surface using adhesive. Permanent fixing is achieved once backfilling operation is complete.
- .2 Vertical Application: Place drainboard with fabric side outwards.
  - .1 Start at the top or bottom of the wall. Drain board may be applied horizontally or vertically.
  - .2 When installed horizontally, position edge of core with flange at the top. When installed vertically, align edge with flange at the upstream edge.
  - .3 Bottom panel should be placed behind the discharge pipe.

.3 Horizontal Application: Place drainboard with fabric side up.
.1 Start installation at lowest point to ensure positive drainage. Position edge of core with flange at the higher edge of the substrate, away from drains.

.4 Overlaps: Pull back loose fabric to expose core. Position core of second panel over the overlap flange of first level.
.1 Overlap in direction of water flow and adhere the overlapped fabric with adhesive to prevent soils and/or concrete from entering core.

.5 Corners: Bend drainage board for inside corners. Cut drainage board to reach corner, providing 100mm (4”) of extra fabric to wrap around corner. Overlap fabric at joint.

.7 Insulation Installation:
.1 Co-ordinate with Section 07 21 13 Board Insulation for insulating materials.
.2 Adhesive:
.1 Apply the insulation adhesive in a serpentine pattern to sheet applied waterproofing membrane.
.2 Immediately embed insulation into the adhesive and press firmly into place to ensure full contact. Apply additional adhesive if allowed to skin over.
.3 Fully butter all joints of insulation panels with adhesive during installation, except at expansion joints.
.4 Stagger the end joints of the insulation.
.5 Cut the insulation to fit closely to all protrusions and obstructions.

.3 Insulation Clips:
.1 Mechanically fasten insulation clips to the sheet applied waterproofing membrane with adhesive recommended by insulation clip manufacturer.
.2 Apply number of insulation clips as recommended by insulation manufacturer, in locations indicated in their written documentation.

3.4 FIELD QUALITY CONTROL

.1 Final Observation and Verification:
.1 Final inspection of sheet applied waterproofing membrane to be carried out by the Owner’s representative, and the contractor.
.2 Contact Manufacturer for warranty issuance requirements.

.2 Sheet applied waterproofing membrane is not designed for permanent UV exposure. Apply insulation and protection board as soon as possible after installation of sheet applied waterproofing membrane. Refer to manufacturer published literature for product limitations.

3.5 CLEANING AND PROTECTION

.1 Progress Cleaning: Leave work area clean at the end of each work day, ensuring safe movement of passing pedestrians.

.2 Waste Management: Co-ordinate recycling of waste materials and packaging at appropriate facility, diverting waste from landfill. Certified installer to be responsible for ensuring waste management efforts are practiced.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Polyisocyanurate insulation.

.2 Polystyrene insulation.

.2 Related Sections:

.1 Section 07 21 19 - Foamed-In-Place Insulation.

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM).

.1 ASTM C1289-22, Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.

.2 Canadian Gas Association (CGA).

.1 CSA B149.1:20, Natural Gas and Propane Installation Code.

.2 CSA B149.2:20, Propane Storage and Handling Code.

.3 Underwriters Laboratories of Canada (ULC).

.1 CAN/ULC-S604:2016, Standard for Factory-Built Type A Chimneys.

.2 CAN/ULC-S701.1:2017, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Coverings.

.3 CAN/ULC-S704-11, Standard for Thermal Insulation, Polyurethane and Polyisocyanurate, Board, Faced – Third Edition.

.4 CAN/ULC-S770-15, Standard Test Method for Determination of Long-Term Thermal Resistance of Closed-Cell Thermal Insulating Foams.

.4 Underwriters Laboratories (UL).

.1 UL 263-20, Fire Tests of Building Construction and Materials.

.2 UL 2762, Adhesives, latest edition.

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Convene pre-installation meeting one week before beginning work of this Section and on-site installations.

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Co-ordinate with other building subtrades.

.4 Review manufacturer's installation instructions and warranty requirements.

1.4 SUBMITTALS

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

.2 Action Submittals:

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheet for each product listed in Part 2.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Protect building materials from damage by:

.1 Fully covering stored materials.

.2 Elevating stored materials off ground.

.3 Disposing of materials with evidence of moisture damage.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Remove from site and dispose of packaging materials at appropriate recycling facilities in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 FOAM BOARD INSULATION

.1 **Type A** - Extruded polystyrene Rigid Insulation (Above Grade): Type 1, Class 1 to CAN/ULC-S704; closed cell, compressive strength 110 kPa, thickness indicated per drawings, RSI 1.14 per 25 mm thickness, butt edges.

.1 Location: where indicated on drawings.

.2 Acceptable products Thermax Sheathing by Dow Building Products, EnergyShield as manufactured by Altas Roofing, Formular codeboard by Owens Corning.

.2 **Type B** - Extruded Polystyrene (Below Grade): Type 4 to CAN/ULC-S701.1, thickness as indicated.

.1 Location: vertical applications at perimeter foundations.

.2 Minimum compressive strength: 40 psi.

.3 Thermal resistance: RSI 0.87 with 90% lifetime limited warranty.

.4 Blowing agent formulation: Zero ozone depleting.

.5 Edge condition: shiplapped edges.

.6 Surface burning characteristics: flame spread less than 25, smoke developed classification less than 450, certified by third party.

.7 Indoor air quality: Compliance certified by Greenguard Indoor Air Quality Certified.

.8 Recycled content: Minimum 20%, certified by third party.

.9 Panel size: to suit location and application.

.10 Acceptable products: Dow Styrofoam SM, Owens Corning Celfort 300.

.11 Horizontal below slab applications: DOW HI-40, Formular C-300 by Owens Corning.

.12 Between self adhered waterproofing membrane and protection board for below grade applications: DOW HI-40, Formular C-300 by Owens Corning.

2.2 ADHESIVE

.1 Adhesive for Bonding Insulation: to UL 2762.

.1 Type 1: flexible synthetic rubber base, solvent type, suitable for bead application by caulking gun, fungi resistant, application temperature -12C to 50C

.2 Compatible with insulation, and substrate.

2.3 ACCESSORIES

.1 Fasteners: Manufacturer's recommended corrosion protected, self-drilling screws for metal stud framing.

.2 Insulation Washers: 45 mm diameter tapered plate plastic washer, with flat bottom for flush mounting.

.3 Spray Foam Sealant: General purpose material to Section 07 21 19 - Foamed in Place Insulation.

.4 Z-bars: 0.72 mm hot dip galvanized sheet steel for structural attachment to building frame.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 EXAMINATION

.1 Examine substrates and immediately inform Consultant in writing of defects.

.2 Before commencement of work ensure:

.1 Substrates are firm, straight, smooth, dry, free of snow, ice or frost, and clean of dust and debris.

3.3 INSTALLATION – GENERAL

.1 Install insulation after building substrate materials are dry.

.2 Install insulation to maintain continuity of thermal protection to building elements and spaces.

.3 Fit insulation tight around electrical boxes, plumbing and heating pipes and ducts, around exterior doors and windows and other protrusions.

.4 Keep combustible insulation minimum 75 mm from heat emitting devices such as recessed light fixtures, and minimum 50 mm from sidewalls of CAN/ULC-S604 type A chimneys and CAN/CSA B149.1 and CAN/CSA B149.2 type B and L vents.

.5 Cut and trim insulation neatly to fit spaces.

.6 Use only insulation boards free from chipped or broken edges.

.7 Use largest possible dimensions to reduce number of joints.

.8 Fasten insulation in place using type of fastener applicable to substrate.

.1 Follow manufacturers written installation instructions for minimum fasteners per insulation board.

.9 Leave insulation board joints unbonded over line of expansion and control joints.

.1 Bond continuous 150 mm wide 0.15 mm polyethylene strip over expansion and control joints using compatible adhesive before application of insulation.

.10 Butt insulation tightly together at side joints and end laps and fill voids entirely with general purpose spray-foam sealant to provide complete thermal barrier.

.1 Offset vertical joints.

.2 Offset both vertical and horizontal joints in multiple layer applications.

3.4 PERIMETER FOUNDATION INSTALLATION

.1 Exterior application:

.1 Install on exterior face of perimeter foundation with adhesive, and clips and fasteners in insulation joints in accordance with manufacturer's written instructions.

.2 Apply continuous 6 mm beads of adhesive at 150 mm on centre in a horizontal serpentine pattern full width of board, and at top and bottom edges.

.1 Apply adhesive fully around protrusions.

3.5 CLEANING

.1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Mineral wool insulation blankets.

.2 Related Requirements:

.1 Section 09 21 16 - Gypsum Board Assemblies.

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM).

.1 ASTM C665-24, Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

.2 ASTM C1320-20, Standard Practice for Installation of Mineral Fiber Batt and Blanket Thermal Insulation for Light Frame Construction.

.3 ASTM E84-25, Standard Test Method for Surface Burning Characteristics of Building Materials.

.2 Canadian Gas Association (CGA).

.1 CSA B149.1:20, Natural Gas and Propane Installation Code.

.2 CSA B149.2:20, Propane Storage and Handling Code.

.3 Underwriters Laboratories of Canada (ULC).

.1 CAN/ULC-S604:2016, Standard for Factory-Built Type A Chimneys.

.1 CAN/ULC-S702.1:2021, Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification First Amendment to Third Edition.

1.3 SUBMITTALS

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

.2 Action Submittals:

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheets.

Part 2 Products

2.1 INSULATION

.1 Batt and blanket mineral fibre: to ASTM C665, CAN/ULC-S702.1.

.1 Type: 1.

.2 Flame Spread: maximum 0, to ASTM E84.

.3 Smoke Development: maximum 0, to ASTM E84.

.4 Wall tthickness: full depth of stud cavity, except as indicated.

.5 Roof thickness: As indicated on Drawings.

.6 Standard of Acceptance: Rockwool Comfortbatt insulation.

.2 Parapet Insulation: Rockwool Cavityrock, thickness to match stud depth.

.3 Firestopping Insulation in Steel Deck Flutes: Rockwool Safing insulation, compatible with approved / listed top of wall detail.

.4 Sound Proofing Insulation: Rockwool Safe'n Sound insulation.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 INSULATION INSTALLATION

.1 Install insulation to maintain continuity of thermal protection to building elements and spaces and to ASTM C1320.

.2 Fit insulation closely around electrical boxes, pipes, ducts, frames and other objects in or passing through insulation.

.3 Do not compress insulation to fit into spaces.

.4 Keep insulation minimum 75 mm from heat emitting devices such as recessed light fixtures, and minimum 50 mm from sidewalls of CAN/ULC-S604 Type A chimneys and CSA B149.1 and CAN/CSA B149.2 Type B and L vents.

.5 Do not enclose insulation until it has been inspected and approved by Engineer.

.6 Refer to wall assembly for locations of Rockwool within stud spacings.

3.3 CLEANING

.1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Foamed-in-place insulation.

.2 Foamed-in-place sealant.

.2 Related Requirements:

.1 Section 07 21 13 - Board Insulation.

.2 Section 08 11 00 - Metal Doors and Frames.

.3 Section 08 51 13 - Aluminum Windows.

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM).

.1 ASTM E96-00e1, Standard Test Methods for Water Vapor Transmission of Materials.

.2 Underwriters' Laboratories of Canada (ULC).

.1 CAN/ULC-S101-14-EN, Standard Methods of Fire Endurance Tests of Building Construction and Materials.

.2 CAN/ULC-S102:2018, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.3 CAN/ULC-S710.1-11 (R2018), Standard For Thermal Insulation – Bead-Applied One Component Polyurethane Air Sealant Foam, Part 1: Material Specification.

.4 CAN/ULC-S705.1-15, Standard for Thermal Insulation – Spray Applied Rigid Polyurethane Foam, Medium Density, Material Specifications, Includes Amendments 1, 2.

.5 CAN/ULC-S705.2:2020, Standard for Thermal Insulation – Spray Applied Rigid Polyurethane Foam, Medium Density – Application.

1.3 SUBMITTALS

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

.2 Action Submittals:

.1 Product Data: Submit manufacturer's printed product literature, specifications and datasheet for each product indicated.

.3 Informational Submittals:

.1 Compatibility: Submit letter, provided and signed by manufacturer of insulation material, indicating products used on the project are compatible with adjacent materials, and materials with which the insulation will be in contact or sealed.

.2 Manufacturer's Instructions: Submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.

1.4 AMBIENT CONDITIONS

.1 Apply foamed-in-place sealants only when substrate and ambient temperatures are within prescribed limits.

.2 Ensure temperature is maintained throughout curing period.

Part 2 Products

2.1 MATERIALS

.1 Use of insulation products manufactured with CFCs as blowing agents is prohibited.

.2 Spray Foam Insulation: to CAN/ULC-S705.1, closed cell, spray applied rigid cellular polyurethane foam air barrier and thermal insulation, medium 29 kg/cu m density.

.1 Performance criteria:

.1 Fire Performance: less than 500 flame spread, less than 500 smoke developed to CAN/ULC-S102.

.2 Water vapour permeance: 42ng/Pa-s-sq m to ASTM E96.

.3 Long term thermal resistance: RSI 1.95 at 50 mm thickness.

.2 Standard of Acceptance: BASF Walltite ECO v2, CertainTeed CertaSpray Closed Cell Foam, Icynene MD-C-200 CDN, Johns Manville JM Corbond III, Heatlok Soya / Polaform Soya by Demilec Soya is an approved alternate.

.3 Locations: Around protrusions and penetrations through air seal, and other locations indicated.

.3 Spray Foam Sealant – General Purpose: one-component, semi-rigid polyurethane sealant, to CAN/ULC-710.1, 16 to 24 kg/m^3, minimum RSI 0.67 per 25 mm thickness:

.1 Standard of Acceptance: Great Stuff Pro Gaps and Cracks Insulating Foam Sealant by Dow Chemical, or comparable product by, but not limited to, RHH Foam Systems Inc., Handi-Foam, Tiger Foam Insulation, and Hilti.

.2 Locations: gaps and cracks up to 75 mm in size.

.4 Spray Foam Sealant – Low Pressure: one-component, semi-flexible polyurethane sealant, to CAN/ULC-S710.1, 27 kg/m^3:

.1 Standard of Acceptance: Great Stuff Pro Window and Door Insulating Foam Sealant by Dow Chemical, or comparable product by, but not limited to, RHH Foam Systems Inc., Handi-Foam, Tiger Foam Insulation, and Hilti.

.2 Locations: gaps and cracks adjacent to door, window and curtain wall framing.

.5 Cementitious Thermal Barrier: ULC rated fire protective coating specially formulated for application over cured polyurethane foam insulation, forming a hard, durable, humidity resistant monolithic surface, minimum 350 kg/m^3 dry density, minimum 23.9 kN/m^2 bond strength, surface burning characteristics 10 flame spread, 0 smoke developed.

.1 Standard of Acceptance: Grace Construction Products Monokote Type Z3306.

.6 Sprayed fire resistive material – ULC Design No. F818: A/D type FP asbestos free blend of mineral wool and Portland cement to CAN/ULC-S101 by AD Fire Protection Systems.

Part 3 Execution

3.1 PREPARATION

.1 Clean surfaces which are to receive insulation, of dirt, dust, grease, loose material or other foreign matter which may inhibit adhesion.

.2 Provide adequate ventilation during and until insulation has cured, to ensure safe working conditions. Introduce fresh air and exhaust air continuously during the 24 hour period after application to maintain non-toxic, unpolluted, safe working conditions.

.3 Temporarily brace door frames as may be required to prevent possible bowing of frames due to over expansion of the foamed-in-place insulation.

.4 Examine substrate surfaces for conditions ready to accept Work.

.5 Report unsatisfactory conditions in writing.

.1 Proceed with Work once unsatisfactory conditions are corrected.

.2 Start of Work implies acceptance of conditions.

.6 Hangers, clips or other mechanical and electrical attachments to be in place before fire proofing application.

3.2 PROTECTION

.1 Provide temporary enclosures to prevent spray and noxious vapour from contaminating air beyond application area.

.2 Protect workers in accordance with manufacturer’s written instructions.

.3 Protect adjacent surfaces and equipment from damage by over spray, fall-out, and dusting of insulation materials.

.4 Dispose of waste foam daily and decontaminate empty drums in accordance with foam manufacturer's instructions.

3.3 INSTALLATION, GENERAL

.1 Where spray-foam insulation or sealant is used to maintain continuity of thermal barrier and is installed in conjunction with membrane air seal / vapour barrier around frames including metal and aluminum frames or protrusions, ensure that foamed-in-place insulation is installed on exterior side of membrane air seal / vapour barrier.

.2 Finished surface: free of voids and imbedded objects.

.3 Apply materials in accordance with manufacturer’s written instructions.

.4 Apply primer when required to properly prepared substrates for special conditions required by foam insulation manufacturer’s requirements.

3.4 INSTALLATION AROUND PROTRUSIONS THROUGH AIR SEAL

.1 Apply by spray method to uniform monolithic density without voids.

.2 Install spray-foam insulation around protrusions including mechanical and electrical protrusions, electrical chases, exhaust systems, heating and cooling ducts, sole plates, top plates, wall sections, and elsewhere as required to achieve and maintain continuity of thermal barrier around such protrusions.

.3 Conduct daily visual inspection, adhesion testing and density measurements as required by CAN/ULC-S705.2 and manufacturer’s application guidelines.

.4 Spray apply cementitious thermal barrier coating over foam insulation to minimum 21 mm thickness where foam insulation exposed to building interior.

3.5 INSTALLATION AROUND CURTAIN WALL AND ENTRANCE FRAMING

.1 Install spray foam sealant around curtain wall frames, and entrance frames to maintain continuity of thermal barrier, after air/vapour barrier has been installed and sealed to framing as specified in Sections 08 11 00 and 08 51 13.

.2 Ensure that spray foam sealant completely fills spaces, without voids, and that foam is continuous at corners.

.3 Provide thermal barrier to interior spaces as indicated and required by OBC 2012.

3.6 CLEAN-UP

.1 Remove masking materials and overspray from adjacent areas immediately after foam surface has hardened.

.2 Repair damaged areas in accordance with manufacturer’s instructions.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 06 17 53 – Shop-Fabricated Wood Trusses.

.2 Section 07 26 13 – Above-Grade Vapour Retarders.

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM).

.1 ASTM C518-21, Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

.2 ASTM C665-24, Standard Specification for Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

.3 ASTM C764-19, Standard Specification for Mineral Fiber Loose-Fill Thermal Insulation.

.4 ASTM C1015-17, Standard Practice for Installation of Cellulosic and Mineral Fiber Loose-Fill Thermal Insulation.

.5 ASTM E84-25, Standard Test Method for Surface Burning Characteristics of Building Materials.

.6 ASTM E136-24c, Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750°C.

.2 Underwriters Laboratories Canada (ULC).

.1 CAN/ULC-S102:2018, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.2 CAN/ULC-S114:2018, Standard Method of Test for Determination of Non-Combustibility in Building Materials.

.3 CAN/ULC-S702.1:2014-AMD1, Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification First Amendment to Third Edition.

.3 Canadian Construction Materials Centre (CCMC).

.1 CCMC Evaluation Listing No. 13141-L.

1.3 SUBMITTALS

.1 Product data for the following:
.1 Loose-fill insulation.

.2 Sustainable Design:
.1 Product Data: For recycled content, indicating postconsumer and preconsumer recycled content.

.3 Installer's Certification: List type, manufacturer, and R-value of insulation installed in each element of the building thermal envelope.
.1 For blown-in fiberglass loose-fill insulation, indicate initial installed thickness, settled thickness, settled R-value, installed density, and coverage area.
.2 Sign, date, and post the certification in a conspicuous location on Project site.

.4 Product Test Reports: submit tests performed by a qualified testing agency.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

.2 Protect insulation as follows:
- .1 Do not expose to sunlight for an extended period except for during installation and concealment.
- .2 Always protect against ignition. Do not deliver materials to Project site until just before installation time.
- .3 Quickly complete installation of insulation in each area of construction.

Part 2 Products

2.1 LOOSE-FILL INSULATION

.1 Insulation to meet requirements of CAN/ULC-S702.1.

.2 Recycled Content: submit confirmation of postconsumer recycled content.

.3 Glass-Fiber Loose-Fill Insulation to ASTM C764, Type I for pneumatic application.
- .1 Basis-of-Design Product: Subject to compliance with requirements, provide CertainTeed Corporation; InsulSafe XC fibreglass blowing insulation or comparable product by one of the following:
  - .1 Johns Manville;
  - .2 Owens Corning.
- .2 Flame-Spread Index: Not more than 0 when tested in accordance with CAN/ULC-S102.
- .3 Smoke-Developed Index: Not more than 5 when tested in accordance with CAN/ULC-S102.

2.2 ACCESSORIES

.1 Insulation for Miscellaneous Voids:
- .1 Glass-Fiber Insulation to ASTM C764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E84.
- .2 Spray Polyurethane Foam Insulation to ASTM C1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84.

.2 Eave Ventilation Troughs: Preformed, rigid fiberboard or plastic sheets designed and sized to fit between roof framing members and to provide ventilation between insulated attic spaces and vented eaves.

Part 3 Execution

3.1 PREPARATION

.1 Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapour retarders.

3.2 INSTALLATION, GENERAL

.1 Comply with insulation manufacturer's written instructions applicable to products and applications.

.2 Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

.3 Install insulation with manufacturer's R-value label exposed after insulation is installed.

.4 Extend insulation to envelop entire area to be insulated. Fill all voids with insulation. Remove projections that interfere with placement.

.5 Apply single layer of insulation to make up total thickness or to achieve specified R-value.

3.3 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

.1 Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
- .1 Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 40 kg/cu. m.
- .2 Spray Polyurethane Insulation: Apply in accordance with manufacturer's written instructions.

.2 Loose-Fill Insulation: Apply in accordance with ASTM C1015 and manufacturer's written instructions.
- .1 Level horizontal applications to uniform thickness as indicated, lightly settle to uniform density, but do not compact excessively.

3.4 PROTECTION

.1 Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

.2 Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Sheet vapour retarder under slab-on-grade.

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM).

.1 ASTM D882-18, Standard Test Method for Tensile Properties of Thin Plastic Sheeting.

.2 ASTM D1709-24, Standard Test Methods for Impact Resistance of Plastic Film by the Free-Falling Dart Method.

.3 ASTM E96-00e1, Standard Test Methods for Water Vapor Transmission of Materials.

.4 ASTM E154/E154M-08aR19, Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.

.5 ASTM E1643-24, Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.

.6 ASTM E1745-17R23, Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.

1.3 SUBMITTALS

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

.2 Product Data: Include product data on sheet vapour retarder and joint tape specified, including data substantiating that materials comply with specified requirements.

1.4 QUALITY ASSURANCE

.1 Use an experienced installer and adequate number of skilled personnel who are thoroughly trained and experienced in the application of the vapour retarder.

.2 Obtain vapour retarder materials from a single manufacturer regularly engaged in manufacturing the product.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials to Project site in original packages with seals unbroken, labelled with manufacturer's name, product, date of manufacturer, and directions for storage.

.2 Store materials in their original undamaged packages in a clean, dry, protected location and within the temperature range required by the material manufacturer.

.3 Protect stored materials from direct sunlight.

Part 2 Products

2.1 MATERIALS

.1 Vapour Retarder: virgin polyolefin resin sheet to ASTM E1745, Class A.

.1 Thickness: 0.38 mm (15 mil).

.2 Water vapour permeance: maximum 6.0 ng/m2/s/Pa to ASTM E1745 after conditioning to ASTM E154 / E154M.

.3 Puncture resistance: to ASTM D1709, >2200 grams.

.4 Tensile strength: to ASTM D882, >7.9 kN/m.

.5 Standard of Acceptance: Stego Wrap (15 mil) Vapor Barrier, WR Meadows Perminator 15, Layfield VaporFLEX 15.

.2 Jointing Tape: Air resistant, pressure sensitive adhesive tape, type recommended by vapour retarder manufacturer for sealing joints and penetrations.

Part 3 Execution

3.1 EXAMINATION

.1 Examine areas and conditions under which work is to be performed.

.2 Verify sub-grade is properly prepared and at correct elevation, level, smooth without sharp projections which could puncture vapour barrier.

.3 Proceed with Work once unsatisfactory conditions are corrected.

.4 Start of Work implies acceptance of conditions.

3.2 INSTALLATION

.1 Install vapour retarder in accordance with ASTM E1643, and manufacturer's written instructions and typical details.

.2 Install vapour retarder under interior slabs-on-grades.

.3 Use sheets of largest practical size to minimize joints.

.4 Joints: Lap minimum 152 mm and seal with jointing tape.

.5 Penetrations: Seal protrusions caused by pipes, conduits, electrical boxes, and similar items penetrating vapour retarder by creating collar with vapour retarder and sealing with jointing tape to create air-tight seal between penetrating objects and vapour retarder.

.6 Inspect sheets for continuity.

.1 Repair punctures and tears with jointing tape or another layer of vapour retarder before work is concealed.

.2 Where damage to vapour retarder exceeds tape width, repair with additional layer of vapour retarder, minimum 300 mm overlap in all directions from edge of damage. Tape continuously around perimeter of patch.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 04 22 00 – Unit Masonry.

.2 Section 07 21 13 - Board Insulation.

.3 Section 08 11 00 – Metal Doors and Frames.

.4 Section 08 36 20 – Sectional Metal Overhead Doors.

.5 Section 08 51 13 – Aluminum Windows.

1.2 SECTION INCLUDES

.1 This Section includes requirements for supplying labour, materials, tools, and equipment to complete the Work as shown on the Drawings as specified in this Section including, but not limited to:

- .1 Materials and installation methods providing primary air vapour barrier materials and assemblies.
- .2 Air/vapour barrier materials to provide continuous seal between components of building envelope and building penetrations.
- .3 Adhesive / Primer.
- .4 Self-Adhered Air and Vapour Barrier.
- .5 Sealant.
- .6 Thru-wall flashing.

1.3 REFERENCES

.1 American Architectural Manufacturers Association (AAMA):

- .1 AMMA 2400-02, Standard Practice for Installation of Windows with a Mounting Flange in Stud Frame Construction.

.2 American Society for Testing and Materials (ASTM):

- .1 ASTM E84-25, Standard Test Method for Surface Burning Characteristics of Building Materials.
- .2 ASTM E96-00e1 - Standard Test Methods for Water Vapor Transmission of Materials.
- .3 ASTM E1677-23, Standard Specification for Air Barrier (AB) Material or System for Low-Rise Framed Building Walls.
- .4 ASTM D1970/D1970M-21, Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.
- .5 ASTM E2112-23, Standard Practice for Installation of Exterior Windows, Doors and Skylights.
- .6 ASTM E2178-21a, Standard Test Method for Air Permeance of Building Materials.

.3 National Fire and Protection Agency (NFPA):

- .1 NFPA 285-2012, Standard Fire Test Method for Evaluation Of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components.

1.4 PERFORMANCE REQUIREMENTS

.1 Air barrier assemblies must meet the following standards:
- .1 Minimum Application Temperature: 41°F (5 °C).
- .2 Service Temperature: -40 °F to 158 °F (-40 °C to 70 °C).
- .3 Water Vapour Permeance (ASTM E96/E96M Method B): 0.08 Perms.
- .4 Air Permeance (ASTM E2178): <0.0002 cfm/ft2 (0.0011 L/s.m.2).
- .5 Air leakage:
- .6 Assembly to ASTM E2357.
- .7 Air Leakage Rate to CAN/ULC-S742, Classification A1.
- .8 Nail Sealability to AAMA 711 and ASTM D1970/D1970M modified.
- .9 Fire Testing to NFPA 285: Compliant in various wall assemblies.
- .10 Declaration Status: LBC Red List Free.

1.5 SUBMITTALS

.1 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures.
- .1 Provide drawings of special joint conditions.

.2 Submit manufacturer's product data sheets in accordance with Section 01 33 00 – Submittal Procedures.
- .1 Air Barrier Manufacturer’s guide specification.
- .2 Air Barrier Manufacturer’s technical data sheets.
- .3 Air Barrier Manufacturer’s details.

.3 Certificates: Product certification that the assembly components are supplied and warranted by single source Air Barrier Manufacturer.

.4 Test and Evaluation Reports:
- .1 Submit Air Barrier Manufacturer statement that anticipated wall assembly complies with NFPA 285.

.5 Submit sample warranty.

.6 Submit manufacturer's installation instructions in accordance with Section 01 33 00 – Submittal Procedures.

1.5 QUALITY ASSURANCE

.1 Perform Work in accordance with Sealant and Waterproofer's Institute - Sealant and Caulking Guide Specification requirements for materials and installation.

.2 Perform Work in accordance with National Air Barrier Association - Professional Contractor Quality Assurance Program and requirements for materials and installation.

.3 Obtain air barrier, flashings, sealants, primers, mastics, and adhesives from a single Air Barrier Manufacturer regularly engaged in the manufacturing and supply of the specified products.

.4 Installer Qualifications:
- .1 Perform Work in accordance with Air Barrier Manufacturer published literature and as specified in this section.
- .2 Maintain one (1) copy of Air Barrier Manufacturer’s instructions on site.
- .3 Allow the Air Barrier Manufacturer representative site access during installation.
- .4 Contact the Air Barrier Manufacturer a minimum of two weeks before scheduling a meeting.

.5 Maintain one copy of documents on site.

1.6 MOCK-UPS

.1 Where directed by Consultant, construct mock-up(s) to verify selections made under submittals and to set quality standards for material(s) and execution in accordance with this Section.

1.7 QUALIFICATIONS

.1 Applicator: Company specializing in performing work of this section with minimum 5 years documented experience with installation of air / vapour barrier systems. Completed installation to be approved by the material manufacturer.

.2 Applicator: Company who is currently licensed by National Air Barrier Association to maintain their license throughout the duration of the project.

1.8 PRE-INSTALLATION MEETINGS

.1 Convene one week before commencing Work of this Section.

1.9 DELIVERY, STORAGE AND HANDLING

.1 Deliver and handle materials in accordance with manufacturer's written instructions, in undamaged and clearly marked containers and wrapping indicating the name of the Air Barrier Manufacturer and product.

.2 Storage:

.1 Store materials as recommended by the Air Barrier Manufacturer and conform to applicable safety regulatory agencies. Refer to all applicable data including, but not limited to, Safety Data Sheets, Product Data sheets, product labels, and specific instructions for personal protection.

.2 Keep solvents away from open flame or excessive heat.

.3 Store rolled materials on end.

1.10 PROJECT ENVIRONMENTAL REQUIREMENTS

.1 Maintain temperature and humidity recommended by materials manufactures before, during and after installation.

.2 Do not perform Work during rain or inclement weather.

.3 Do not perform Work on frost covered substrates or surfaces that are wet to touch.

.4 Product requirements may vary. Refer to Air Barrier Manufacturer’s published literature.

1.11 SEQUENCING

.1 Sequence work to permit installation of materials in conjunction with related materials and seals.

1.12 WARRANTY

.1 Provide Air Barrier Manufacturer’s standard 10 year material warranty.

Part 2 Products

2.1 AIR/VAPOUR BARRIER, AIR BARRIER, PRIMERS & ACESSORIES

.1 Cold Applied Membrane (AVB): to meet performance requirements in Part 1 of this Section, self-adhering membrane consisting of an SBS rubberized asphalt compound

integrally laminated to thermoplastic film, minimum 1.0 mm (40 mils), "Blueskin SA" by Henry Company.

.2 Thru-Wall Flashing: cold applied self-adhering membrane consisting of an SBS rubberized asphalt compound integrally laminated to a cross-laminated polyethylene film, min. 1.0mm 40mils), "yellow" in color "Blueskin TWF by Henry Company.

.3 Primer: type recommended by air / vapour barrier manufacturer for type of substrate used.

.4 Tapes for joint sealing of sheathing: type as recommended by air/vapour barrier manufacturer.

.5 VOC content of paints, coatings, adhesives, and sealants used in the interior of the building envelope to be low VOC content.

.1 Contractor to provide cut sheets, Safety Data Sheets, signed attestations or other official literature from manufacturers clearly identifying product emission rates. Documentation showing amount (in litres) of each material(s) used should also be provided.

Part 3 Execution

3.1 EXAMINATION

.1 Verify that surfaces and conditions are ready to accept the Work of this section and are in accordance with Barrier Manufacturer requirements and as specified in this Section before installation of air barrier. Commencement of the Work or any parts thereof, indicates installer acceptance of the substrate.

.2 Ensure all surfaces are clean, dry, sound, smooth, continuous and comply with air barrier manufacturer's requirements.

.3 Masonry joints must be struck flush.

.4 Concrete surfaces to be smooth and without large voids, spalled areas or sharp protrusions.

.5 Report any unsatisfactory conditions to the Consultant in writing.

.6 Do not start work until deficiencies have been corrected. Commencement of work implies acceptance of conditions.

3.2 PREPARATION

.1 Remove loose or foreign matter which might impair adhesion of materials.

.2 Ensure all substrates are clean of oil or excess dust; all masonry joints struck flush, and open joints filled; and all concrete surfaces free of large voids, spalled areas or sharp protrusions.

.3 Ensure all substrates are free of surface moisture before application of membrane and primer.

.4 Ensure metal closures are free of sharp edges and burrs.

.5 Prime substrate surfaces to receive air/vapour barrier and/or air barrier in accordance with manufacturer's instructions.

.6 Tape all joints of gypsum sheathing to air/vapour barrier and/or air barrier manufacturers

printed instructions.

3.3 INSTALLATION

.1 Install materials in accordance with manufacturer's instructions. Caulk with sealant to ensure complete seal.

.2 Do not install air barrier over substrates that are wet to touch.

.3 Place liquid seal onto roof vapour retarder and seal with sealant. Caulk to ensure complete air seal. Position lap seal over firm bearing.

.4 Install seal between window and door frames and adjacent wall seal materials with sealant. Caulk to ensure complete seal. Position lap seal over firm bearing.

.5 Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

.6 Do not proceed with installation of air barrier assembly components until substrate and environmental conditions are in accordance with Air Barrier Manufacturer’s published literature.

3.4 CLEANING

.1 As the Work proceeds, and upon completion, promptly clean up and remove from the premises all rubbish and surplus materials resulting from the foregoing Work.

.2 Clean soiled surfaces, spatters, and damage to adjacent areas caused by Work of this Section.

.3 Check area to ensure cleanliness and remove debris, equipment, and excess material from the site.

3.5 PROTECTION OF WORK

.1 Do not permit adjacent work to damage work of this section.

.2 Ensure finished Work is protected from climatic conditions.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Sections:
.1 Section 07 62 00 - Sheet Metal Flashing and Trim.
.2 Section 06 10 00 – Rough Carpentry.

1.2 REFERENCES

.1 American Architectural Manufacturer's Association (AAMA).
.1 AAMA 1402:2013, Standard Specifications for Aluminum Siding, Soffit and Fascia.

.2 American Society for testing and Materials (ASTM).
.1 ASTM A653/A653M-23, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
.2 ASTM A1003/A1003M-23e01, Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members.

.3 Underwriters Laboratories of Canada (ULC).
.1 CAN/ULC-S114:2018 (R2024), Standard Method of Test for Determination of Non-Combustibility in Building Materials.

1.3 SUBMITTALS

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

.2 Product Data:
.1 Submit manufacturer's printed product literature, specifications and data sheet.

.3 Shop Drawings:
.1 Submit shop drawings indicating dimensions, profiles, attachment methods, schedule of soffit locations, trim and closure pieces, metal furring, and related work.
.1 Submit project specific plans, manufacturer's typical plans are not permitted.

.4 Samples:
.1 Samples for initial selection: submit manufacturer's standard colour swatches on metal substrate.
.1 Engineer to select from standard colour range in finish specified.
.2 Samples for verification: Submit duplicate 300 mm long samples of soffit profile, in colour selected from initial sample.
.3 Submit manufacturer's installation instructions.
.4 Qualification data for manufacturer and installer.

1.4 QUALITY ASSURANCE

.1 Manufacturer Qualifications: company specializing in producing preformed metal soffits with 5 years documented experience.

.2 Installer and Fabricator Qualifications: person specializing in preformed metal soffit installations with 5 years documented experience approved by manufacturer.

.3 Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver components, preformed metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

.2 Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

.3 Store preformed metal panels horizontally, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage. Do not allow storage space to exceed 49 deg C.

.4 Retain strippable protective covering on metal panels for period of panel installation.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Minimize construction waste sent to the landfill, separate and recycle materials as specified in Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

1.7 PROJECT CONDITIONS

.1 Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturer's written instructions and warranty requirements.

Part 2 - Products

2.1 STEEL SOFFIT AND COMPONENTS

.1 Exterior Soffit: to AAMA 1402, Class patterned:

.1 Material: aluminum, venting with slots.

.2 Finish: Baycoat 10,000 series.

.3 Colour: colour selected by Consultant from manufacturer`s full range.

.4 Edge: square with matching integral filler.

.5 Thickness: 0.61 mm base metal thickness.

.6 Standard of Acceptance: V-RIB Soffit Panels by Agway Metals Inc. or approved equivalent.

.7 Location: All exterior soffits.

.2 Exterior Soffit Accessories:

.1 Exposed trim: 25 mm wall trim of same material as soffit, with fastener holes pre-punched.

.2 Panel splices, profile to match panels

.3 Retainer clip for integral filler

.4 End Plugs: 0.635 mm thick aluminum with square edges.

.5 Perimeter Trim

.1 Perimeter Caps: 0.635 mm thick aluminum 46 mm inside dimension by 47 mm top flange by 25 mm bottom flange by 3000 mm long.

.2 Wall Angles: 0.635 mm thick aluminum 23.8 mm wide by 23.8 mm high by 3 000 mm long with hemmed edges.

.6 Access Panels: Minimum 610 by 610 mm or 610 x soffit overhang dimension, hinged and locking access door fabricated from soffit panels and manufacturer's standard extruded aluminum trim.

.7 Finish: Identical to soffit panels.

2.2 PVC SOFFIT AND COMPONENTS

.1 Interior Ceiling Soffit: to Flame spread classification of 5 as per CAN/ULC S102.2-10 and meets CFIA (Canada) and FDA (USA) approved requirements for walls and ceilings:

.1 Material: PVC interlocking tongue and groove system with hidden stainless steel fasteners and pre-punched nailing flanges.

.2 Finish colour: standard white.

.3 Thickness: 12.5 mm thickness.

.4 Profile: 406 mm x standard practical lengths (3.0 m, 3.6 m and 4.8 m).

.5 Standard of Acceptance: Trusscore by Agway Metals Inc. or approved equivalent.

.6 Location: All interior ceiling soffits and as indicated on the drawings

.7 Accessories: provide all necessary trims, flashings and sealant as per manufacturer's written specifications and details.

2.3 SUSPENSION SYSTEM

.1 Vertical Support Struts: 64 mm channel stud framing to ASTM A1003, roll formed from hot dipped galvanized steel sheet, to ASTM A653/A653M, Z275 coating designation.

.1 Base steel thickness: 0.84 mm.

.2 Symmetrical Carrier: inverted "U" shape, double grip, 1.01 mm thick aluminum, black polyester enamel finish.

.1 Slotted at intervals to receive stabilizing components.

.3 Stabilizer Bars: 0.635 mm thick aluminum, black polyester enamel finish.

.4 Hanger wire: galvanized soft annealed steel wire, 2.6 mm diameter.

2.3 FASTENERS

.1 Provide fasteners of type, material, size, corrosion resistance, holding power, and other properties required to fasten components.

Part 3 - Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 INSTALLATION

.1 Install soffits in accordance with AAMA 1402 and manufacturer's written instructions and as follows:

- .1 Install Soffit on Suspension System indicated.
- .2 Install PVC Trusscore by Agway Metals as per manufacturer’s written specifications and details

.2 Suspension System where indicated on the drawings:

- .1 Vertical Support Struts:
  - .1 Mechanically fasten to structural steel roof framing, and carriers.
  - .2 Spacing: 500 mm on centre, within 150 mm of end of each carrier, and each side of carrier splices.
  - .3 Provide hanger wire at each strut.
    - .1 Located within 76 mm.
    - .2 Attach to structural framing and carrier wrapped tightly 3 full turns.
- .2 Symmetrical Carriers: Install 610 mm on center by direct suspension from vertical support struts and hanger wire.
  - .1 Splice as required in accordance with manufacturer’s written instructions.
- .3 Stabilizer Bars: Install perpendicular to symmetrical carriers, 610 mm on center.

3.3 CLEANING

.1 Remove damaged components, replace with undamaged components.

.2 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

.3 Clean with non-solvent non-abrasive commercial cleaning solution.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 07 62 00 - Sheet Metal Flashing and Trim.
.2 Section 07 46 13 – Preformed Metal Soffits.

1.2 REFERENCES

.1 American National Standards Institute (ANSI).
  .1 ANSI/ASME B18.6.4-18, Self-Tapping Sheetmetal Screw, Steel.

.2 American Society for Testing and Materials International, (ASTM).
  .1 ASTM A653/A653M-23, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron. Alloy Coated (Galvanized) by the Hot Dip Process.
  .2 ASTM D2832-92R16, Guide for Determining Volatile and Nonvolatile Content of Paint and Related Coatings.
  .3 Canadian Standards Association (CSA).
    .1 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.
  .4 National Research Council Canada (NRC).
    .1 National Building Code of Canada (NBCC) 2020.
  .5 SCAQMD Rule#1168 South Coast Air Quality Management District.
  .6 Underwriters Laboratories (UL).
    .1 UL 2761-2011, Sustainability for Sealants and Caulking Compounds, Edition 1.

1.3 SUBMITTALS

.1 Product data: submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 – Submittal Procedures.
  .1 Submit copies of WHMIS SDS - Safety Data Sheets. Indicate VOC's for caulking materials during application and curing.

.2 Shop Drawings:
  .1 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures.
  .2 Indicate dimensions, profiles, attachment methods, schedule of wall elevations, trim and closure pieces, Z bars, insulation and related work.
  .3 The VOC content of adhesives and sealants used in the interior of the building envelope must be less than the VOC content limits of SCAQMD Rule#1168.
    .1 Contractor to provide cut sheets, Safety Data Sheets, signed attestations or other official literature from manufacturers clearly identifying product emission rates. Documentation showing the amount (in litres) of each material(s) used should also be provided.

.3 Samples:
.1 Submit samples in accordance with Section 01 33 00 – Submittal Procedures.
.2 Submit duplicate 100 x 100 mm samples of siding material, of colour and profile specified.

.4 Manufacturer's Instructions:
  .1 Submit manufacturer's installation instructions.

1.4 DESIGN CRITERIA

.1 Design preformed metal panel wall to provide for thermal movement of component materials without causing buckling, failure of joint seals, undue stress on fasteners or

other detrimental effects.

.2 Design wall system to accommodate, by means of expansion joints, any movement in wall and between wall and building structure, caused by structural movements without permanent distortion, damage to infills, racking of joints, breakage of seals, or water penetration.

.3 Design members to withstand dead load and wind loads as calculated in accordance with NBCC and applicable municipal regulations, to maximum allowable deflection of 1/180 of span.

.4 Provide for positive drainage of condensation occurring within wall construction and water entering at joints, to exterior face of wall in accordance with NRC "Rain Screen Principles".

1.5 QUALITY ASSURANCE

.1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

.2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.3 Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

Part 2 Products

2.1 STEEL CLADDING AND COMPONENTS

.1 Zinc coated steel sheet: commercial quality to ASTM A653/A653M, with Z275 designation zinc coating.

2.2 PREFINISHED COATING

.1 Prefinished factory applied coating:
  .1 Weather ‘XL’ Standard Colour range, 24 ga, by VicWest. Provide sample.

2.3 FASTENERS

.1 Nails: CSA B111. Screws: ANSI/ASME B18.6.4. Purpose made cadmium plated steel.

2.4 ACCESSORIES

.1 Insulation: poly-isocyanurate insulation, foil faced. Refer to drawings for size.

.2 Insulation adhesive: purpose made for insulation type and zinc coated sheet metal non-combustible after curing.

.3 Sealant: Polysulphide, one-part, non-sag to UL 2761, colour to match siding.

.4 The VOC content of adhesives and sealants used in the interior of the building envelope must be less than the VOC content limits of SCAQMD Rule#1168.

.1 Contractor to provide cut sheets, Safety Data Sheets, signed attestations or other official literature from manufacturers clearly identifying product emission rates. Documentation showing amount (in litres) of each material(s) used should also be provided.

2.5 FABRICATION

.1 Exterior panel: Thicknesses (24 ga.) factory preformed coated metal to VicWest profile, 7/8" (22 mm), 67.5 mm from crest to crest. Panel length as indicated on elevations and section drawings.

.1 Approved alternate: Agway Metals Inc. corrugated profile factory preformed cladding provided it matches the specified material and performance specifications.

.2 Exposed trim: inside corners, outside corners, cap strip, drip cap, undersill trim, starter strip and window/door trim of same material, colour and gloss as cladding, with fastener holes pre-punched.

.3 Z-bars: 0.72 mm, hot dip galvanized sheet steel for structural attachment to building frame, thermally broken.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 INSTALLATION

.1 Install metal siding assembly in accordance with reviewed shop drawing and manufacturer's written instructions.

.2 Install "Z" bar girts to structural wall supports, using self-tapping screws. Interlock and seal side and end joints.

.3 Install continuous starter strips, inside and outside corners, edgings, soffit, drip, cap, sill and door opening flashings as indicated.

.4 Install insulation using adhesive to ensure continuous thermal barrier in conjunction with air/vapour barrier formed by liner sheet.

.5 Install exterior panels to "Z" bars. Install and secure all Z-bar framing as required. Fasten cladding to Z-bar framing material as required. Z-bar to be secured to substrate with fasteners designed for specific application

.6 Maintain joints in exterior cladding, true to line, tight fitting, hairline joints.

.7 Attach components in manner not restricting thermal movement.

.8 Caulk junctions with adjoining work with sealant. Do work in accordance with Section 07 92 00 - Joint Sealants.

.9 Exposed raw/cut edges along the new cladding panels are not acceptable. All raw/cut edges to be fully concealed by overlapping factory finished panel, trim, flashing, prefabricated detail, etc.

.10 Cutting of cladding panels must be completed in a manner that does not damage the panel or paint finish in any location.

3.3 CLEANING

.1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 – General

1.1 Related Sections

.1 General Requirements.
.2 Safety Requirements.
.3 Rough Carpentry – Section 06 10 00.
.4 Preformed Metal Cladding – Section 07 46 43.
.5 Sheet Metal Flashings and Trims – Section 07 62 0.0
.6 Plumbing Requirements.
.7 Electrical & Mechanical Requirements.

1.2 General

.1 Provide the necessary labour and materials to complete the roof replacement as per the project specifications and drawings.

.2 Provide the necessary labour and materials to allow for all modifications to the electrical services, mechanical equipment, and natural gas piping system required to complete the project, as per the project specifications and drawings.

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

.1 Product Data:

.1 Declaration of material compatibility.

.2 Submit two copies of most recent technical roofing components data sheets describing materials' physical properties.

.2 Shop Drawings:

.1 Indicate flashing, roof dividers, control and expansion joint locations, tapered insulation details and mechanical fasteners.

.2 Provide layout for all tapered insulation. Provide detailed scaled roof plan drawing for tapered insulation. Indicate enlarged scaled cross-section details at each change in slope and roof areas.

.3 Provide a 8½" x 11½" size enlarged assembly colored sketch indicating all products in roof assembly in section detail that are used including but not limited to: fasteners, adhesives, flashings, membrane(s), roofing membrane(s), insulation, sloped insulation, recovery board, and vapour barrier. Each roofing product indicated in this enlarged assembly section sketch is to be of different colour than the next adjacent roof product. Line types of different product colour can also be used. Match each roof product shown on the coloured assembly sketch with its own corresponding data and/or cut sheet shop drawing of product information.

.4 Indicate flashings, control joints, tapered insulation and other pertinent details.

.5 Submit WHMIS SDS - Safety Data Sheets Section 01 33 00 _ Submittal Procedures. Indicate VOC content for:

.1 Primers.

.2 Sealers.

1.3 Roof Assembly

.1 Supply all labour and materials necessary to complete the new Modified Bitumen Membrane Roofing, as specified and detailed in the areas as indicated on the drawings.

R01-Typical Roof Assembly to be:

1-ply Modified Bitumen Cap Sheet Membrane
1-ply Modified Bitumen Base Sheet Membrane
6mm (1/4") Asphaltic Protection Board
2% Tapered Rigid Insulation System
75mm (3") Rigid Secondary Insulation
75mm (3") Rigid Base Insulation
3.5mm Vapour Barrier
Concrete topping
Precast Hollowcore Concrete Structure

R02-Typical Roof Assembly to be:
1-ply Modified Bitumen Cap Sheet Membrane
1-ply Modified Bitumen Base Sheet Membrane
6mm (1/4") Asphaltic Protection Board
2% Tapered Rigid Insulation System
75mm (3") Rigid Secondary Insulation
75mm (3") Rigid Base Insulation
3.5mm Vapour Barrier
16mm (5/8") Deck Sheathing
Steel Deck

1.4 Roof Assembly Flashing

.1 Supply all labour and materials necessary to complete the new Modified Bitumen Membrane Roof Flashing, as specified and detailed, in the areas as indicated on the drawings.

1.5 Precautions

.1 Roofing to not be carried out when materials are damp and base sheet to not be applied when ambient temperature is less than minus ten (-10) degrees Celsius. (Postpone roofing work when inclement weather appears imminent).

.2 Warning - Do not overload structural roof deck(s) with materials and/or equipment. Prime Contractor must engage their Structural Engineer, licensed in the Province of Ontario, to complete an engineering review and provide a stamped report for all construction means and methods. Intended construction means and methods to be discussed in detail between Prime Contractor and their Structural Engineer. This is to include but not limited to: material loading and handling, equipment type, loading and operation, existing roof removal methods, new roof installation methods and any other items related to the contract works. It is the Prime Contractor's sole responsibility to ensure the integrity of the structural roof decks throughout all stages of the project. Copy of this report to be submitted to the Engineer of project.

.3 Contractor may not employ the use of ride-on type roofing equipment (i.e. Labour Saver, Dingo, Bobcat, Garlock, Skid-Steer or similar) in any location throughout the project. Do not overload the roof decks with materials and/or equipment in any location. Contractor to assume all risks associated with damage to existing roofing and structure because of materials / equipment storage, usage and installation.

.4 Fasteners/Adhesives for each component of the roof assembly (deck sheathing, insulation, sloped insulation, overlay board, roofing membranes): as recommended by roofing system manufacturer to suit metal deck as applicable, and as required to meet CSA A123.21 wind uplift criteria. Contractor to provide all wind uplift information as per the manufacturer's specifications and project specific standards/requirements.

.5 At existing metal deck areas, the existing vapour barrier is to be fully removed. Only residual poly vapour barrier fully bonded to steel deck surface can remain. Prior to installation of new vapour barrier, confirm with Roof manufacturer compatibility with existing vapour barrier and install in accordance with Roof manufacturer specifications and details.

.6 Apply each part of roofing system only when surfaces are clean and dry.

.7 Conduct, operations to leave deck exposed for minimum period of time. Protect, as required, to prevent water infiltration or environmental damage to building interior. At no time to the deck be left exposed overnight.

.8 Insulation to not be left exposed to the elements, nor to more be laid than can be completely covered in the same day.

.9 Provide temporary membrane to render all insulation watertight if for some unforeseen reason work cannot be completed as specified. Remove temporary membrane completely prior to any further roofing operations.

.10 Where work must continue over finished roofing membrane, protect surface with minimum 13 mm thick plywood sheets.

.11 Strictly adhere to all safety guidelines for the torching of Modified Bituminous Membrane.

.12 Any sharp projections, that in the opinion of the Engineer may penetrate the vapour barrier, to be ground smooth and flush.

.13 All aspects of the re-roofing operation to follow in close sequence. No part of the operation to be so far ahead of the succeeding part that the latter cannot be finished that working day.

1.6 Warranty

.1 Prior to award of the project, Contractor must provide a copy of their certification in current good standing with the chosen material manufacturer. Contractor must also provide in writing, their ability to issue the specified warranty.

.2 Remedy all defects in the Modified Bituminous Membrane Roofing and Membrane Flashings installed hereunder which appear within a period of **Five (5) Years** from date of final completion. In addition, submit Membrane Manufacturer's **15-Year Manufacturer's Full System No Dollar Limit Warranty** upon completion of project. Standard of Acceptance: **Platinum by Soprema or approved alternate**

.3 Make all necessary repairs and replacements with **48 hours** of receipt of written notification. Provide a written warranty confirming above, issued on the corporate letterhead, signed and sealed by an authorized signing officer.

.4 Nothing contained in this article to be construed as in any way restricting or limiting the liability in common law and statutory liability of the Contractor.

Part 2 – Products

2.1 Substrate Overlay Sheathing

.1 **Glass Mat Gypsum Roof Board:** Pre-primed with fibreglass mats front & back mechanically bonded to a high-density gypsum core. Boards to be 1.2 m x 2.4 m, thickness 16 mm (5/8") with pre- primed surface. Standard of acceptance: **Dens Deck Prime Roof Board or approved alternate**.

2.2 Adhesive

.1 **Adhesive**: low-rise, 2-component, polyurethane adhesive. Used for securing insulation to vapour retarder, insulation layers & protection board to insulation.

Standard of acceptance: **Duotack by Soprema or approved alternate.** Strictly follow minimum temperature application as per the manufacturer's guidelines. **Note: All adhesive must be applied by an approved manufacturer's applicator.**

2.3 Bitumen & Primers

.1 **Self-Adhesive Membrane Primer:** composed of SBS synthetic rubbers, adhesive enhancing resins and volatile solvents designed for use with self-adhesive waterproofing membranes on most substrates. Standard of Acceptance: **Elastocol Stick by Soprema or approved alternate.**

.2 **Black Bituminous Primer:** to be composed of asphalt modified bitumen with thermoplastic polymers and volatile solvents. Standard of Acceptance: **Elastocol 500 by Soprema or approved alternate.**

.3 **Roofing Cement:** with water displacing characteristics, to ensure an effective bond to both wet and dry surfaces. The ability to adhere during inclement weather conditions. Composed of selected asphalts, mineral fillers combined with refined solvent, and special chemical ingredients to create a water displacement quality. Standard of Acceptance**: Karnak Amphibikote 155 (wet and dry) or approved alternate**

2.4 Vapour Barrier Membranes

.1 **Parapet, Curbs and Walls:** Modified bitumen membrane with a minimum 100gram/m^2 non-woven polyester reinforcement and a minimum thickness of 2.5mm. Under face to be self-adhesive and covered by a removable silicone release film. Top face to be covered by a thin poly-film. Membrane to satisfy CGSB 37-GP-56M requirements. Standard of Acceptance: **Sopraseal Stick 1100T by Soprema or approved alternate.**

.2 **Underneath Parapets, Curbs and Walls**: composed of SBS modified bitumen reinforced with composite reinforcement. The surface is sanded. The underface, self-adhesive, is covered with a release protection film. Standard of Acceptance: **Sopraply Stick by Soprema or approved alternate.**

.3 **Roof Field:** membrane composed of a non-woven polyester reinforcement and SBS modified bitumen. Membrane to be a minimum of 3.5mm thick. Standard of Acceptance: **Sopralene 180 SP 3.5 by Soprema or approved alternate**

2.5 Batt/ Blanket Insulation

.1 **Batt/Blanket Insulation:** semi-rigid stone wool batt insulation for exterior wood and steel stud applications. To be non-combustible and fire resistant. Standard of Acceptance**: Comfortbatt by Rockwool or approved alternate**

2.6 Rigid Insulation

.1 **Polyisocyanurate Insulation: (thicknesses as indicated)** closed cell polyisocyanurate foam bonded on top and bottom sides to an organic/inorganic facer. Board size not to exceed 1200 mm x 1200 mm. Insulation to meet CAN/CGSB 51.26-M and CAN/ULC-S704. Standard of Acceptance: **Sopra-Iso by Soprema or approved alternate.**

2.7 Tapered Insulation

.1 **Tapered Polyisocyanurate (2% as indicated):** tapered insulation system as specified material above (Polyisocyanurate). Modules to be factory cut to correct slopes and clearly marked to match provided shop drawings. All valley corners and crickets to be factory mitred. Slope to meet designer's requirements and approval**. Slopes to be 4-way directional to all roof drain locations and a minimum 38 mm (1.5") tapered panel thickness to meet each drain sump as indicated.** Shop drawings indicating layout, thicknesses and type of material to be submitted for approval prior to ordering materials. Tapered insulation package must cover the entire roof surface as indicated. **Tapered insulation package must be designed to slope upwards beginning at each roof drain location and be continuous to the roof area(s) perimeters, with no flat areas, no breaks, no interruptions or no secondary insulation layer reductions. The tapered**

insulation MUST commence above the secondary insulation layer (as indicated) at all locations. Flat areas or reduction/removal of secondary layer to accommodate tapered insulation will NOT be accepted. Standard of Acceptance: **Posi-Slope or approved alternate.**

.1 Submit the manufacturer's latest specifications including compliance data. **Only manufacturer's data sheets will be acceptable.**

.2 **Crickets:** Manufactured from polyisocyanurate. Modules to be factory cut/mitred to correct slopes and clearly marked.

.3 **Roof Drain Sumps (as indicated):** Manufactured from polyisocyanurate. Modules to be factory cut/mitred to correct slopes and clearly marked. All roof drains must be sumped a maximum of 1.2 m x 1.2 m (4'x 4'), with a minimum 2% slope to drain. All sumps to be a minimum of 13mm (0.5") thick and maximum 38mm (1.5") thick.

.4 Insulation slopes and thickness to be as indicated on the detailed drawings and roof plan and to be a distinct separate layer with joints staggered over the base insulation. Ensure sump drops in elevation minimum 16mm. Chamfer sump edges to receive protection board.

.5 Modules to be factory cut to correct slopes and clearly marked to match provided shop drawings. **All valley corners and crickets to be factory mitred.**

2.8 Protection Board

.1 **Protection Board:** 6mm (1/4") thick asphaltic roofing board composed of a mineral fortified asphaltic core between 2 asphaltic saturated fibreglass liners. Board size to be 1220mm x 1520mm. Standard of Acceptance: **Sopraboard by Soprema or approved alternate.**

2.9 Fire Protection Membrane

.1 **Fire Protection Membrane:** glass mat reinforcement coated with oxidized bitumen. Both sides are sanded. Standard of Acceptance: **Sopraglass 100 by Soprema or approved alternate**

2.10 Modified Bitumen Membrane

.1 Two (2)-ply system made from prefabricated modified bitumen membranes containing minimum 15% of elastomer Styrene Butadiene Styrene (SBS) and reinforced with non-flammable, fireproof and stress resistant insert of glass fibre or polyester.

.1 **Membrane Base Ply:** SBS—modified bitumen sheet, to CGSB 37-GP-56M Type 2, Class C, Grade 2, supplied in Rolls 1 m wide, for torch installation and to be torched over, Minimum 3.0 mm thick, minimum 180 g/m^2 non-woven Polyester reinforcement. Standard of Acceptance: **Sopralene Flam 180 by Soprema or approved alternate**

.2 **Membrane Cap Ply:** SBS-modified bitumen sheet, supplied in rolls 1 m wide, for torch installation, with granule surfacing minimum 3.8 mm thick, minimum 250 g/m^2 non-woven polyester reinforcement, meeting CGSB 37-GP-56-M classification Type 1, Class A, Grade 2. Standard of Acceptance: **Sopralene Flam 250 GR by Soprema or approved alternate**

.3 **Membrane Base Flashings:** SBS-modified bitumen sheet, supplied in rolls 1 m wide, for self-adhesive installation and to be torched over, minimum 2.5 mm thick, minimum 130 g/m^2 glass reinforcement. Standard of Acceptance: **Sopraflash Flam Stick by Soprema or approved alternate.**

.4 **Membrane Cap Flashings:** SBS-modified bitumen sheet, supplied in rolls 1 m wide, for torch installation and to be torched over, with granule surfacing, minimum 3.8 mm thick, minimum 250 g/m^2 non-woven polyester reinforcement, meeting CGSB 37-GP-56-M classification Type 1, Class A, Grade 2. Standard of Acceptance: **Sopralene Flam 250 GR by Soprema or approved alternate.**

.5 **Membrane Reinforcing Ply:** SBS—modified bitumen sheet, to CGSB 37-GP-56M Type 2, Class C, Grade 2, supplied in Rolls 1 m wide, for torch installation and to be torched over, Minimum 3.0 mm thick, minimum 180 g/m^2 non-woven Polyester reinforcement. Standard of Acceptance: **Sopralene Flam 180 by Soprema or approved alternate**

.6 **Sacrificial Membrane**: SBS-modified bitumen sheet, supplied in rolls 1 m wide, for torch installation, with granule surfacing minimum 3.8 mm thick, minimum 250 g/m^2 non-woven polyester reinforcement, meeting CGSB 37-GP-56-M classification Type 1, Class A, Grade 2. Standard of Acceptance: **Sopralene Flam 250 GR by Soprema or approved alternate**

.7 **Protective (Walkway) Membrane:** SBS-modified bitumen sheet, supplied in rolls 1 m wide, for torch installation, with granule surfacing minimum 3.8 mm thick, minimum 250 g/m^2 non-woven polyester reinforcement, meeting CGSB 37-GP-56-M classification Type 1, Class A, Grade 2. Standard of Acceptance: **Sopralene Flam 250 GR by Soprema or approved alternate**

.2 Low temperature Requirements
Grade 2 material to pass low temperature requirements at -30^{o}C to CGSB 37-GP-56M.

.3 Test Results
Test results from a certified independent laboratory showing conformance to above requirements to be submitted with tender documents or within 48 hours of tender closing, if requested.

.4 Standard of Acceptance
S.B.S. Modified Bitumen Membranes as manufactured by the following: Soprema, Bakor, Johns Manville, and IKO

2.11 Roof System Accessories

1. **Roofing Nails:** to CSA B111, Table 12, of electrogalvanized steel, sufficient length to penetrate wood substrate at least 25mm Nails to have a minimum head diameter or 25mm. Standard of Acceptance: **Electrogalvanized Bulk Roofing Nails by Canada Fine Parts & Supplies or alternate**

.2 **Round Top Cap Nails:** In compliance with CSA B-III1979 standard, table 12, nails to be made of galvanized steel, long enough to penetrate the wood blocking by a minimum 25 mm (1") depth on flashings and parapet walls. **45 mm (1-3/4") Electrogalvanized Bulk Metal Cap Hand Nails by Canada Fine Parts & Supplies or approved alternate**

.3 **Bird Screen (Gooseneck Vents):** 20 mm x 20 mm galvanized wire mesh.

.4 **Deck Sheathing/ Base Flashing Fasteners:** Corrosion resistant # 12 screws and hexagonal steel plates. Standard of Acceptance: **Dekfast Pre-Assembled Screws & Plates or alternate**

NOTE (Base Flashing Fasteners): In locations where the substrate causes interference with the above noted fastener, Contractor is responsible to supply and install the appropriate length and diameter fastener to properly support and secure the stress plate and underlying membrane.

.5 **Liquid Membrane Flashing:** one-component polyurethane and bitumen liquid membrane, and a flexible 100g/m^2 woven polyester membrane. Standard of Acceptance: **Alsan Flashing & 6" Reinforcement Mesh by Soprema or approved alternate**

.6 **Pre-Cast Concrete Paver**: to CSA A231.1, exposed aggregate surface, 600 mm x 600 mm (24" x 24") size 50 mm (2") thick. Colour and finish to be approved by Owner.

.7 **Rigid Separation Insulation – Where required as per site conditions:** to be extruded foamed polystyrene conforming to CAN/CGSB 51.20-M TYPE 4 AND CAN/ULC-S701. Thickness to be 25 mm min. Standard of Acceptance: **Roofmate by Dow or approved alternate.**

.8 **Vent Stack Flashings:** 1-piece aluminum construction with flashing sleeve and integral flange, matching aluminum hood and perforated collar, pre-molded urethane insulation liner and EPDM base seal. Standard of Acceptance: **SJ-31 Vandal Proof Stack Jack Flashing by Thaler Roofing Specialties only**. **Extend vent pipe as required. Extend vent pipe from below deck if required to match height of new flashing**

.9 **Loose Granules:** composition and colour to match granule surface of roofing membranes. Granules to be embedded into heated asphalt surfaces at joints between rolls or at any other locations where the bitumen bleed-out exceeds the manufacturer's recommendations. Standard of Acceptance: **Granules by Soprema or alternate.**

.10 **Protection Mats:** 19 mm x 1.22 m x 1.8 m rubber matting manufactured from recycled materials. Standard of acceptance: **Sopramat by Soprema or alternate.**

.11 **Flame Guard Tape (**Only Where Required):** composed of SBS modified bitumen and a glass mat reinforcement with a sanded surface and self-adhesive underface with a silicone release film. A minimum width of 150 mm for installation at protection boards and vertical transitions. Standard of Acceptance: **Sopraguard Tape by Soprema or approved alternate.**

.12 **Misc. Accessory Flashing:** precast blocks made of polyester resin Standard of Acceptance: **Sopramastic Blocks by Soprema or approved alternate.**

.14 **Accessory Flashing Filler**: is a polyether-based resin, single-component, moisture cure elastomer sealing mastic. Odourless and to have low VOC content. Standard of Acceptance: **Sopramastic PF by Soprema or approved alternate**

.15 **Accessory Adhesive:** polyether-based resin, single-component, moisture cure elastomer sealing mastic and adhesive with low VOC content. Standard of Acceptance: **Sopramastic SP2 by Soprema or approved alternate.**

.16 **Mastic:** solvent-based mastic containing SBS modified bitumen, fibres and mineral fillers. **Sopramastic by Soprema or alternate.**

.17 **Mechanical Flashings:** Pre-fabricated galvanized steel B-Vents c/w storm collar, height to suit detail (minimum 14" tall), all joints solder welded.

.18 **Free Standing Supports:** engineered prefabricated support made of high- density polypropylene plastics with UV Protection. HDG structural steel frame, rollers and hardware. Support to be appropriately sized to support item (i.e. gas, electrical, refrigeration). Standard of Acceptance: **PP-10 w/ Roller, PP-10 with Chanel, RB-18 or other by Portable Pipe**

Hangers only. Contractor may NOT substitute PP-10 for SS8-C or SS8-R pipe supports.

.19 **High Temperature Gasket/Sealant** – single component, room temperature vulcanizing RTV gasketing compound to provide "formed-in-place" gaskets for mechanical assemblies. Product to resist aging, weathering and thermal cycling without hardening, shrinking or cracking. (up to 750°F intermittent). Standard of Acceptance: **Optimum Red by Permatex or approved alternate.**

.20 **Expansion Joint:** monolithic expansion joint made of EPDM-based synthetic rubber consisting of two (2) flanges coated on the surface and underface with a woven oxidized and stabilized polyacrylonitrile, with an expandable core. Expansion joint to be custom manufactured to suit all site conditions, including but not limited to: 90-degree, angled, cross, T-shaped and curved transitions, as well as continuously in other directions. Expansion joint to be manufactured with a minimum expansion/contraction as noted. Contractor responsible to complete accurate field measurements for the fabrication of this product to meet all project requirements. Standard of Acceptance: **Soprajoint Plus 75 by Soprema or approved alternate.**

Part 3 – Execution

3.1 Surface Inspection and Preparation

.1 After removal of the existing roof system assemblies and before commencing the work of this section, conduct an inspection of the entire substrate with the Engineer and the Roofing Contractor to approve the condition of the substrate. Ensure that the deck and all parts of the structure that are to be covered with roofing membrane possess a smooth surface with an even finish, free of excessive moisture, ridges, hollows and sharp corners. **Obtain letter from roof material manufacturer's accepting substrate.** Before commencing works, ensure that all surfaces are smooth, dry, clean and free of ice and debris. The deck must be free of contamination by materials which could affect the adhesion of the roofing or the physical integrity of the membrane itself.
No salt or calcium to be used to remove ice or snow

.2 Ensure that the work has been properly completed, that there is a proper slope as indicated, with minimal ponding that may occur.

.3 Commencement of roofing installation to be construed as acceptance of the substrate, and thereafter the Contractor to be fully responsible for satisfactory work as required herein

3.2 Installation

.1 Do not install materials under conditions of rain, snow or fog.

.2 Install roofing elements on clean and dry surfaces, in accordance with the manufacturer's requirements and recommendations.

.3 Perform work on a continuous basis as surface and weather conditions allow.

.4 Protect adjoining surfaces against any damage that could result from roofing installation.

3.3 Equipment

.1 Maintain all equipment and tools in good working order.

.2 Use torch types recommended by the membrane manufacturer.

3.4 Protection

.1 **Cover walls and adjacent work where materials are hoisted or used.**

.2 Use warning signs and barriers. Maintain in good order until completion of work.

.3 Clean off drips and smears of bituminous material.

.4 Dispose of rainwater off roof and away from face of building until roof drains of hoppers installed and connected.

.5 Do not permit traffic across finished roof area unless protected by catwalks, prevent traffic over above roof level. Comply with precautions deemed necessary by the Engineer. Repair damage caused by non-compliance with Engineers requirements.

.6 Where work must continue over finished roofing membrane, protect the surface with minimum 1/2" thick plywood sheets.

.7 At end of each day's work or when stoppage occurs due to inclement weather, provide protection for completed and incomplete work.

.8 Install water cut-offs at the end of a day's work, remove same prior to continuing roof application.

3.5 Primer Application

.1 Treat all surfaces to be roofed with Primer to improve adhesion. Apply by brush or roller at a rate of 350 g/m^2. Ensure all surfaces are thoroughly covered and primer is allowed to properly flash-off prior to any membrane application.

.2 Note that the drying time of the primer is related to the ambient temperature and may vary from a few hours to a whole day. Do not proceed until the primer is dry.

.3 Apply to all metal surfaces (aluminum and copper) prior to any membrane installation.

.4 Apply primer on all substrates that are to receive self-adhering, torch applied & asphalt applied membranes.

.5 All primer to be installed as per manufacturer's Guidelines and recommendations.

.6 **Surfaces of gypsum sheathing must be fully coated with black bituminous primer (Elastocol 500) to a full, even and consistent finish prior to any membrane applications (voids or uncoated areas are not acceptable). Contractor must follow manufacturer recommended installation procedures and quantities.**

3.6 Substrate Overlay Sheathing Installation

.1 Steel Deck Roof Assemblies:

.1 Inspect the underside of the deck to ensure fasteners will not be visible, damage the structure or interior surfaces, affect electrical and mechanical services. Fasteners to penetrate top flute of the steel deck maximum 20 mm.

.2 Advise Engineer of any unusual circumstances affecting the work. Be responsible and correct all damage caused by work to match existing materials and finish.

.3 Mechanically fasten each board to the steel & wood decks as required by roofing system manufacturer to meet all current wind uplift criteria.

.4 Attach 16 mm (5/8") gypsum sheathing over steel & wood decks As indicated herein. Install gypsum sheathing boards with long side perpendicular to flutes of steel deck. Stagger joints in boards. Terminate ends of boards on top of the flutes.

.5 Secure to top flute of steel deck & surface of wood deck with screws spaced in pattern to meet manufacturer wind uplift criteria. Use screw-type anti-backout corrosion resistant fasteners with metal plates as generally approved or required by the gypsum manufacturer.

.6 Prime metal plates that will be covered with bitumen roofing. Ensure primer is tack-free before proceeding.

3.7 Vapour Barrier Installation

.1 Prior to installation of field vapour barriers, install self-adhering vapour barrier at all parapets, walls, curbs, and other vertical surfaces, as detailed on the drawings. Set the vapour barrier removing the release paper and applying pressure to the entire surface with a steel roller. Apply vapour barrier with 75 mm side laps. Extend vapour barrier 150 mm onto the roof deck.

.2 Install **1-ply of Sopralene 180 SP 3.5** fully torch applied over surface of substrate overlay sheathing.

.3 Install batt insulation at openings in deck and carefully apply temporary covers at openings to prevent bleeding of bitumen into building.

.4 Starting at low point and laying across roof slope fully adhere vapour barrier to surface of sheathing using proper shingling methods. Lap sides 75 mm and ends 150 mm.

.5 Apply the vapour retarder following the manufacturer's guidelines. Ensure application is free of air pockets, wrinkles, fishmouths, or tears. Check all seams and repair areas where adhesion is lacking and repair them with approved methods.

.6 Apply a single ply vapour barrier extending up and onto the parapet coping as detailed.

3.8 Rigid Insulation Installation

.1 Install insulation to meet thickness as indicated herein and indicated on the drawings (thicknesses as indicated).

.2 At drain location(s), install 2% sloped insulation sump in a single layer. Finish insulation sump flush with top of surrounding insulation, size to be as indicated herein and on drawings.

.3 Install all insulation layers (base, secondary, fillers and tapered) with 2-part urethane adhesive as required by roofing system manufacturer to meet all current wind uplift criteria. Fit boards tightly together. All gaps between boards to be filled with insulation. Stagger all joints in boards

by a minimum of 300 mm (12”). Stagger all joints from each other and from the layer below.

.4 All insulation panels to be neatly cut at projections and points of termination. Replace all broken, damaged or misfit boards as work progresses.

.5 Where necessary, back-cut insulation to allow it to conform and stay bonded to irregular surfaces without bridging. After placement, walk insulation into place to ensure positive bonding is achieved.

3.9 Protection Board Installation

.1 Install 6 mm (1/4”) protection board by embedding into beads of 2-part urethane adhesive over the surface of the polyisocyanurate foam insulation. Adhere overlay board to insulation with adhesive at the rate and pattern specified as for insulation (above).

.2 Place boards in parallel rows with end joints staggered. Lay out in rows in the same direction as the polyisocyanurate foam.

.3 Do not install more insulation than can be completely roofed in the same day.

3.10 Roof Membrane Installation

.1 **Base Ply Membrane:** Allow membrane rolls to relax before installation. Torch apply base ply membrane over the Protection board, overlap rolls 75 mm on sides and 150 mm on ends and in shingle-fashion up from bottom of slope. Ensure application is free of air pockets, wrinkles, fishmouths, or tears. Torch seal all seams. Check all seams and repair using a torch.

.2 **Cap Ply Membrane:** Torch adhere cap ply membrane to base sheet, using proper shingling methods. Stagger seams in cap sheet a minimum 300 mm with those of the base sheet. Lap sides 75 mm and ends 150 mm. Degranulate surface granules where cap sheet is to be lapped by cap flashings or other overlying membrane.
Ensure application is free of air pockets, wrinkles, fishmouths, or tears. Check all seams and repair areas where adhesion is lacking, and repair them, using a torch.

.3 **Base Ply Flashings:** All membrane flashings are to be 2-ply application. Self-adhere all base ply flashings, ensure all deficiencies have been corrected within the membrane below prior to installation of new base ply flashings. Stagger joints at least 100 mm with those of the base ply. Use maximum 1 m lengths of membrane. Check all seams in base ply after application and repair areas where adhesion is lacking, using a torch.

.4 **Base Flashing Fasteners -** Upon completion of base ply flashing membrane applications, install a minimum of two (2) equally spaced rows of pre-assembled fasteners & plates, spaced at 450 mm (18”) OC as per sketch example (SK1). Locations include but are not limited to: parapets, penetrations, curbs, control joints, expansion joints, raised walls, roof separators, etc. At locations where detail exceeds 450 mm (18”) in height, additional rows of fasteners are to be installed at every 450 mm (18”) interval from second fastener row to the top of detail. All fastener and plate locations to be fully coated with black bituminous primer.

.5 **Membrane Reinforcing Ply/Membrane -** Upon completion of base ply flashing membrane and base flashing fastener applications, install a torch applied membrane reinforcing ply at all 90-degree intersections. Install as specified for base ply membrane (above). Locations include but are not limited to: parapets, penetrations, curbs, control joints, expansion joints, raised walls, and roof separators. Membrane reinforcing ply to extend onto roof surface a minimum of 150 mm (6") and carry up the vertical surface to the upper leading edge (maximum of 18"). Base flashing fasteners more than the first two (2) rows are to receive a minimum 200 mm x 200 mm (8" x 8") cover patch of the same material. See sketch example (SK1).

.6 **Cap Ply Flashings:** After base ply flashings are complete, cap ply flashings to be laid in strips maximum 1 m wide and torch applied. Overlap 75 mm on sides and 150 mm onto flat roof area. Use chalk line to measure and neatly embed granules (where applicable) at overlay onto cap sheet.

.7 Stagger joints minimum 100 mm from joints in cap sheet, and minimum 300 mm from joints in base sheet flashings. Degranulate as required where other membrane work is to overlay granulated membrane surfaces.

3.11 Vent Flashings

.1 Install spun aluminum vent stack covers at all existing vent pipes. Extend existing vent pipes as required to a minimum height of 400 mm above the completed membrane surface. Extension to be same material as existing vent pipe. Provide sufficient allowance for pipe expansion or contraction.

.2 Prime aluminum flange, center over existing vent stack and set into torch softened base sheet. Flash with one (1) ply of reinforcing membrane, to extend a minimum of 200 mm beyond flange. Complete installation with the application of the cap sheet membrane.

3.12 Roof Drains

.1 Co-ordinate the roof drain installation with plumbing/mechanical works.

.2 Ensure the integrity of the vapour barrier is maintained, where applicable.

.3 Install base sheet, 1 ply of reinforcing membrane (180 gram/m^2, torch applied) 1.0 m x 1.0 m centered over the drain and then complete the cap sheet application over the first two plies. Extend the cap sheet under the clamping ring.

.4 Trim roofing membrane and set clamping ring.

3.13 Sacrificial Membrane

.1 Install sacrificial membrane at all locations as indicated and or required. All locations to be fully torch applied.

.2 Sacrificial membrane to be extended 75 mm (3") beyond protection matting in all directions

3.14 Free Standing Gas Pipe Supports

.1 Install free standing gas pipe supports where indicated on the drawings. Spacing will vary depending on pipe size. For spacing requirements see Mechanical specifications.

.2 Install sacrificial membrane, fully torch applied, at pipe support location. Place support on 19 mm protection mat/pad and adjust roller height to suit site condition. Install steel clamp to secure pipe to support.

3.15 Protection Mats

.1 19 mm rubber protection mats to be installed at all locations as indicated and or required.

.2 Protection mats to be installed in full size pieces (1.22 m x 1.8 m) and as per manufacturer's instructions. Leave a 25 mm (1") gap between pieces for expansion.

.3 Protection mats to be fully adhered in all locations with manufacturer approved adhesive.

3.16 Pavers

.1 Install pavers as detailed and where indicated on the drawings.

.2 Install sacrificial membrane, fully torch applied, at paver/protection mat locations. Place paver on 19 mm rubber protection mat and ensure pavers are level after installation.

3.17 Roof Top Mechanical Units

.1 Disconnect existing mechanical units and remove from structural support (i.e. curb, frame, stand, legs, posts or other) by means of crane. Store units in an appropriate manner

.2 **Build/install new roof curb detail, where indicated on project drawing(s). Top of all curbs to be a minimum of 400 mm above finished roof surface, as detailed.**

.3 To extend ductwork (where applicable), remove last piece of ductwork and replace with new piece. Fabricate new piece to proper shape and dimensions to suite new site conditions. See mechanical specifications

.4 Reinstall unit on curb and reconnect.

.5 Extend all gas and electrical services as required. See mechanical specifications.

3.18 Metal Flashings

.1 Metal flashings are specified in Section 07 62 00. Co-ordinate this work with that section.

3.19 Liquid Membrane

.1 Prepare surfaces as recommended by manufacturer; surfaces must be clean, dry, and free of dirt, dust, and particles.

.2 Apply a base coat of liquid membrane onto surfaces, 150 mm from joints. angles, or openings.

.3 Install reinforcing membrane on service conduit and onto vertical surface; notch reinforcing membrane to allow for better tie-in detail on vertical surface. Apply liquid membrane flashing membrane over reinforcing membrane.

.4 Install reinforcing membrane on vertical surface round service conduit and over previously installed reinforcing membrane. Apply liquid membrane flashing over second reinforcing membrane.

.5 Apply finish coat of liquid membrane over dry, previously applied liquid membrane.

.6 Apply liquid membrane flashing as recommended by the manufacturer, and following written instructions

3.20 Completion of Days Work

.1 Install a water tie-off at the edge of completed roofing work at the end of the day, to prevent water entry. Remove this completely at the start of the next days work. Inspect all exposed membrane to assure that it is left in a watertight condition overnight. Ensure that drainage is provided to prevent buildup of water on partially completed works.

.2 Provide a fire watch on the site, after torching work has been completed for the day, for at least 3 hours at the end of each day. Walk the entire day's production area to check for smoke and or hot spots using a hand-held infrared thermometer.

.3 Inspect all laps of the membrane application to ensure they are properly bonded. Repair any deficiencies prior to leaving the site for the day.

.4 Base sheet applications should not be left exposed overnight unless all seams are torch welded prior to leaving the work site.

3.21 Cleaning

.1 Upon completion of the work of this Section remove from the premises all surplus material, dirt and debris caused by the work of this Section and leave the installation clean.

.2 Clean any drips, spills and surplus material from adjacent surfaces and make good any damage caused by the work of this Section.

3.22 General

.1 Patching the cap sheet membrane to be carried out utilising patches with a minimum size of 450 mm x 100 mm.

.2 Minimum length of cap sheet on flat run of roof to not be less than 300 mm (12").

.3 Wrinkled or deformed ends of cap sheets rolls will not be tolerated and therefore, must be discarded prior to application.

.4 Following completion of new roofing, torch soften and apply a liberal application of approved bulk type mineral granules to cap sheet membrane edges where asphalt has extruded or flowed beyond clean lines and to all surface damage.

.5 Splices in delivered rolls of membrane are to be removed. Cut back the roll 450 mm on both sides of the splices and remove prior to installation.

SPECIAL CONDITIONS

SCOPE

1. Each Contractor/Tenderer must carefully examine the tender package (specifications & drawings) and each site of the proposed work. The Contractor / Tenderer is responsible to verify and confirm all dimensions, details and site conditions prior to submitting each tender bid. The contractor / tenderer may not claim, after submission of the tender bid, for any misinterpretations with respect to the conditions imposed by the Contract Documents or Design Drawings. Proposed extras for discrepancies between noted dimensions, square footages, detail measurements and quantities and actual site conditions will not be considered.

2. Where applicable, contractor may NOT proceed with ordering tapered insulation for the project prior to completing a full site evaluation complete with detailed measurements of all roof areas, drain locations and applicable details. This is to be completed at the contractor's own expense. Proposed extras for discrepancies between provided roof plans and detail locations and actual site conditions will not be considered.

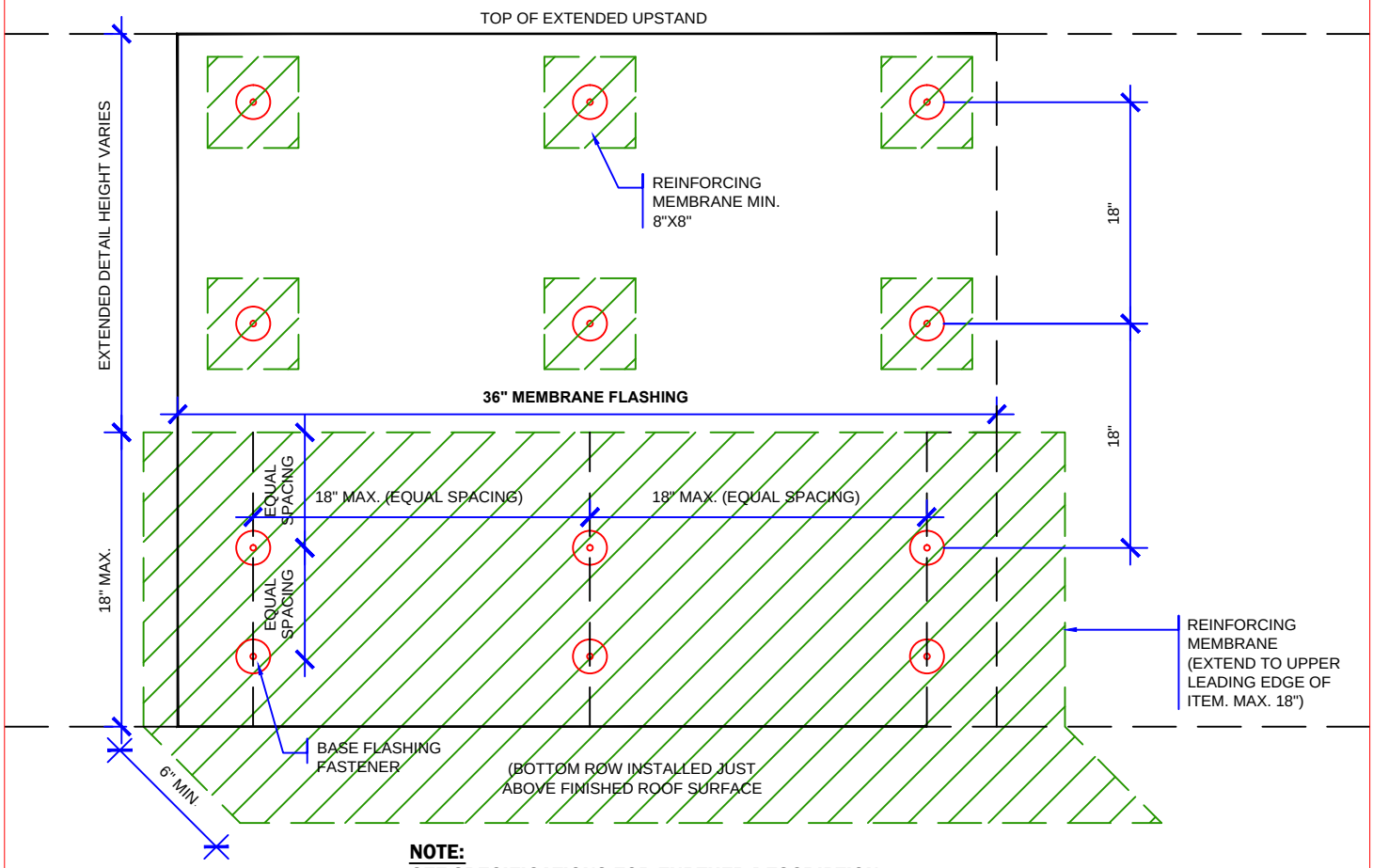
3. Prior to the installation of any granulated cap membrane, **Contractor must ensure the installation of the base flashing fasteners and reinforcing ply / strip is completed in all**

locations as directed above. Engineer must be provided a minimum of 48hrs. advanced notice from the Contractor to arrange a site review to confirm the applications. Contractor may not proceed with any granulated cap membrane applications without the approval to proceed from the project Engineer. Failure to comply with this directive will result in the removal and replacement of all required membrane layers as instructed. All required remedial works will be at the Contractor's sole expense

4. **Drain Flushing** - All existing and new roof drain locations within the contract roof areas and any additional roof area(s) used for mobilization, storage, and staging, are to be flushed and checked for positive drainage after completion of roofing works. Roofing Contractor to retain the services of a qualified sub-contractor specializing in this type of work. All required water for the flushing works is to be provided by the sub-contractor. The use of water from the work site is prohibited. Upon completion, sub-contractor to provide a detailed report, indicating all drains locations are flowing at maximum capacity and no blockages of any type remain. The Roofing Contractor to be fully responsible for the acts, performance and omissions of its sub-contractor and their employees or agents.

5. **Thermographic Analysis** – If leakage occurs and poor workmanship is noted during the roof replacement process, the Engineer may request a complete thermographic analysis of all contract roof areas. If requested, the Roofing Contractor is to retain the services of a qualified firm specializing in this type of analysis. Thermographic analysis to be followed with a detailed report, identifying all areas of concern. The Roofing Contractor to be fully responsible for these costs and the acts, performance and omissions of its chosen analysis firm.

END OF SECTION



NOTE:
SEE SPECIFICATIONS FOR FURTHER DESCRIPTION

SK1 - BASE FLASHING FASTENER DETAIL

Part 1 General

1.1 RELATED WORK SPECIFIED ELSEWHERE

.1 Section 06 10 00 - Rough Carpentry.

.2 Section 06 17 10 - Prefabricated Wood Trusses.

1.2 REFERENCES

.1 ASTM A123/A123M – 24, Specification for Zinc (Hot Galvanized) Coatings on Iron and Steel Products.

.2 ASTM A653/A653M - 23, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.3 CSA A123.3-05 (R2020), Asphalt or Tar Saturated Roofing Felt.

1.3 SAMPLES

.1 Submit 300 x 300 mm samples of each sheet metal material for review in accordance with Section 01 33 00 – Submittal Procedures.

1.4 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures which indicate arrangements of sheets and joints, types and locations of fasteners and special shapes and relationship of panels to structural frame.

Part 2 Products

2.1 SHEET METAL MATERIALS

.1 Zinc coated steel sheet: to ASTM A653/A653M, (G90), commercial quality, with Z275 coating, regular spangle surface, thickness as noted.

.2 Roof profile: “Prestige-16”, 24 gauge as manufactured by Vicwest with hidden fasteners. Final colour to later selection but to closely match existing roof colour on adjacent buildings. Approved alternate Agway Metals or Ideal Roofing on the proviso it meets the requirements of this section.

.3 Flashings & trim: same material and colour as for roof profile.

2.2 ACCESSORIES

.1 Isolation coating: alkali resistant bituminous paint.

.2 Underlayment: provide breathable synthetic roll underlayment membrane as indicated. Acceptable products: Deck-Armor by GAF or DiamondDeck by CertainTeed.

.3 Slip sheet: As per roofing manufacturer’s specification.

.4 Sealants: Tremco Dymeric 240 or approved alternate, compatible with specified roofing products.

.5 Cleats: of same material and temper as sheet metal, minimum 50mm wide. Thickness same as metal being secured.

.6 Closure strips: closed cell neoprene as indicated and prefinished sheet metal to match roofing.

.7 Fasteners: concealed type for roofing otherwise with colour matching head, stainless steel type.

.8 Washers: of same material as sheet metal, 1.6 mm thick with rubber packings.

.9 Touch-up paint: as recommend by sheet metal roofing manufacturer.

2.3 FABRICATION

.1 Fabricate sheet metal roofing as indicated and as detailed on reviewed shop drawings and in accordance with manufacturer's printed details. Where details differ with printed instructions, refer to Consultant for clarification and provide detail as directed.

.2 Provide required flashings, closures, clips, and sealants for a complete installation. Flashings noted on Drawings are to be deemed as minimum requirements. Provide any additional item necessary to obtain a weather tight installation.

.3 Provide complete weather seal between roofing and flashings.

.4 For all flashings hem exposed edges on underside 12 mm, mitre and seal.

.5 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.

.6 Protect metals against oxidization by backpainting with isolation coating where required.

Part 3 Execution

3.1 INSTALLATION

.1 Do sheet metal roofing and soffit in strict accordance with manufacturer's printed instructions and reviewed shop drawings.

.2 Use concealed fastenings except where approved by Consultant before installation.

.3 Provide underlay under sheet metal roofing. Secure in place and lap joints as per manufacturer's written specifications.

.4 Apply slip sheet as per manufacturer's written specifications.

.5 Install sheet metal roof panels using cleats spaced in accordance with reviewed shop drawings.

.6 Flash roof penetrations with material matching roof panels and make watertight.

.7 Form seams in direction of water-flow and make watertight.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 The Aluminum Association Inc. (AA).

.1 Aluminum Sheet Metal Work in Building Construction.

.2 AA DAF45, Designation System for Aluminum Finishes.

.2 American Society for Testing and Materials International (ASTM).

.1 ASTM A653/A653M-23, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 ASTM A792/A792M-23, Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.

.3 ASTM B32-20, Standard Specification for Solder Metal.

.4 ASTM B209/B209M-21a, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

.5 ASTM D1187/D1187M-97R24, Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal.

.3 Canadian Roofing Contractors Association (CRCA).

.1 CRCA Roofing Specifications Manual 2020.

.4 Canadian Standards Association (CSA Group).

.1 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.

.5 Sheet Metal and Air Conditioning Contractors' National Association Inc. (SMACNA).

.1 SMACNA 1120-2012 Architectural Sheet Metal Manual.

1.2 SAMPLES

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

.2 Submit duplicate 50 x 50 mm samples of each type of sheet metal material, colour and finish.

1.3 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 all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.

Part 2 Products

2.1 METAL MATERIALS

.1 Zinc Coated Steel Sheet: 0.61 mm thickness, commercial quality to ASTM A653/A653M, with Z275 designation zinc coating.

.2 Prefinished Sheet Steel: Metallic coated by the hot-dip process and 2-Coat fluoropolymer to AAMA 621.

.1 Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat.

.2 Prepare, pre-treat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

.3 Colours: Selected by Consultant from manufacturer's standard range, allow for three colours.

.3 Sheet Aluminum: ASTM B209/B209M, Aluminum Association alloy AA1100, minimum 1.22 mm thickness except otherwise indicated and required by design requirements.

.1 Finishes:

.1 Clear anodic for exterior exposed aluminum surfaces: AAMA AA A41 anodized to AAMA 611 and AA DAF-45, AA-M12C22A41, Class I, minimum 18 microns thickness.

2.2 ACCESSORIES

.1 Isolation coating: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

.2 Sealing compound: rubber asphalt type.

.3 Underlay for metal flashing: dry sheathing.

.4 Sealants: as specified in Section 07 92 00 - Joint Sealants.

.5 Cleats: Of same material, thickness, and temper as sheet metal flashing being secured, minimum 75 mm high.

.6 Fasteners: Of same material as sheet metal, to CSA B111, ring thread flat head roofing nails of length and thickness suitable for application.

.7 Washers: Of same material as sheet metal, 1 mm thick with rubber packings.

.8 Solder: Grade A to ASTM B32, approved brand of soldering flux for type of metal.

.9 Touch-up paint: as recommended by prefinished material manufacturer.

2.3 FABRICATION

.1 Fabricate metal flashings and other sheet metal work in accordance with applicable CRCA 'FL' series details, SMACNA's "Architectural Sheet Metal Manual," and as indicated.

.2 Fabricate aluminum flashings and other sheet aluminum work in accordance with AA-Aluminum Sheet Metal Work in Building Construction

.3 Form pieces in 2400 mm maximum lengths.

.1 Make allowance for expansion at joints.

.2 Underflash at joints.

.4 Hem exposed edges on underside 12 mm.

.1 Mitre and seal corners with sealant.

.5 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.

.6 Seams:

.1 Galvanized and Prefinished Steel: Fabricate non-moving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use.

.2 Aluminum: Fabricate non-moving seams with flat-lock seams. Form seams and seal with epoxy seam sealer.

.7 Apply isolation coating to metal surfaces to be embedded in concrete or mortar.

2.4 METAL FLASHINGS

.1 Form exposed flashings, drip edges, copings and fascias to profiles indicated from materials indicated:

.1 Prefinished Steel Sheet: Minimum 0.61 mm thick, base metal thickness

.2 Sheet Aluminum: Minimum 1.22 mm metal thickness.

.2 Form concealed flashings to profiles indicated of minimum 0.61 mm thick galvanized sheet steel.

2.5 PANS

.1 Form pans to receive sealing compound from 0.61 mm thick galvanized steel sheet metal with minimum 200 mm upstand above roof drains and continuous flanges with no open corners.

.1 Solder joints.

.2 Make pans minimum 50 mm wider than member passing through roof membrane.

Part 3 Execution

3.1 INSTALLATION

.1 Install sheet metal work in accordance with CRCA FL series details, SMACNA's "Architectural Sheet Metal Manual," and as indicated.

.2 Use concealed fastenings except where approved before installation.

.3 Provide underlay under metal flashings.

.1 Secure in place and lap joints 100 mm.

.4 Counterflash bituminous flashings at intersections of roof with vertical surfaces and curbs.

.1 Flash joints using S-lock forming tight fit over hook strips.

.5 Lock end joints and caulk with sealant.

.6 Metal protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by SMACNA.

.1 Coat back side of uncoated aluminum sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.

.2 Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install course of underlayment and cover with slip sheet.

.1 Secure in place and lap joints 100 mm.

.7 Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.

.1 Space movement joints at a maximum of 3 m with no joints allowed within of corner or intersection.

.2 Where lapped expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 25 mm deep, filled with sealant concealed within joints.

.8 Soldered Joints:

.1 Do not solder metallic-coated steel and aluminum sheet.

.2 Do not use torches for soldering.

.3 Clean surfaces to be soldered, removing oils and foreign matter.

.4 Pre-tin edges of sheets to be soldered to width of 38 mm, except reduce pre-tinning where pre-tinned surface would show in completed Work.

.5 Heat surfaces to receive solder and flow solder into joint.

.6 Fill joint completely.

.7 Completely remove flux and spatter from exposed surfaces.

.9 Copings: Anchor to resist uplift and outward forces according to recommendations in SMACNA's "Architectural Sheet Metal Manual" and as indicated.

.1 Interlock exterior and interior leg with continuous cleat anchored to substrate at 75 mm centers.

.10 Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum 100 mm over base flashing.

.1 Install stainless-steel draw band and tighten.

.11 Install pans, where shown around items projecting through roof membrane.

.1 Fill pans with sealing compound.

3.2 CLEANING AND PROTECTION

.1 Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

.2 Clean and neutralize flux materials.

.3 Clean off excess solder.

.4 Clean off excess sealants.

.5 Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer’s written installation instructions.

.6 On completion of installation, remove unused materials and clean finished surfaces.

.7 Maintain in a clean condition during construction.

.8 Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Roof hatches, ladder safety posts, and their components.

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM).

.1 ASTM A506-16R21, Standard Specification for Alloy and Structural Alloy Steel, Sheet and Strip, Hot-Rolled and Cold-Rolled.

.2 ASTM A36/A36M-19, Standard Specification for Carbon Structural Steel.

.2 Underwriters Laboratories (UL).

.1 UL 2761-2011, Sustainability for Sealants and Caulking Compounds, Edition 1.

1.3 SYSTEM DESCRIPTION

.1 Design Requirements:

.1 Roof hatches to withstand snow load indicated on Structural drawings with a maximum deflection of 1/150th of the span and operation of the cover shall not be affected by temperature variation without damage to unit or permanent deformation to seals.

1.4 SUBMITTALS

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

.2 Product data: submit manufacturer's printed product literature, specifications and data sheets for each product listed in Part 2.

.3 Shop Drawings:

.1 Indicate size and description of components, materials, attachment devices, description of frame and finish, and project specific construction details.

.4 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions.

1.5 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for hardware complete with pertinent details, spare parts lists and warnings against harmful maintenance materials and practices for incorporation into manual specified in 01 78 00 - Closeout Submittals.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Collect and separate waste materials for recycle or disposal in accordance with Section 01 74 20 – Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 MANUFACTURERS

.1 Acceptable manufacturers include:

.1 The Bilco Company, Type E 914 x 914 mm roof hatch.

.2 Babcock-Davis, Type B-RHG3636 roof hatch.

.3 Maxam Metal products, Steel Curbed Roof Hatch, Model RHS-2 Insulated

2.2 MATERIALS

.1 Steel sheet: regular quality alloy steel to ASTM A506.

.2 Cover: brakeformed, hollow-metal design with 25 mm concealed fiberglass insulation, 76 mm beaded, overlapping flange, fully welded at corners, and internally reinforced for 195 kg/m2 live load.

.3 Curb: 305 mm in height with integral cap flashing, 25 mm fiberboard insulation, fully welded at corners, and 89 mm mounting flange with 11 mm provided for securing frame to the roof deck.

.4 Gasket: extruded EPDM rubber gasket permanently adhered to cover, with full recovery after 50% compression.

.5 Hinges: heavy-duty pintle hinges with 9 mm Type 316 stainless steel hinge pins.

.6 Latch: slam latch with interior and exterior turn handles and padlocks hasps, with hold open operating arm and vinyl grip handle to permit one handed operation.

.7 Lift assistance: compression spring operators enclosed in telescopic tubes. Automatic hold-open arm with grip handle release.

.8 Finish: stainless steel Type 304 with mill finish and electrochemical passivation of welds.

.9 Sealing compound: to UL 2761, rubber asphalt type. Refer also to Section 07 92 00 – Joint Sealants.

.10 Hardware: all hardware for roof hatch components to be stainless steel type 316.

2.3 ACCESSORIES

.1 Fasteners: to manufacturer's standard, for curb to structure and for hatch lip frame to outer attachment.

.2 Safety Post: provide two posts per ladder, one per stringer.

.1 High strength square steel tubing.

.2 Post permanently mounted to fixed ladder, providing positive hand-hold enabling user to enter or exit access door in an upright and balanced position.

.3 Telescoping tubular steel section locking automatically when fully extended.

.4 Upward and downward movement controlled by a stainless steel spring balancing mechanism.

.5 Unit complete with adjustable fasteners for attachment to top two rungs of ladder below roof hatch.

.1 Hardware: Stainless steel type 316.

.6 Finish: Yellow powder coat.

.3 Safety Railing: provide at exterior of roof hatch, Bilco's Bil-Guard 2.0 roof hatch safety railing system.

2.4 FABRICATION

.1 Fabricate components free of twists, bends, or visual distortion and insulated.

.2 Weld corners and joints.

.3 Assemble roof hatch components as indicated.

.4 Ensure continuity of weather-tight seal.

.5 Design flashings to collect and lead off accumulated condensation.

.6 Zinc plate hardware and attachments and shop prime ready for field painting.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 INSTALLATION

.1 Erect components plumb, level and in proper alignment.

.2 Ensure continuity of building envelope air barrier and vapour retarder systems.

.1 Set deck flange in continuous bed of sealing compound on roof vapour retarder.

.3 Adjust and seal assembly with provision for expansion and contraction of components.

.4 Secure prefabricated curb assembly to curb.

.5 Coat aluminum and copper in contact with dissimilar materials, with isolation coating.

.6 Fasten safety posts securely and ensure safe, smooth, easy, controlled operation when raising and lowering post.

3.3 CLEANING

.1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 - General

1.1 Section Includes

.1 Supply and installation of roof accessories, including:
- .1 Architectural roof supports.
- .2 Preformed associated metal flashings.

1.2 Related Sections

.1 Section 03 05 10 – Cast-in-Place Concrete.

.2 Section 05 31 00 – Metal Deck.

.3 Section 06 10 00 – Rough Carpentry.

.4 Section 07 52 00 – Modified Bituminous Membrane Roofing.

.5 Section 07 92 00 – Joint Sealants.

1.3 References

.1 The work of this Section to conform to:
- .1 CSA B272-93 R2000) – Prefabricated Self-Sealing Roof Vent Flashings.
- .2 CRCA (Canadian Roofing Contractor's Association).
- .3 SPRI (Single Ply Roofing Institute).
- .4 CUFCA (Canadian Urethane Foam Contractor's Association).
- .5 CSA G40.20/G40.21-13 (R2023), General Requirements for Rolled or Welded Structural Quality Steel / Structural Quality Steel.
- .6 CSA W47.1:19 (R2024), Certification of Companies for Fusion Welding of Steel.
- .7 CSA W59:24, Welded Steel Construction.
- .8 CSA G164-18 (R2023), Hot Dip Galvanizing of Irregularly Shaped Articles.

.2 The work of this Section to conform to:
- .1 NRCA (National Roofing Contractor's Association).
- .2 ASTM C1029-25, Standard Specification for Spray-Applied Rigid Cellular Polyurethane Thermal Insulation.
- .3 ASTM D3963/D3963M-21, Standard Specification for Fabrication and Jobsite Handling of Epoxy-Coated Steel Reinforcing Bars.
- .4 ASTM A36/A36M-19, Standard Specification for Carbon Structural Steel.
- .5 ASTM A123/A123M-24, Standard Specification for Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products.
- .6 ASTM F2674-07, Standard Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners [Metric].

1.4 Submittals

.1 Manufacturer's descriptive literature for each product, including section or other type details.

.2 Manufacturer's written installation instructions.

.3 Shop drawings and samples, when required, in accordance with Section 01 33 00 – Submittal Procedures.

.4 All shop drawings for products identified under this Section to be stamped by a professional engineer licensed in the Province of Ontario.

1.5 Quality Assurance

.1 Roof accessories manufacturer to have minimum 5 years documented experience in the design and fabrication of roofing specialties and accessories.

1.6 Special Warranty

.1 Warrant products installed under this section of work to be free of leaks, condensation and defects in materials and/or manufacture for a period of 20 years when installed in accordance with the manufacturer's written instructions.

Part 2 – Products

2.1 Manufacturer

.1 Provide products as manufactured by Thaler Metal Industries, 1-800-387-7217 Mississauga, Ontario, Canada or provide equal products by another manufacturer approved in advance by the Architect, based upon:

.1 20 year warranty against leaks, condensation and defects in material and/or manufacture, as applicable;
.2 compliance with CSA B272-93 (Prefabricated Self-Sealing Roof Vent Flashings);
.3 air barrier design using EPDM seals only;
.4 maintenance free design;
.5 materials and sizes options, and thicknesses;
.6 injection molded urethane insulation to ASTM C1029-90, as applicable;
.7 treated flashing deck flange, as applicable;
.8 written installation instructions.

2.2 Manufactured Units

.1 Bottom of Stair Stringers Support: **Thaler model ARS-510-2-N/S** (refer to structural and architectural drawings for connection). Stack Jack Flashing urethane insulated, refer to details for height of sleeve, stainless steel. Provide for all accessories including but not limited to: ladder lugs, nuts and bolts, steel cap, stainless steel stud and base, EPDM flashing deck seals and flange, etc. Provide custom angle top of Thaler support to U/S of stringer to match angle of stair stringer. Provide for each stair stringer.

.2 Pipe Penetrations: **Thaler model MEF-3A** for all pipe penetrations as denoted on the drawings. Refer to enlarged pipe penetration detail for flashings, insulation, heights, sleeves, etc. For pipe penetrations less than 76mm diameter, provide Thaler model MEF as required to fit pipe, suited to fit all necessary flashings, insulation, sleeves, etc. Refer to mechanical and electrical drawings for exact height, locations and quantites required.

.3 Parapet Ladder Supports: **Thaler model ARS-550-2-N/S**. Provide all accessories including but not limited to: support plate, stainless steel stud, HSS and base plate, EPDM Deck flange, stack jack flashing urethane insulated, refer to details for height, 22 ga. Type 304 stainless steel. Co-ordinate with Parapet ladder installer/supplier with exact height, locations. Provide two (2 of) supports for each ladder.

.4 Fall Arrest Support: **Thaler model FARA - 11**. Provide all accessories including but not limited to: support plate, stainless steel stud, HSS and base plate, EPDM Deck flange, stack jack flashing urethane insulated, refer to details for height, 22 ga. Type 304 stainless steel. Co-ordinate with installer/supplier with exact height, locations. Provide nine (9 of) supports.

Part 3 – Execution

3.1 Examination

.1 Report to the Contractor in writing, defects of work prepared by other trades and other unsatisfactory site conditions. Verify site dimensions. Commencement of Work will imply acceptance of prepared work.

3.2 Preparation

.1 For retrofit work, remove existing roof assembly as necessary to allow for installation of supports.

.2 In the event of structural deficiencies, deck corrosion or deterioration, ensure that a structural engineer has assessed and approved all surfaces upon which the work of this Section depends. Institute repairs and/or reinforcement where necessary.

.3 If necessary, protect building interior and contents against ingression of water, dust, debris or other deleterious material.

3.3 Installation

.1 Roof Supports

.1 Install supports in accordance with manufacturer's printed instructions, shop drawings and as specified.

.2 Ensure supports are installed under the direct supervision of a Professional Engineer and Roofing Engineer.

.3 Where necessary, provide protection against deterioration due to contact of dissimilar materials.

.4 Ensure work is inspected prior to application of roofing.

.2 Flashing

.1 Install roof support flashing in accordance with

manufacturer's printed instructions.

.2 Set flashing deck flange in layer of plastic cement and flash in with 3 overlapping layers of felt flashing.

.3 Torch membrane until bitumen is fluid and set flashing deck flange into fluid. Flash in flange with two overlapping layers of ModBit and seal with asphalt sealer. Do not overheat Base Seal.

.4 Set deck flange in layer of membrane adhesive and extend single ply up sleeve to highest elevation possible and clamp membrane to STACKJACK Flashing.

.5 Set deck flange in layer of membrane adhesive and extend single ply up sleeve to highest elevation possible and clamp membrane to flashing. Weld roofing to deck flange.

3.4 Field Quality Control

.1 Comply with the requirements of Section 01 45 00 - Quality Control.

3.5 Adjusting

.1 Verify that all manufactured units have been installed in accordance with specifications and details and will function as intended. Adjust any items where necessary to ensure proper operation.

3.6 Cleaning

.1 Clean manufactured units using materials and methods approved by manufacturer. Do not use cleaners or techniques which could impair performance of the roofing system.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 04 22 00 – Unit Masonry.

.2 Section 07 92 00 – Joint Sealants.

.3 Section 09 21 16 – Gypsum Board Assemblies.

.4 Division 21 through 28 – Facilities Services.

1.2 REFERENCE STANDARDS

.1 American Society for Testing and Materials (ASTM).

.1 ASTM E2174-24, Standard Practice for On-site Inspection of Installed Firestop Systems.

.2 ASTM E2393-24, Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers.

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS).

.1 Safety Data Sheets (SDS).

.3 National Research Council Canada (NRC).

.1 National Building Code of Canada 2020 (NBCC).

.2 NRCC-49677. June 2007. Best Practice Guide on FireStops and Fire Blocks and their Impact on Sound Transmission.

.4 Underwriters Laboratories of Canada (ULC).

.1 CAN/ULC-S101-14-EN, Standard Methods of Fire Endurance Tests of Building Construction and Materials.

.2 CAN/ULC-S102:2018, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.3 CAN/ULC-S115:2023, Standard Method of Fire Tests of Firestop Systems.

.1 Underwriters Laboratories of Canada (ULC) of Scarborough runs CAN/ULC-S115:2023 under their designation of ULC-S115:2023 and publishes the results in their "FIRE RESISTANCE RATINGS DIRECTORY" that is updated annually.

.5 International Firestop Council (IFC).

.1 Recommended IFC Guidelines for Evaluating Firestop System Engineering Judgments.

.2 Recommended IFC Guidelines for Evaluating Firestop System Engineering Judgments - Perimeter Fire Barrier Systems.

.3 Inspection Guidelines for Through-Penetration Firestops, Fire resistant Joint Systems, Perimeter Fire Barriers, and Duct Enclosures - 5th Edition.

.6 Green Globes Canada.

.1 Green Globes for New Construction. Technical Manual 2015.

1.3 DEFINITIONS

.1 Firestop Material: material or combination of materials used to retain integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke, and hot gases through penetrations in, or construction joints between fire rated wall and floor assemblies.

.2 Through-penetration: opening or foreign material, pipes, conduits, ducts, cable trays, cable, wire, structural components or any other element passing completely through an

opening in a fire rated barrier/assembly such that the full thickness of the rated material is breached either in total or in part.

.3 Membrane penetration: any penetration of a fire rated barrier that breaches one side but does not pass completely through to the other side, including recessed electrical devices.

.4 Fire resistive joint: any joint or opening, whether static or dynamic, within or between adjacent sections of fire rated interior or exterior walls, floors, ceilings or roof decks.

.5 Fireblocking: building materials installed to resist the free passage of flame, smoke and noxious gases to other areas of the building through concealed spaces.

.6 Intumescent: materials that expand with that to seal around objects threatened by fire.

.7 F-rating: the time a firestop, penetrating item, building, material, firestop material, can withstand direct flame without a burn through as tested to CAN/ULC-S115.

.8 T-Rating: the amount of time a through-penetration firestop limits the temperature rise on the cold side-outside the test furnace as tested to CAN/ULC-S115.

.9 Non-rated fire separations: a separation that prevents the passage of fire and smoke for time that allows the fire suppression system to be activated and contain the fire. For this project, all non-rated fire separations as indicated on drawings to be assigned a minimum time of 60 minutes fire resistance rating and to be firestopped on both sides of the fire separation.

.10 Single Component Firestop System: firestop material that has Listed Systems Design and is used individually without use of high temperature insulation or other materials to create firestop system.

.11 Multiple Component Firestop System: exact group of firestop materials that are identified within Listed Systems Design to create on site firestop system.

.12 Tightly Fitted; (ref: NBC Division B Part 3.1.9.1(1) and 9.10.9.6(1)): penetrating items that are cast in place in buildings of non-combustible construction or have 0 annular space in buildings of combustible construction.

.1 Words tightly fitted should ensure that integrity of fire separation is such that it prevents passage of smoke and hot gases to unexposed side of fire separation.

1.4 SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer s printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit only the most current literature that has been updated by the manufacturer on a regular basis. Submit only literature that includes a date less than 24 months old.

.3 Submit manufacturer’s printed product data sheets. Submit complete product data sheet for each individual component. Provide a comprehensive list and indicate the following properties for each component:

.1 Product name and product number.

.2 Product characteristics and performance criteria.

.3 Physical size, finish and limitations.

.4 Technical data on out-gassing, off-gassing and age testing.

.5 Curing time.

.6 Chemical compatibility to other construction materials.

.7 Shelf life. Include expiry date.

.8 Life expectancy.

.9 Temperature range for installation.

.10 Humidity range for installation.

.4 Submit copies of WHMIS SDS - Safety Data Sheets.

.5 Submit Product Data in accordance with Green Globes Material Declaration form as contained in the GG Technical Manual.

.3 Manufacturer's engineering judgment identification number and drawing details when no ULC or cUL system is available for an application. Engineering judgment to include both project name and Contractor's name who will install firestop system as described in drawing.

.4 Shop Drawings:

.1 Submit shop drawings to show location, proposed material, reinforcement, anchorage, fastenings and method of installation.

.2 Construction details should accurately reflect actual job conditions.

.3 Submit design system listings.

.1 Indicate proposed material, including technical data, reinforcement, anchorage, fastenings and method of installation. Construction details to accurately reflect actual job conditions.

.2 Provide CAN/ULC-S115 design system listings on each system for each application for each area as indicated.

.3 When more than one product is specified for the firestop design listing system or more than one backing/damning material is indicated, identify the item that will be used on this project.

.5 Samples:

.1 Submit duplicate samples showing actual firestop material(s) proposed for the project in un-opened containers.

.2 Include all anchors / fasteners and damming material. Select samples from the same batches and production runs of products that will be used on-site. Identify each product indicating the shelf life and expiry date.

.6 Quality assurance submittals: submit following in accordance with Section 01 45 00 - Quality Control.

.1 Test reports: in accordance with CAN/ULC-S101 for fire endurance and CAN/ ULC-S102 for surface burning characteristics.

.1 Submit certified test reports from approved independent testing laboratories, indicating compliance of applied firestopping with specifications for specified performance characteristics and physical properties.

.2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.1 Submit certification by the manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOC's) and are non-toxic to building occupants.

.3 Manufacturer's Instructions: submit manufacturer s installation instructions and special handling criteria, installation sequence, and cleaning procedures.

.4 Manufacturer s Field Reports: submit to manufacturer s written reports within 3 days of review, verifying compliance of Work, as described in PART 3 - FIELD QUALITY CONTROL.

1.5 RECORD DOCUMENTATION

.1 Submit as-built records in accordance with Section 01 78 390 - Project Record Documents.

.2 Maintain a daily log of all activities on site during construction. Provide a copy of all daily logs at completion of firestopping work.

.3 Provide a copy of as-built drawings, project manual, schedules and firestop details.

.4 Mark up the drawings, schedules and details weekly, showing all alterations, changes and confirmation of each design listing in relationship to the project schedules.

.5 Provide completed firestopping schedules for floors, walls and ceilings.

.6 Indicate all service penetrations or joints through each reference wall, floor and ceiling in the schedules. Record all information. Indicate all required descriptions for each column based on the actual on-site condition. Submit schedules to PMT at the end of the project for maintenance use.

1.6 OPERATION AND MAINTENANCE MATERIALS

.1 Submit Operation and Maintenance products and records and incorporate the following materials:

.1 Safety Data Sheets (SDS).

.2 Product literature of each product used on this project.

.3 Approved design listings and Engineer Judgments.

.4 Matrix schedule indicating all design listings and Engineer Judgments and matching them to the penetration or joint type. Included in this schedule to be a quantity of each design listing / EJ on each floor.

1.7 ENGINEERING JUDGMENTS (EJ)

.1 Where there are no specific tested design system listings available from the manufacturer for a firestop configuration, review systems from all other manufacturers to attempt to obtain a design system listing.

.2 Include in each EJ, a drawing of the proposed system, a description of the system, project name and room name including the room number that the EJ is located in. Include copies of all referenced design listings and signed and dated by the manufacturer’s fire protection engineer. Once the EJ has been reviewed, submit the EJ to the Authority Having Jurisdiction for final approval.

.3 EJ to be issued only by firestop manufacturer’s qualified technical personnel or in concert with the manufacturer, by a knowledgeable registered Professional Engineer, or fire protection engineer, or an independent testing agency that provides listing services for firestop systems.

.4 EJ to be based upon interpolations of previously tested firestop systems that are either sufficiently similar in nature or clearly bracket the conditions upon which the Engineering Judgment is to be given. Additional knowledge and technical interpretations based upon accepted engineering principles, fire science and fire testing guidelines (e.g. ASTM E2032) may also be used as further support data.

.5 EJ to be based upon full knowledge of the elements of the construction to be protected and understanding of the probable behaviour of that construction and the recommended firestop system protecting it were they to be subjected to the appropriate firestop standard fire test method for the required fire rating duration.

.6 EJ to be limited to the specific conditions and configurations upon which the Engineering Judgment was rendered and should be based upon reasonable performance expectations for the recommended firestop system under those conditions.

.7 EJ to be accepted only for a single specific job and location and should not be transferred to any other job or location without thorough and appropriate review of all aspects of the next job or location's circumstances.

1.8 QUALITY ASSURANCE

.1 Qualifications:

.1 Installer: company specializing in firestopping installations approved by manufacturer with not less than 5 years documented experience.

.2 Installation Responsibility: the procurement of through-penetration firestop systems and fire-resistive joint systems on this project to be from a single sole source firestop specialty manufacturer.

.3 The work is to be installed by a Contractor with at least one of the following qualifications:

.1 FM 4991 approved Contractor.

.2 ULC approved Contractor.

.3 Hilti accredited firestop specialty Contractor.

.2 Pre-Installation Meetings: convene pre-installation meeting one week before beginning work of this Section with Owner, Consultant, and manufacturer's representative to:

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Co-ordination with other building subtrades.

.4 Review manufacturer's installation instructions and warranty requirements.

.3 Site Meetings: as part of Manufacturer s Services described in PART 3 - FIELD QUALITY CONTROL, schedule site visits, to review Work, at stages listed.

.1 After delivery and storage of products, and when preparatory Work is complete, but before installation begins.

.2 Twice during progress of Work at 25% and 60% complete.

.3 Upon completion of Work, after cleaning is carried out.

1.9 DELIVERY, STORAGE AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle 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 the site in undamaged condition and in original unopened containers, marked to indicate brand name, manufacturer, ULC markings.

.2 Storage and Protection:

.1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Replace defective or damaged materials with new.

.3 Waste Management and Disposal:

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

1.10 PROJECT CONDITIONS

.1 Do not use materials that contain flammable solvents.

.1 Schedule installation of firestopping materials after completion of penetrating item installation but before covering or concealing of openings.

.2 Schedule installation of preformed joint materials to be installed with the metal framing.

.2 Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.

.3 Weather conditions: Do not proceed with installation of firestop materials when temperatures exceed the manufacturer's recommended limitations for installation printed on product label and product data sheet.

.4 During installation, provide masking and drop cloths to prevent firestopping materials from contaminating any adjacent surfaces.

1.11 WARRANTY

.1 For the Work of this Section, the 12 months warranty period is extended to 24 months.

.2 Manufacturers to warrant work of this Section against defects and deficiencies in the product material for a period of 24 months. Promptly correct any defects or deficiencies, which become apparent within warranty period at no expense.

.3 Fire and smoke stop system. Contractor hereby warrants workmanship on material and installation for period of 24 months. Promptly correct any defects or deficiencies which become apparent within warranty period at no expense.

Part 2 Products

2.1 PERFORMANCE REQUIREMENTS

.1 Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by the firestopping manufacturer based on testing and field experience.

.2 Provide components for each firestopping system that are needed to install fill material. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.

.3 Provide a round fire-rated cable management device whenever cables penetrate fire rated walls, where frequent cable changes and additions may occur. The fire-rated cable management device to consist of a corrugated steel tube with zinc coating, contain an inner plastic housing, intumescent material rings, and inner fabric smoke seal membrane. The length of the sleeve to be 305 mm. The fire-rated cable management device to contain integrated intumescent firestop wrap strip materials enough to maintain the hourly rating of the barrier being penetrated. The fire-rated cable management device to contain a smoke seal fabric membrane or intumescent firestop plugs enough to achieve the L-Rating requirements of the barrier type. Install device per the manufacturer’s published installation instructions.

.4 Penetrations in Fire Resistance Rated Walls: Provide firestopping with ratings determined in accordance with CAN/ULC-S115 as indicated below:

Fire Resistance Rating of Separation	Required ULC or cUL “F” Rating of Firestopping Assembly
30 minutes	20 minutes

45 minutes	45 minutes
1 hour	45 minutes
1.5 hours	1 hour
2 hours	1.5 hours

.5 For combustible pipe penetrations through a Fire Separation provide a firestop system with a "F" Rating as determined by ULC or cUL which is equal to the fire resistance rating of the construction being penetrated.

.6 Penetrations in Horizontal Assemblies: Provide firestopping with ratings determined in accordance with CAN/ULC-S115. For penetrations through a Fire Wall or horizontal Fire Separation provide a firestop system with a "FT" Rating as determined by ULC or cUL which is equal to the fire resistance rating of the construction being penetrated.

.1 W-Rating: Class 1 rating in accordance with water leakage test per CAN/ULC-S115.

.7 Provide a firestop system with an assembly rating as determined by CAN/ULC-S115 which is equal to the time rating of construction joint assembly.

.8 Penetrations in smoke barriers: Provide firestopping with ratings determined in accordance with CAN/ULC-S115.

.1 L-Rating: Not exceeding 5.0 cfm / square feet of penetration opening at both ambient and elevated temperatures.

.9 Mold Resistance: Provide penetration firestopping with mold and mildew resistance rating of 0 as determined by ASTM G21.

2.2 ACCEPTABLE MANUFACTURERS

.1 Subject to compliance with through penetration firestop systems and joint systems listed in the ULC Fire Resistance Directory – Volume III or UL Products Certified for Canada (cUL) Directory, provide products of the following manufacturers as identified below:

.1 Basis of Design: Hilti (Canada) Corporation, Mississauga, Ontario.
.2 AD Fire Protection Systems Inc.
.3 3M Fire Protection Products.
.4 Tremco Firestop Systems.

.2 Substitution requests will be considered in accordance with requirements of this Section.

2.3 MATERIALS

.1 Use only firestop products that have been ULC or cUL tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.

.2 Accessories: provide components for each firestopping and smoke seal systems that are needed to install fill materials. Use only components specified by firestopping material manufacturer and approved by the qualified testing agency. Accessories include, but are not limited to, the following items:

.1 Permanent forming, damming, and backing material.
.2 Temporary forming material.

.3 Acceptable Hilti pre-formed firestop devices for use with non-combustible and combustible pipes (closed and open systems), conduit and cable bundles penetrating gypsum walls:

.1 Tub Box Kit (CP 681) for use with tub installations.
.2 Speed Sleeve (CP 653) for use with cable penetrations.
.3 Firestop Drop-In Device (CFS-DID) for use with non-combustible and combustible penetrants.
.4 Firestop Block (CFS-BL).

.4 Acceptable Hilti sealants or caulking materials for use with non-combustible items including steel pipe, copper pipe, rigid steel conduit, electrical metallic tubing (EMT), and sheet metal ducts:

.1 Intumescent Firestop Sealant (FS-ONE MAX).
.2 Fire Foam (CP 620)/CP 660.
.3 Flexible Firestop Sealant (CP 606).
.4 Firestop Silicone Sealant Gun Grade (CFS-S SIL GG).

.5 Acceptable Hilti sealants, sprays, or pre-formed materials for use with fire-rated construction joints and other gaps:

.1 Top Track Seal (CFS-TTS).
.2 Top Track Seal for Metal deck (CFS-TTS MD).
.3 Firestop Joint Spray (CFS-SP WB).
.4 Firestop Silicone Joint Spray (CFS-SP SIL).
.5 Flexible Firestop Sealant (CP 606).
.6 Firestop Silicone Sealant Gun Grade (CFS-S SIL GG).
.7 Bottom of Wall sealant (CP 605).

.6 Acceptable Hilti pre-formed mineral wool designed to fit flutes of metal profile deck; as a backer for spray material:

.1 Speed Plugs (CP 777).
.2 Speed Strips (CP 767).

.7 Acceptable Hilti non-curing, re-penetrable intumescent putty or foam materials for use with flexible cable or cable bundles:

.1 Firestop Putty Stick (CP 618).
.2 Firestop Plug (CFS-PL).

.8 Acceptable Hilti wall opening protective materials for use with cUL. / ULC listed metallic and specified non-metallic outlet boxes:

.1 Firestop Putty Pad (CP 617).
.2 Firestop Box Insert.

.9 Acceptable Hilti sealants or caulking materials used for openings between structurally separate sections of wall and floors:

.1 Firestop Joint Spray (CFS-SP WB).
.2 Flexible Firestop Sealant (CP 606).
.3 Firestop Silicone Sealant Gun Grade (CFS-S SIL GG).
.4 Firestop Silicone Sealant Self Leveling (CFS-S SIL SL).

.10 Acceptable Hilti product for single or cable bundles up to 25 mm diametre penetrating gypsum, masonry, concrete walls or wood floor assemblies: CFS-D Firestop Cable Disk.

.11 Acceptable Hilti product for joints and penetrations in non-rated fire separations:

.1 CP 506 Smoke and Acoustic sealant.
.2 CP 572 Smoke and Acoustic Spray.

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 EXAMINATION

.1 Verify substrate conditions are acceptable for product installation in accordance with manufacturer's instructions and approved design system listings for each condition.

.2 Verify that all joints, service penetrating elements and supporting devices / hangers have been properly installed as indicated on approved design listings. All temporary lines and markings have been removed to meet the approved design system listings for each condition has been identified.

.3 Verify that the proposed firestopping system is composed of components that are compatible with each other, the substrates forming the openings, and the items, if any, penetrating the firestopping under conditions of application and service, as demonstrated by firestopping manufacturer based on testing and field experience.

.4 Ensure no additional items have been installed through opening that does not appear on the approved design listing.

.5 Ensure areas that are to be firestopped are accessible for proper installation and inspection.

.6 Report in writing to the Consultant any defective surfaces or conditions affecting the firestop system installation, immediately and before commencing any installations.

.7 Proceed only when defected surfaces or conditions have been corrected. Beginning of installation means acceptance of site conditions.

3.3 PREPARATION

.1 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials.

.1 Ensure that substrates and surfaces are clean, dry and frost free.

.2 Prepare surfaces in contact with firestopping materials and smoke seals to manufacturer's instructions.

.3 Maintain insulation around pipes and ducts penetrating fire separation.

.4 Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.

.5 Do not proceed until unsatisfactory conditions have been corrected.

.6 Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.

3.4 COORDINATION

.1 Coordinate construction of openings, penetrations and construction joints to ensure that the firestop systems are installed according to specified requirements.

.2 Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems. Coordinate construction and sizing of joints to ensure that fire-resistive joint systems are installed according to specified requirements.

.3 Coordinate firestopping with other trades so that obstructions are not placed in the way before the installation of the firestop systems.

.4 Do not cover up through-penetration firestop and joint system installations that will become concealed behind other construction until each installation has been examined by the building inspector.

3.5 INSTALLATION

.1 Regulatory Requirements: Install firestop materials in accordance with ULC Fire Resistance Directory or UL Products Certified for Canada (cUL) Directory or Omega Point Laboratories Directory.

.2 Install firestopping and smoke seal material and components in accordance with manufacturer's certified tested system listing.

.3 Seal holes or voids made by through penetrations, poke-through termination devices, and unpenetrated openings or joints to ensure continuity and integrity of fire separation are maintained.

.4 Provide temporary forming as required and remove forming only after materials have gained enough strength and after initial curing.

.5 Tool or trowel exposed surfaces to neat finish.

.6 Remove excess compound promptly as work progresses and upon completion.

3.6 SEQUENCES OF OPERATION

.1 Proceed with installation only when submittals have been reviewed by Consultant.

.2 Install floor firestopping before interior partition erections.

.3 Deck bonding: firestopping to precede spray applied fireproofing to ensure required bonding.

.4 Mechanical pipe insulation: certified firestop system component.

.1 Ensure pipe insulation installation precedes firestopping.

3.7 REPAIRS AND MODIFICATIONS

.1 Identify damaged or re-entered seals requiring repair or modification.

.2 Remove loose or damaged materials. Where penetrating items are to be added, remove enough material to insert new elements. Cause no damage to the balance of the seal.

.3 Ensure that surfaces to be sealed are clean and dry. Install materials in accordance with specified installation requirements herein. Use only materials approved by manufacturer as suitable for repair of original seal. Do not mix different manufacturer's products.

.4 Repair all damage resulting from firestop destructive testing.

3.8 FIELD QUALITY CONTROL

.1 Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas.

.2 Keep areas of work accessible until inspection by applicable Code authorities.

.3 Inspection of through-penetration firestopping to be performed in accordance with ASTM E2174 and ASTM E2393.

.4 Perform under this Section patching and repairing of firestopping caused by cutting or penetrating of existing firestop systems already installed by other trades.

.5 Manufacturer's Field Services: The manufacturer's representative to be present during the first installation of every first firestop system. The manufacturer's technical

representative to provide periodic walk-through. After every site visit the manufacturer's technical representative to submit site reports to indicate application reviewed, location and installer. Contractor to submit site reports by manufacturer to Consultant within one week of each visit.

3.9 IDENTIFICATION AND DOCUMENTATION

.1 The firestop contractor is to supply documentation for each single application addressed. This documentation is to identify each penetration and joint location for the entire project.

.2 The documentation for through penetrations and construction joints to be in a table format or and to include:

.1 A sequential location number.
.2 The Project Name.
.3 Date of Installation.
.4 Detailed description of the penetration's location.
.5 Tested System or Engineered Judgment Number.
.6 Type of assembly penetrated or construction joint.
.7 A detailed description of the size and type of penetrating item.
.10 Hourly rating achieved.
.11 Installers Name.

.3 Copies of the documentation to be included in the O&M at the completion of the project.

.4 **Type 1 Identification:** Identify through-penetration firestop systems with pressure-sensitive, self-adhesive, preprinted vinyl labels. Attach labels permanently to wall surfaces of penetrated construction on both sides of each firestop system installation where labels will be visible to anyone seeking to remove penetrating items or firestop systems. Include the following information on labels:

.1 The words: "Warning -Through Penetration Firestop System-Do Not Disturb. Notify Building Management of Any Damage."
.2 Contractor's Name, address, and phone number.
.3 Through-Penetration firestop system designation of applicable testing and inspecting agency.
.4 Date of Installation.
.5 Through-Penetration firestop system manufacturer's name.
.6 Installer's Name.

.5 **Type 2 Identification:** Identify all fire rated and 0 rated partitions with 75 mm high pressure-sensitive, self-adhesive, preprinted vinyl labels, colour red. Attach labels permanently to both sides of wall surfaces at 6.0 m on centres not more than 1000 mm below underside of deck where labels will be visible to anyone seeking to provide future penetrations. Include the following information on labels:

.1 The words: "WARNING – [x] HOUR FIRE SEPARATION". Insert appropriate wall rating as applicable.

3.10 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.

.3 Remove temporary dams after initial set of firestopping and smoke seal materials.

3.11 SCHEDULE

.1 Firestop and smoke seal at:

.1 Penetrations through fire-resistance rated masonry, concrete, and gypsum board partitions and walls.

.2 Top of fire-resistance rated masonry and gypsum board partitions.

.3 Intersection of fire-resistance rated masonry and gypsum board partitions.

.4 Control and sway joints in fire-resistance rated masonry and gypsum board partitions and walls.

.5 Penetrations through fire-resistance rated floor slabs, ceilings and roofs.

.6 Openings and sleeves installed for future use through fire separations.

.7 Around mechanical and electrical assemblies penetrating fire separations.

.8 Rigid ducts: greater than 129 cm^2.

3.12 FIRESTOPPING DETAILS

.1 The following recognized and tested details are approved to be used on this project at various rated assemblies.

Firestopping Details		**Rev.0**
ITEM NO.	LOCATION	SYSTEM / DESIGN NUMBER
1	Top of steel stud wall at U/S steel deck – parallel to deck flutes	UL HW-S-0098
2	Top of steel stud wall at U/S steel deck – perpendicular to deck flutes	UL HW-S-0001
3	Interior partitions (1 HR) & (2 HRS)	ULC W453
4	Bottom of steel stud wall at concrete slab	UL BW-S-0025
5	Top of steel stud wall at U/S steel beam	UL HW-D-0626
6	Top of steel stud wall adjacent to steel beam / joist	UL HW-D-0773

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American Society for testing and Materials International (ASTM).

.1 ASTM C834-17R23, Standard Specification for Latex Sealants.

.2 ASTM C919-24, Standard Practice for Use of Sealants in Acoustical Applications.

.3 ASTM C920-18R24, Standard Specification for Elastomeric Joint Sealants.

.4 ASTM C1193-16R23, Standard Guide for Use of Joint Sealants.

.5 ASTM C1248-22, Standard Test Method for Staining of Porous Substrate by Joint Sealants.

.6 ASTM C1330-23, Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants.

.2 Department of Justice Canada (Jus).

.1 Canadian Environmental Protection Act, 1999 (CEPA).

.3 Transport Canada (TC).

.1 Transportation of Dangerous Goods Act, 1992 (TDGA).

.4 Underwriters Laboratories (UL).

.1 UL 2761-2011, Sustainability for Sealants and Caulking Compounds, Edition 1.

1.2 SUBMITTALS

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

.2 Action Submittals:

.1 Product Data: describing.

.1 Sealant compound.

.2 Primers.

.3 Sealing compound, each type, including compatibility when different sealants are in contact with each other, and in contact with laminated glass.

.2 Samples:

.1 Submit duplicate colour samples of each type of material and colour.

.2 Provide Samples with joint sealants in 13 mm wide joints formed between two 150 mm long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

.3 Where custom colours are requested, submit colour samples of actual product for review by Consultant.

.3 Informational Submittals:

.1 Manufacturer's instructions for installation of each product specified.

.2 Statement of Compatibility: Compatibility between sealants primers, and substrates is essential. Provide written declaration to Consultant stating that materials meet this requirement.

.3 For products specified to comply with SWRI Sealant Validation Program, provide written confirmation from SWRI of product compliance.

.4 Test Reports.

1.3 QUALITY ASSURANCE

.1 Testing: Test sealants in contact with samples of porous materials to be sealed to ensure no staining of material will result in accordance with ASTM C1248.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Deliver and store materials in original wrappings and containers with manufacturer's seals and labels, intact. Protect from freezing, moisture, water and contact with ground or floor.

.2 Waste management and disposal: to Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

1.5 ENVIRONMENTAL REQUIREMENTS

.1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of Safety Data Sheets (SDS) acceptable to Labour Canada.

.2 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.

.3 Ventilate area of work by use of approved portable supply and exhaust fans.

.1 For work within existing buildings, arrange with Owner for ventilation system to be operated on maximum outdoor air and exhaust during installation of caulking and sealants.

Part 2 Products

2.1 GENERAL

.1 Do not use caulking that emits strong odours, contains toxic chemicals or is not certified as mould resistant in air handling units.

.2 When low toxicity caulks are not possible, confine usage to areas which offgas to exterior, are contained behind air barriers, or are applied several months before occupancy to maximize offgas time.

.3 Where sealants are qualified with primers use only those primers.

.4 Sealants used as structural component: tested and approved by sealant manufacturer before application, to confirm adhesion and compatibility with substrates.

.1 Provide samples of substrates to sealant manufacturer for testing.

.5 Stain-Test-Response Characteristics: Where sealants are specified to be non-staining to porous substrates, provide products that have undergone testing according to ASTM C1248 and have not stained porous joint substrates indicated for Project.

.6 Colours: selected by Consultant from manufacturer’s standard range.

.7 Comply with ASTM C920 and other requirements indicated for each liquid-applied chemically curing sealant, including those referencing ASTM C920 classifications for type, grade, class and uses.

.8 Compatibility: Provide joints sealants, primers and backings that are compatible with one another, and with joint substrates under conditions of service and application as demonstrated by joint sealant manufacturer based on proven test results and field experience.

.9 Sealants: not exude materials that travel into or onto adjacent materials, causing damage, or attracting soiling, which becomes apparent during service life of building.

2.2 SEALANT MATERIAL DESIGNATIONS

.1 Exterior sealants: Dow Corning 790, no alternate.

.2 Silicones One Part to UL-2761.

.3 Acrylic Latex One Part to ASTM C834.

.4 Acoustical Sealant to ASTM C919.

.5 Other interior sealants: Dow Corning 790, Tremco Dymeric, Tremco Dymonic.

.6 Preformed Compressible and Non-Compressible back-up materials.

- .1 Polyethylene, Urethane, Neoprene or Vinyl Foam.
  - .1 Extruded closed cell foam backer rod.
  - .2 Size: oversize 30 to 50 percent.
- .2 Neoprene or Butyl Rubber.
  - .1 Round solid rod, Shore A hardness 70.
- .3 Bond Breaker Tape.
  - .1 Polyethylene bond breaker tape which will not bond to sealant.

2.3 SEALANT SELECTION

.1 Type 1: perimeter of exterior openings where frames meet exterior facade of building (i.e. brick, block, precast, masonry). Control and expansion joints in exterior surfaces of unit masonry walls. Coping joints and coping-to facade joints.

.1 Acceptable material: Dow Corning.

.2 Type 2: seal interior perimeters of exterior openings as detailed on drawings:

.1 Acceptable material: Tremco Dymonic.

.3 Type 3: perimeter of interior hollow metal frames, as detailed and itemized: Sealant type: latex.

.1 Acceptable material: acrylic latex.

.4 Type 4: interior masonry vertical control joints (block-to-block, block-to-concrete, and intersecting masonry walls). Interior masonry to gypsum board. Interior masonry to structural steel. Joints at tops of non-load bearing masonry walls at the underside of poured concrete. Exposed interior control joint sin drywall.

.1 Acceptable material: Tremco Dymonic.

.5 Type 5: mildew-resistant, one part, movement range ±25 percent.

.1 Acceptable materials: Dow Corning 786, GE Sanitary 1700.

.6 Type 6: Perimeter of bath fixtures (e.g. sinks, tubs, urinals, stools, waterclosets, basins, vanities, countertops/backsplash).

.1 Acceptable materials: general purpose neutral cure clear silicone, Dow Corning CWS.

.7 Type 7: acoustical sealant to ASTM C919.

.2 Standard of Acceptance: Tremco Acoustical Sealant, Grabber Construction Products Acoustical Sealant, STI Smoke 'N' Sound Sealant.

.8 Type 8: one-part polyurethane, self-leveling.

.1 Standard of Acceptance: Sikaflex 1cSL, Bostic Chem-Calk 955 Self Leveling, Tremco Vulkem 45 SSL, MasteSeal SL 1.

.9 Type 9: Multi-Component Urethane: ASTM C920, Type M, Grade NS, Class 50; Uses T, NT, M, A, and O; two component, chemical curing, nonstaining, nonbleeding, colour selected by Consultant.

.1 Standard of Acceptance: Tremco Dymeric 240, and subject to compliance with specified requirements Comparable Products by BASF, and Sika.

.10 At precast hollow core slab interior joints use Tremco Dymeric 240 before application of paint finish.

.11 Joint Cleaner: Non-corrosive and non-staining type, compatible with joint forming materials and sealant recommended by sealant manufacturer.

.12 Primer: as recommended by manufacturer, meeting maximum VOC requirements.

.13 Back-up Materials:

.3 Backer rod: polyethylene, closed cell foam backer rod, compatible with sealant, recommended by manufacturer, diameter oversize 30 to 50 percent to suit joint.

.4 Bond breaker tape: polyethylene, pressure sensitive bond breaker tape which will not bond to sealant.

.5 Expanding Foam Sealant: Precompressed, open cell, chemically stabilized acrylic impregnation, adhesive backed, high density polyurethane foam, precompressed size indicated, width indicated, grey colour.

Part 3 Execution

3.1 EXAMINATION

.1 Joint-Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.

.2 Joint-Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

3.2 PROTECTION

.1 Protect installed Work of other trades from staining or contamination.

3.3 SURFACE PREPARATION

.1 Examine joint sizes and conditions to establish correct depth to width relationship for installation of backup materials and sealants.

.2 Clean bonding joint surfaces of harmful matter substances including dust, rust, oil grease, and other matter which may impair Work.

.3 Do not apply sealants to joint surfaces treated with sealer, curing compound, water repellent, or other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.

.4 Ensure joint surfaces are clean and free from rust, grease, frost, oil, and loose materials.

.5 Prepare surfaces in accordance with manufacturer's directions.

.6 Test materials being sealed, caulked for staining, adhesion.

3.4 PRIMING

.1 Where necessary to prevent staining, mask adjacent surfaces before priming and caulking.

.2 Prime sides of joints in accordance with sealant manufacturer's instructions immediately before caulking.

3.5 BACKUP MATERIAL

.1 Apply bond breaker tape where required to manufacturer's instructions.

.2 Install joint filler to achieve correct joint depth and shape, with approximately 30% compression.

3.6 MIXING

.1 For multi-component sealants, mix materials in strict accordance with sealant manufacturer's instructions.

3.7 APPLICATION

.1 Sealant:

.1 Apply sealant in accordance with manufacturer's written instructions.

.2 Mask edges of joint where irregular surface or sensitive joint border exists to provide neat joint.

.3 Apply sealant in continuous beads.

.4 Apply sealant using gun with proper size nozzle.

.5 Use sufficient pressure to fill voids and joints solid.

.6 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities.

.7 Tool exposed surfaces before skinning begins to give slightly concave shape.

.8 Remove excess compound promptly as work progresses and upon completion.

.9 Apply non-paintable silicone sealants after wall surfaces have been painted.

.10 Bakor 570-05 polybitume sealing compound: do not thin apply with a caulking gun. Work material to avoid air pockets and improve the bond.

.2 Curing:

.1 Cure sealants in accordance with sealant manufacturer's instructions.

.2 Do not cover up sealants until proper curing has taken place.

.3 Cleanup:

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

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

.3 Remove masking tape after initial set of sealants.

END OF SECTION

SECTION NO. 08	OPENINGS	NO. OF PAGES
Section 08 11 00	Metal Doors and Frames	5
Section 08 36 20	Sectional Metal Overhead Doors	3
Section 08 51 13	Aluminum Windows	10
Section 08 71 00	Door Hardware	8
Section 08 71 10	Hardware Schedule	10
Section 08 80 50	Glazing	5

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Exterior and interior metal doors and frames.

1.2 RELATED REQUIREMENTS

.1 Section 08 71 00 - Door Hardware.

1.3 REFERENCES

.1 American Society for Testing and Materials International (ASTM).

.1 ASTM A653/A653M-23, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 ASTM C578-23, Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.

.3 ASTM D3322-23, Standard Practice for Testing Primers and Primer Surfacers Over Preformed Metal.

.2 Canadian Standards Association (CSA International).

.1 CSA G40.20-13/G40.21-13(R2023), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.2 CSA W59:24, Welded Steel Construction.

.3 Canadian Steel Door Manufacturers' Association (CSDMA).

.1 CSDMA (Section 08 11 00 – 2022), Steel Doors Frames Product Specifications.

.2 CSDMA (Section 08 11 00 – 2009), Recommended Selection and Usage Guide.

.4 National Fire Protection Association (NFPA).

.1 NFPA 80-2025, Standard for Fire Doors and Other Opening Protectives.

.5 Underwriters' Laboratories of Canada (ULC).

.1 CAN/ULC-S104-15 (R2020), Standard Method for Fire Tests of Door Assemblies.

1.4 SUBMITTALS

.1 Provide product data, shop drawings, and samples in accordance with Section 01 33 00 – Submittal Procedures.

.2 Shop Drawings:

.1 Indicate elevation of each door and frame type.

.2 Indicate each type of door, material, steel core thicknesses, mortises, reinforcements, location of exposed fasteners, glazed openings, arrangement of hardware, fire rating, and finishes.

.3 Indicate each type frame material, core thickness, reinforcements, location of anchors and exposed fastenings, reinforcing, fire rating, and finishes.

.4 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and door schedule.

1.5 COORDINATION

.1 Coordinate hardware preparation requirements with wood doors.

1.6 DELIVERY, STORAGE AND HANDLING

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

.2 Waste Management and Disposal: Separate waste materials for reuse and recycling.

Part 2 Products

2.1 DESIGN REQUIREMENTS

.1 Steel fire rated doors and frames: labelled and listed by an organization accredited by Standards Council of Canada in conformance with CAN/ULC-S104 for ratings specified or indicated.

.2 Provide fire labelled frames for openings requiring fire protection ratings.

.1 Test products in conformance with CAN/ULC-S104 and listed by nationally recognized agency having factory inspection services.

2.2 MATERIALS

.1 Hot dipped galvanized steel sheet: to ASTM A653/A653M, CS, Type B, coating designation ZF75, minimum base steel thickness in accordance with CSDMA Table 1 - Thickness for Component Parts.

.2 Door Core Materials:

.1 Honeycomb: Structural small cell 25.4 mm maximum kraft paper 'honeycomb'. Weight: 36.3 kg per ream minimum, density: 16.5 kg/m^3 minimum, sanded to required thickness.

.2 Polystyrene: Rigid extruded fire retardant, closed cell board. Density; 16 to 32 kg/m^3, thermal values; RSI 1.0 minimum, Type 1, in accordance with ASTM C578.

.3 Temperature rise rated (TRR) core: composition to limit temperature rise on unexposed side of door to 250 degrees C at 30 or 60 minutes, as determined by governing building code requirements. Core to be tested as part of a complete door assembly, in accordance with CAN/ULC-S104, covering Standard Method of Tests of Door Assemblies and listed by nationally recognized testing agency having factory inspection service.

.3 Reinforcement: to CSA G40.20/G40.21, Type 44W, coating designation to ASTM A653/A653M, ZF75.

2.3 PRIMER

.1 Touch-up primer to ASTM D3322.

2.4 ACCESSORIES

.1 Door silencers: single stud rubber/neoprene type.

.2 Metallic paste filler: to manufacturer's standard.

.1 Interior top and bottom caps: Steel.

.2 Fire labels: metal riveted.

.3 Frame Thermal Breaks: Rigid PVC extrusion.

.4 Glazing: To Section 08 80 50 - Glazing

2.5 FRAMES FABRICATION GENERAL

.1 Fabricate frames in accordance with CSDMA specifications.

.2 Fabricate frames to profiles and maximum face sizes as indicated.

.3 Exterior frames: 1.6 mm welded type construction, thermally broken.

.4 Interior frames: 1.6 mm welded type construction.

.5 Blank, reinforce, drill and tap frames for mortised, templated hardware, and electronic hardware using templates provided by finish hardware supplier.

.1 Reinforce frames for surface mounted hardware.

.6 Protect mortised cutouts with steel guard boxes for masonry construction.

.7 Prepare frame for door silencers as follows:

.1 Three for single door openings.

.2 Two at head for double door openings.

.8 Manufacturer's nameplates on frames are not permitted.

.9 Conceal fastenings except where exposed fastenings are indicated.

.10 Factory-apply touch up primer at areas where zinc coating has been removed during fabrication.

2.6 FRAMES: WELDED TYPE

.1 Welding in accordance with CSA W59.

.2 Accurately mitre or mechanically join frame product and securely weld on inside of profile.

.3 Perimeter corner joints: as defined in Appendix 2 of CSDMA, “Recommended Specifications for Commercial Steel Door and Frame Products”, except as specified otherwise:

.1 Profile welded, punch-mitered: continuously welded on inside of frame along profile faces, rabbets, returns and soffit intersections. Fill exposed faces and grind smooth to uniform seamless surface.

.2 Tack welded: not permitted.

.4 Securely attach floor anchors to inside of each jamb profile.

.5 Weld in 2 temporary jamb spreaders per frame to maintain proper alignment during shipment.

2.7 FRAME ANCHORAGE

.1 Provide appropriate anchorage to floor and wall construction.

.2 Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb.

.3 Provide two anchors for rebate opening heights up to 1520 mm and one additional anchor for each additional 760 mm of height or fraction thereof.

.4 Locate anchors for frames in existing openings not more than 150 mm from top and bottom of each jambs and intermediate at 660 mm on centre maximum.

2.8 DOOR FABRICATION, GENERAL

.1 Doors: swing type, flush, laminated core construction.

.2 Fabricate doors with longitudinal edges mechanically interlocked, adhesive assisted, with visible edge seams, except as otherwise indicated.

.3 Blank, reinforce, drill doors and tap for mortised, templated hardware, and electronic hardware.

.4 Factory prepare holes 12.7 mm diameter and larger except mounting and through-bolt holes, on site, at time of hardware installation.

.5 Reinforce doors where required, for surface mounted hardware.

.1 Provide closer reinforcement both sides all doors, including doors not scheduled to receive closers.

.6 Provide inverted, recessed, welded steel channels for top and bottom of doors.

.7 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.

.8 Provide fire labeled doors for those openings requiring fire protection ratings, as scheduled.

.1 Test such products in strict conformance with CAN/ULC-S104 and list by nationally recognized agency having factory inspection service and construct as detailed in Follow-Up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.

.9 Manufacturer’s nameplates on doors are permitted only on hinge side of door, concealed from view.

2.9 DOORS: LAMINATED CORE CONSTRUCTION

.1 Exterior Doors: Form face sheets from 1.6 mm sheet steel with polystyrene core, laminated under pressure to face sheets

.2 Interior Doors: Form each face sheet from 1.3 mm thick ZF75 coated steel with honeycomb core or temperature rise rated core where required for fore resistance rating, laminated under pressure to face sheets.

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 PREPARATION

.1 Check floor flatness in area where fame is to be installed, and within door swing path. Correct irregularities.

.2 Remove temporary shipping spreaders prior to installation.

.3 Check door and frame product for correct size, swing, rating and opening number.

.4 Verify substrate conditions are as detailed in Contract Documents and are acceptable for product installation in accordance with manufacturer's instructions.

3.3 INSTALLATION GENERAL

.1 Install labelled steel fire rated doors and frames to NFPA 80 except where specified otherwise.

.2 Install doors and frames to CSDMA Installation Guide.

3.4 FRAME INSTALLATION

.1 Set frames plumb, square, level and at correct elevation.

.2 Secure anchorages and connections to adjacent construction.

.3 Brace frames rigidly in position while building-in.

.1 Install temporary horizontal wood spreader at third points of door opening to maintain frame width.

.2 Provide vertical support at centre of head for openings over 1200 mm wide.

.3 Remove temporary spreaders after frames are built in.

.4 During setting of frame product, check and correct for opening width, opening height, square, alignment, twist, and plumb in accordance with CSDMA, "Recommended Dimensional Standards for Commercial Steel Doors and Frames".

.5 Make allowances for deflection of structure to ensure structural loads are not transmitted to frames.

.6 Caulk perimeter of frames between frame and adjacent material with sealant specified in Section 07 92 00 - Joint Sealants.

3.5 DOOR INSTALLATION

.1 Install doors and hardware in accordance with hardware templates and manufacturer's instructions and Section 08 71 00 - Door Hardware.

.2 Provide even margins between doors and jambs and doors and finished floor and thresholds having the following tolerances:

.1 Hinge side: 3 mm.

.2 Latchside and head: 3 mm.

.3 Finished floor, top of carpet, non-combustible sill, and thresholds: 13 mm.

.4 Bottom of door and top of threshold at rated doors: 19 mm max.

.3 Adjust operable parts for correct function.

3.6 FINISH REPAIRS

.1 Touch up with primer finishes damaged during installation.

.2 Fill exposed frame anchors and surfaces with imperfections with metallic paste filler and sand to a uniform smooth finish.

3.7 FRAME SCHEDULE

.1 HM – exterior and interior

.1 Standard door frame face profile: 50 mm.

END OF SECTION

Part 1 General

1.1 RELATED WORK SPECIFIED ELSEWHERE

.1 Section 05 50 00 - Metal Fabrications.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).
- .1 CSA G164-18 (R2023), Hot Dip Galvanizing of Irregularly Shaped Articles.

.2 American Society for Testing and Materials (ASTM).
- .1 ASTM A653/A653M-23, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .2 ASTM A1008/A1008M-24, Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable.

1.3 DESIGN CRITERIA

.1 Design door assembly to withstand minimum 50,000 cycles per annum.

1.4 SHOP DRAWINGS

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

.2 Indicate materials, operating mechanisms, required clearances.

1.5 MAINTENANCE DATA

.1 Provide maintenance and operation data for overhead door hardware for incorporation into maintenance manual specified in Section 01 33 00 – Submittal Procedures.

Part 2 Products

2.1 MATERIALS

.1 Galvanized sheet steel: commercial quality to ASTM A653/A653M with Z275 zinc coating.

.2 Primer: compatible for galvanized steel surfaces.

.3 Insulation: 75 mm thick polyurethane core.

.4 Cable: multi-strand galvanized steel aircraft cable.

2.2 DOOR

.1 Fabricate minimum 75 mm thick flush panel doors of 0.838 mm roll formed sheet steel sections. Sheet to be zinc-coated with a minimum of G90 galvanizing and steel surface to be smooth. Door assembly to provide minimum R26 thermal resistance, size as indicated on the drawings. Provide doors with shop applied baked enamel finish, colour to later selection by Consultant from standard colour range. Model Thermomark 530 Sectional Steel door by Wayne Dalton or approved equivalent.

2.3 OPERATORS

.1 Equip door operation by: “Doorlec 3T311”operator c/w built-in chain host for manual operation in the event of power failure.

.2 Electrical motors, controller units, remote pushbutton stations, relays and other electrical components: to CSA approval with CSA enclosure type CEMA 1. Provide transformer and control wiring as required for complete installation.

.3 Power supply: 120V, 1 phase, 60 Hz for electric motor ½ HP.

.4 Controller units with integral motor reversing starter, 3 heater elements for overload protection, including 3 pushbuttons and control relays as applicable.

.5 Operation: surface mounted, with “OPEN-STOP-CLOSE” designations on pushbuttons.

.6 Safety switches: combination roll rubber with limit switches for full length of bottom rail of bottom section of door, to reverse door to open position when contacting objects on closing cycle.

.7 Door speed: 305 mm per second.

.8 Mounting brackets: galvanized steel, size and gauge to suit conditions.

2.4 HARDWARE

.1 Tracks:
- .1 **Type 1 – Door B3011**: Standard Lift Track and hardware with 75 mm size 2.48 mm core thickness galvanized steel track for torsion spring lifting and include ancillary hardware items.
- .2 **Type 2 – Doors B3006 and B3008**: Custom High Lift Track and hardware with 75 mm size 2.48 mm core thickness galvanized steel track for torsion spring lifting and include ancillary hardware items.

.2 Rollers: full floating hardened steel, ball bearing, size to suit track.

.3 Roller brackets: adjustable, min. 2.48 mm galvanized steel.

.4 Accessories:
- .1 5mm thick formed sheet 1524 mm high track guards.
- .2 Pusher springs.
- .3 Flat bar door latch with night latch operated from inside.
- .4 Glazing-Sealed double-glazed windows, location and approximate size as shown on drawings, to manufacturer’s standard detail.
- .5 Double contact bulb type extruded neoprene weatherstrip for door sill section, full width.
- .6 Extruded aluminum and arctic grade vinyl weatherstrip for jambs and head, to manufacturers standard.

.5 Finish ferrous hardware items with minimum zinc coating of G90 to CSA G164.

2.5 SPECIAL FUNCTION

.1 In addition to door operators indicated in Article 2.3 Operators, provide an integral receiver with a remote-control unit to operate each door.

Part 3 Execution

3.1 INSTALLATION

.1 Install door and hardware.

.2 Touch-up with primer where galvanized finish damaged during fabrications with finish paint where enamel finish is scratched.

.3 Lubricate springs and adjust door operating components to ensure smooth opening and closing of door.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 07 27 10 – Air Barriers.

.2 Section 07 92 00 – Joint Sealants.

.3 Section 08 80 50 – Glazing.

1.2 REFERENCES

.1 ASHRAE/IES 90.1-2016.

.2 ANSI/ASHRAE/USGBC/IES 189.1-2018.

.3 Aluminum Association (AA): AA DAF 45-03(R2009), Designation System for Aluminum Finishes.

.4 American Architectural Manufacturers Association (AAMA).
- .1 AAMA/WDMA/CSA 101/I.S.2/A440-22, NAFS - North American Fenestration Standard/Specification for windows, doors, and skylights.
- .2 AAMA CW-10-82, Care and Handling of Architectural Aluminum from Shop to Site.
- .3 AAMA CW-11-85, Design Wind Loads and Boundary Layer Wind Tunnel Testing.
- .4 AAMA T1R-A1-15, Sound Control for Fenestration Products.
- .5 AAMA 501-15, Methods of Test for Exterior Walls.
- .6 AAMA 501.1-17, Standard Test Method for Water Penetration of Windows, Curtain Walls and Doors Using Dynamic Pressure.
- .6 AAMA 611-24, Specifications for Anodized Architectural Aluminum.
- .7 AAMA 612-17a, Voluntary Specifications, Performance Requirements, and Test Procedures for Combined Coatings of Anode Oxide and Transparent Organic Coatings on Architectural Aluminum.
- .8 AAMA 2603-21, Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix).
- .9 AAMA 2604-20, Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix).

.5 American Society for Testing and Materials (ASTM).
- .1 ASTM A36/A36M-19, Specification for Carbon Structural Steel.
- .2 ASTM A123/A123M-24, Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- .3 ASTM A167-99(2017), Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- .4 ASTM A653/A653M-23, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) Or Zinc-Iron Alloy-Coated (Galvannealed) By the Hot-Dip Process.
- .5 ASTM B209/B209M-21a, Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- .6 ASTM B221-21, Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- .7 ASTM E283/E283M-19, Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
- .8 ASTM E330/E330M-14(2021), Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights, and Curtain Walls by Uniform Static Air Pressure Difference.

.9 ASTM E331-00R23, Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
.10 ASTM E413-22, Classification for Rating Sound Insulation.
.11 ASTM E1105-15R23, Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference.

.6 Canadian General Standards Board (CGSB)
.1 CAN/CGSB 12.8-2017, Insulating Glass Units.

.7 Canadian Standards Association (CSA).
.1 CSA A440.2:19/CSA A440.3:19, Fenestration Energy Performance.
.2 CSA A440.4:19 (R2024), Window, Door, and Skylight Installation standard for performance of windows.
.3 CSA A440S1:19 (R2022), Canadian supplement to AAMA/WDMA/CSA 101/I.S.2/A440-22, North American Fenestration Standard/Specification for windows, doors, and skylights.
.4 CSA G40.20-13/G40.21 (R2023), General Requirements for Rolled or Welded Structural Quality Steel / Structural Quality Steel.
.5 CSA S136-16 (R2021), North American Specification for the Design of Cold-Formed Steel Structural Members.
.6 CSA S136S1:19, Supplement 1 to the North American Specification for the Design of Cold-Formed Steel Structural Members.
.7 CAN S157-17/S157.1-17 (R2022), Strength Design in Aluminum / Commentary on CSA S157-17, Strength Design in Aluminum to Register for.
.8 CSA W59.2:18 (R2023), Welded Aluminum Construction.

.8 North American Fenestration Standard (NAFS).
.1 AAMA/WDMA/CSA101/I.S.2/A440-17, North American Fenestration Standard/Specification for window, doors, and skylights.

.9 Society for Protective Coatings (SSPC).
.1 SSPC - Paint 20-2019, Zinc Rich Coating, (Type I - Inorganic and Type II – Organic).
.2 SSPC - Paint 40-2019, Zinc-Rich Moisture-Cure Polyurethane Primer, Performance-Based.

.10 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
.1 SCAQMD Rule 1113 (2016), Volatile Organic Compound (VOC) Limits.
.2 SCAQMD Rule 1168 (2022), Adhesives and Sealants Applications.

.11 Fenestration & Glazing Industry Alliance (FGIA).

1.3 SYSTEM DESCRIPTION

.1 Design Criteria:
.1 Design aluminum windows, frames, and doors in exterior walls to:
.1 AAMA/WDMA/CSA 101/I.S.2/A440.
.2 Accommodate expansion and contraction within service temperature range of - 35 to 35 degrees C.
.3 Limit deflection of mullions to maximum 1/175th of clear span when tested to ASTM E330 under wind load of 1.2 kpa submit certificate of tests performed.
.4 Movement within system.
.5 Movement between system and perimeter framing components or

substrate.

.6 Design all connections between all frames and surrounding structure (including but not limited to foundation, concrete block, steel structure, steel studs, and blocking) and clearly indicate designed connections on manufacturer's shop drawings along with demonstration that the connections meet the load requirements outlined above.

.2 Performance Requirements (Fenestration Canada):
- .1 Minimum Performance Grade (PG): 30.
- .2 Minimum Positive Design Pressure: 1440 PA.
- .3 Minimum Negative Design Pressure: -1440 PA.
- .4 Minimum Water Penetration Resistance Test Pressure: 260 PA.
- .5 Minimum Canadian Air Infiltration / Exfiltration: A2.

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Co-ordination: co-ordinate work of this Section with installation of fire stopping, air barrier placement, vapour retarder placement, flashing placement, installing ductwork to rear of louvres, rough carpentry and components or materials.

1.5 EXAMINATION

.1 Examine the structure to which work is to be fixed and report any deficiency which is detrimental to the proper installation of the work.

.2 Verify all dimensions on site, and site dimension to ensure that adjustments in fabrication and installation are provided for and clearances to other construction have been maintained.

.3 Report any defects discovered to the Architect and do not commence work before these have been remedied. Commencement of work to be construed as acceptance of underlying conditions.

1.6 SUBMITTALS

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

.2 Product Data:
- .1 Submit manufacturer's instructions, printed product literature and data sheets for curtain wall and windows components, anchorage and fasteners, glass and infill, and internal drainage details and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:
- .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario.
- .2 Indicate system dimensions, framed opening requirements and tolerances, adjacent construction, anchor details anticipated deflection under load, affected related Work, weep drainage network, expansion and contraction joint location and details, and field welding required.

.4 Samples: Submit two samples of finish and colour for review in accordance with Section 01 33 00 – Submittal Procedures.

.5 Test Reports:
- .1 Submit substantiating engineering data, test results of previous tests by independent laboratory including supportive data for:
  - .1 Window performance requirements.
  - .2 Aluminum finish.

.3 Wind load resistance.
.4 Forced entry resistance.
.5 Mullion deflection - combination and composite windows.

1.7 MAINTENANCE DATA

.1 Provide operation and maintenance data for windows for incorporation into manual specified in Section 01 77 00 - Closeout Procedures.

1.8 WASTE MANAGEMENT

.1 Provide covered storage area to protect materials and products from sunlight, moisture, staining, and impact or other damage.

.2 Separate protective materials for reuse or recycling.

.3 Separate corrugated cardboard in accordance with the Waste Management Plan and place in designated areas for recycling.

.4 Place materials defined as hazardous or toxic waste in designated containers.

.5 Use the least toxic sealants, adhesives, sealers, and finishes necessary to comply with the requirements of this section. Refer to Section 07 92 00 – Joint Sealants.

.6 Close and seal tightly all partly used sealant containers and store protected in well ventilated fire-safe area at moderate temperature.

.7 Place used sealant tubes and other containers in areas designated for hazardous materials.

.8 Separate strapping, and wood and metal spreader bars for reuse or recycling.

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

1.9 WARRANTY

.1 From the date of Certificate of Substantial Performance, the hermetically sealed glazing units to be warranted for a period of five (5) years against vision obstruction due to the formation of dust or film on the internal surfaces, caused by the failure of the hermetic seal other than through glass breakage.

.2 All other parts of the work to be warranted against defects due to faulty materials and/or workmanship for a period of three (3) years from the date of the Certificate of Substantial Performance.

.3 Repair and/or replace when so directed by the Architect, within the said periods, any and all portions of work which fail to perform according to the requirements of these Specifications.

1.10 PROTECTION

.1 Apply temporary protective coating to finished surfaces. Remove coating after erection. Do not use coatings that will become hard to remove or leave residue.

.2 Leave protective covering in place until final cleaning of building.

Part 2 Products

2.1 MATERIALS

.1 Aluminum

.1 All aluminum extrusions to be 6063 TS aluminum alloy with T5 temper. Sash members to be tubular, with nominal wall thickness of 1.6 mm generally and 2.3mm at areas receiving operating hardware.

.2 All aluminum doors and frames to be given an anodic oxide treatment to obtain an Architectural Class 2 Anodic Coating in accordance with Aluminum Association specification AA-M12C22A31, #17, Clear.

.2 Exterior aluminum sills to be break formed aluminum sheet metal to suit job condition, minimum 3 mm thick, complete with joint covers, end caps and drip deflectors, drains, anchoring devices. Finish to be #17, Clear.

.3 Weatherstripping to be flexible vinyl spline with durometer rating 60 ±5.

.4 All screws, bolts and fastenings, to be either cadmium plated or stainless steel.

.5 Aligning corner clips to be aluminum.

.6 Hermetically Sealed Glazed Units: to be made from two sheets of optically clean glass separated by an insulate spacer in accordance with CAN/CGSB-12.8. Refer to specification Section 08 80 50 – Glazing.

.7 Screens to be fabricated from extruded aluminum sections with mechanical corners. Mesh to be 18/16 aluminum wire cloth held in place by continuous Koroseal spline. Frames for insect screens to be same colour as window frame.

2.2 FABRICATION

.8 Fabricate in accordance with CSA A440S1:19 supplemented as follows:

.1 Fabricate units square and true with maximum tolerance of plus or minus 1.5 mm for units with a diagonal measurement of 1800 mm or less and plus or minus 3 mm for units with a diagonal measurement over 1800 mm.

.2 Face dimensions detailed are maximum permissible sizes.

.3 Brace frames to maintain squareness and rigidity during shipment and installation.

.4 Finish steel clips and reinforcement with shop coat primer to 380 g/m2 zinc coating to CAN/CSA-G164.

.5 Provide 2 mm thick aluminum drip flashing at the head of all windows.

2.3 HARDWARE

.1 Hardware for operable window sashes to be:

.1 Four Bar Hinge-zinc plated finish, maximum 50 degree opening, size to suit operator size and weight.

.2 For operating sashes, provide 100 mm ‘’Limiters’’ to restrict extension of the sash while in open position.

.3 Provide two (2) cam locking handles complete with pull rings. Provide sash pull pole for access pull ring (2 of).

2.4 ISOLATION COATING

.1 Isolate aluminum from following components, by means of isolation coating:

.1 Dissimilar metals except stainless steel, zinc, or white bronze of small area.

.2 Concrete, mortar and masonry.

.3 Wood.

2.5 GLAZING

.1 Glaze windows in accordance with CAN/CSA-A440. Refer to Section 08 80 50 – Glazing for glass and glazing material.

2.6 AIR BARRIER AND VAPOUR BARRIERS

.1 Equip window frames with factory or site installed air and vapour barrier material for sealing to building air and vapour barrier as follows:

.1 Material: identical to, or compatible with, building air barrier and vapour retarder materials to provide required air tightness and vapour diffusion control throughout exterior envelope assembly.

.2 Material width: adequate to provide required air tightness and vapour diffusion control to building air barrier and vapour barrier from interior.

2.7 PANNING

.1 Provide 25 mm x minimum 25 mm extruded aluminum square snap on type panning, clear anodized finish to match new frames as required to cover gap between window/door frames and existing brick or interior finishes.

2.8 INSULATED PANELS

.1 At exposed exterior face of window framing, provide 3 mm thick aluminum both sides of 19 mm pressure treated plywood sheathing for one sandwich panel unit for installation between exterior aluminum cap and rear mullion. Finish to be same colour as frame.

.2 Insulate behind sandwich panels with minimum 100 mm thick semi-rigid insulation Curtainrock board insulation as manufactured by Rockwool Inc.

.3 Where back-up insulated sandwich panels are exposed to view in the building interior, 3 mm thick aluminum to be used. Finish to match window frame.

.4 Where back-up insulated panels are not exposed to view in the building interior, use 0.9 mm thick (20 gauge) galvanized sheet steel at interior face of panel.

2.9 WINDOW

.1 Acceptable Products:

.1 Prevost: 3400 Series.
.2 Kawneer: 1600 System 1.
.3 Alumicor: 2500 Series.

Overall mullion depth including caps to be:

.1 Minimum 152 mm. Refer to drawings.

.2 Provide reinforcing of mullions as required. Caps to be 19 mm.

The system to be designed to meet wind load requirements, maximum stress of 0.96 KPA (20 PSI) and have a maximum deflection of L/200 of the span.

.2 The entire window system to be designed according to the "Open Rain Screen" principle and to provide:

.1 Gaskets, sleeved spigotted joints, and seals necessary to ensure rain water does not enter the cavities of the system.

.3 Mullion sections to be tubular extruded sections when the system is designed for spigot joinery, and split mullion extruded sections when screw spline joinery is to be used. Incorporate split mullions as required to allow for thermal expansion, and at curved windows.

.4 All horizontal sections to form equalized pressure and sealed gutter members.

.5 Vertical expansion and construction joints to be sleeved spigotted joints between mullion ends in combination with an applied sealant.

.6 Provide structural steel supports, brackets and all anchoring to building structure, anchors to have three-way adjustment. Welding to be completed after curtain wall is aligned. Touch up painting of welded areas to be done on site.

2.10 VENTILATING SASH FABRICATION

.1 Operating windows to conform to CSA A440S1:19.

.2 Windows to be designed to withstand wind load criteria as laid down in the Ontario Building Code with a maximum deflection of L/200 span.

.3 Ventilating sashes to be bottom hinged and projecting in, located as shown on the drawings.

.4 Acceptable Products:

.1 Kawneer Series 526 Isoport.

.2 Alumicor Series 1350.

.3 Prevost Series 1300.

All operable windows to be thermally broken and rain screen principle.

.5 One-piece sill adaptor to be sloped to exterior for weathering.

.6 Entire perimeter of sash to close on double flexible vinyl weatherstripping inserted into integral grooves in extruded aluminum sash and weathering section giving two-point weathering contact.

.7 Positive aligning corner clips inserted into integral grooves to exterior face of sash.

.8 Glazing stops to be snap-in type installed from the interior and held in place by means of integral groove in sash surround.

.9 Sash members to be factory assembled with corners machine cut at 45 deg. With concealed structural corner fastening.

.10 As required, reinforce sashes to size of units.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for aluminum curtain wall installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate.

.2 Verify dimensions, tolerances, and method of attachment with other work.

.3 Verify wall openings and adjoining air barrier and vapour retarder materials are ready to receive work of this Section.

.4 Inform Consultant of unacceptable conditions immediately upon discovery.

.5 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION OF WINDOWS

.1 Install in accordance with CAN/CSA-A440.

.2 Install in accordance with approved shop drawings and with manufacturer's instructions.

.3 Install framing plumb, level, square, free from warp, twist or other defect, and anchor securely to provide adequate resistance.

.4 Provide all steel angles, brackets, supports, and anchors required for complete installation.

.5 Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

.6 Make adequate provisions for thermal expansion of framing. Fasteners at window heads to allow for minimum 12 mm deflection of the building structure.

.7 Secure and shim windows with non-corrosive and inorganic material. Anchor clips, blocking, shims, and all other attachments to be concealed.

.8 Install steel reinforcing in aluminum frames where necessary to meet performance requirement.

.9 Provide all fastening and clips required for positive fastening of framing to concrete wall and concrete block wall.

.10 Aluminum to be isolated from dissimilar materials by means of suitable alkali-resistant material such as bituminous paint, baked enamel, epoxy resin solution or zinc chromate paint. Follow manufacturer’s recommendations.

.11 Use thermal isolation where components penetrate or disrupt building insulation.

.12 Coordinate attachment and seal of perimeter air barrier and vapour retarder materials.

.13 Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

.14 Install doors and hardware in accordance with hardware templates and manufacturer's instructions.

.15 Adjust door components to ensure smooth operation.

.16 Install glass and infill panels in accordance with Section 08 80 50 – Glazing. Place sealant on the up-slope side of the pressure plate cover caps; finish the surface with a slope to encourage drainage over the cap. Cover caps to conceal screws and ensure continuous sightline.

.17 Install perimeter sealant to method required to achieve performance criteria. Backing materials, and installation criteria in accordance with Section 07 92 00 - Joint Sealants

3.3 SILL INSTALLATION

.1 Install aluminum sills with uniform wash to exterior, level in length, straight in alignment with plumb upstands and faces.

.2 Site measure every window opening to ensure accurate fit.

.3 Secure sills in place with anchoring devices located at joints of continuous sills and evenly spaced 600 mm on centre in between.

.4 Fasten expansion joint cover plates and drip deflectors with self-tapping stainless steel screws.

3.4 CAULKING

.1 Seal joints between windows and window sills with sealant. Bed sill expansion joint cover plates and drip deflectors in bedding compound. Caulk between sill upstand and window-frame. Caulk butt joints in continuous sills.

.2 Apply sealant in accordance with Section 07 92 00 - Joint Sealants. Conceal sealant within window units except where exposed use is permitted by Consultant.

3.5 DELIVERY AND STORAGE

.1 Deliver, store and handle windows to prevent damage. Replace all damaged products with new, undamaged products which confirm to the Specification.

.2 Cross brace large window units for shipping and protect finished surfaces with protective wrappings.

3.6 PROTECTION DURING CONSTRUCTION

.1 During construction protect windows and glass against damage from plaster, mortar, and any other cause.

.2 Protect pre-finished aluminum surfaces with protective coatings and wrappings, until installation of glazing commences. Ensure that method of protection does not damage finish.

3.7 CLEANING

.1 Before turning the building over to the Owner During, clean the exposed glass and aluminum surfaces. Do not use abrasive materials on anodized and painted surfaces.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 06 10 00 – Rough Carpentry.

.2 Section 08 11 00 – Metal Doors and Frames.

.3 Door Hardware Schedule.

1.2 REFERENCE STANDARDS

.1 American National Standards Institute (ANSI).

.1 ANSI A117.1-2017, Standard for Accessible and Usable Buildings and Facilities.

.2 American Society for Testing and Materials International, (ASTM).

.1 ASTM E90-23, Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

.3 American National Standards Institute (ANSI)/Builders Hardware Manufacturer's Association (BMHA).

.1 ANSI/BHMA A156.1-2021, American National Standard for Butts and Hinges.
.2 ANSI/BHMA A156.3-2020, Exit Devices.
.3 ANSI/BHMA A156.4-2024, Door Controls - Closers.
.4 ANSI/BHMA A156.5-2020, Auxiliary Locks and Associated Products.
.5 ANSI/BHMA A156.6-2021, Architectural Door Trim.
.6 ANSI/BHMA A156.13-2022, Mortise Locks and Latches Series 1000.
.7 ANSI/BHMA A156.16-2018, Auxiliary Hardware.
.8 ANSI/BHMA A156.18-2020, Materials and Finishes.
.9 ANSI/BHMA A156.21-2019, Thresholds.
.10 ANSI/BMHA A156.22-2021, Door Gasketing and Edge Seal Systems.
.11 ANSI/BHMA A156.28-2023, Recommended Practices for Mechanical Keying Systems.
.12 ANSI/BHMA A156.115-2016, Hardware Preparation in Steel Doors or Steel Frames.

.4 National Fire Protection Association (NFPA).

.1 NFPA 80-2025, Standards for Fire Doors and Other Opening Protectives.

.5 Canadian Steel Door and Frame Manufacturer's Association (CSDFMA).

.1 CSDMA Recommended Dimensional Standards for Commercial Steel Doors and Frames 2000.

.6 Underwriters Laboratories of Canada (ULC).

.1 CAN/ULC-S104-15 (R2020), Standard Method for Fire Tests of Door Assemblies.
.2 CAN/ULC-S112-10 (R2021), Standard Method of Fire Test of Damper Assemblies.

.7 Underwriters Laboratories (UL).

.1 UL 10B 2015 (R2024), Standard for Fire Tests of Door Assemblies, Edition 10.
.2 UL 10C 2016 R2021), Positive Pressure Fire Tests of Door Assemblies, Edition 3.
.3 UL 437 2013 (R2023), Standard for Key Locks.

1.2 SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for door hardware and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Samples:

.1 Submit for review and acceptance of each unit.

.2 Samples will be returned for inclusion into work.

.3 Identify each sample by label indicating applicable specification paragraph number, brand name and number, finish and hardware package number.

.4 After approval samples will be returned for incorporation in Work.

.4 Hardware List:

.1 Submit Hardware Schedule the DHI and industry standard vertical format using a qualified Architectural Hardware Engineer (AHC).

.2 Indicate specified hardware, including make, model, material, function, size, finish and other pertinent information.

.5 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

.6 Manufacturer's Instructions: submit manufacturer's installation instructions.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 – Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for door hardware for incorporation into manual.

1.4 MAINTENANCE MATERIALS AND SUBMITTALS

.1 Extra Stock Materials:

.1 Supply maintenance materials in accordance with Section 01 78 00 – Closeout Submittals.

.2 Provide maintenance data, parts list, and manufacturer's instructions for each type door closers, locksets, door holders and fire exit hardware for incorporation into maintenance manual.

.3 Brief maintenance staff regarding proper care, cleaning, and general maintenance.

.4 Tools:

.1 Supply 2 sets of wrenches for door closers, locksets, and fire exit hardware.

1.5 QUALITY ASSURANCE

.1 Regulatory Requirements:

.1 Hardware for doors in fire separations and exit doors certified by a Canadian Certification Organization accredited by Standards Council of Canada.

.2 Use cUL, UL or WHI listed and labeled hardware for doors in fire rated partitions and fire exits.

.3 Use only ANSI A156 listed and certified hardware and submit documentation accordingly with Hardware Schedule submission.

.2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.6 DELIVERY, STORAGE AND HANDLING

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

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Package items of hardware including fastenings, separately or in like groups of hardware, label each package as to item definition and location.

.4 Storage and Handling Requirements:
- .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2 Store and protect door hardware from nicks, scratches, and blemishes.
- .3 Protect prefinished surfaces with wrapping or strippable coating.
- .4 Replace defective or damaged materials with new.

1.7 WARRANTY

.1 Provide extended warranties for products as listed, in accordance with General Conditions but for the number of years specified.
- .1 Exit devices: 2 years.
- .2 Door closers: 10 years.

Part 2 Products

2.1 HARDWARE ITEMS

.1 Use one manufacturer's products only for similar items.

2.2 DOOR HARDWARE

.1 Locks and latches:

- .1 Mortise locks and latches: to ANSI/BHMA A156.13, series L1000 mortise lock, Grade 1, Security Grade 1, designed for function and keyed as stated in Hardware Schedule.
- .4 Lever handles: 06 Design.
- .5 Roses: round.
- .6 Normal strikes: box type, lip projection not beyond jamb.
- .7 Cylinders: key into keying system as directed.
- .8 Finished to 630.

.2 Butts and hinges:

- .1 to ANSI/BHMA A156.1, designated by letter A and numeral identifiers, followed by size and finish, listed in Hardware Schedule.
- .2 Use non ferrous base metal hinges on all exterior doors. Use non-removable pins (NRP) on all out swinging lockable interior and exterior doors.

.3 Exit devices:

- .1 to ANSI/BHMA A156.3, Grade 1, J401 trim, UL 437 listed, conventional design, heavy duty, finished to 630.
- .2 Where vertical rod devices (concealed or surface) are used on fire rated doors, these devices to be approved for top rod only applications.

.3 Acceptable product: Von Duprin Series 98.

.4 Door closers and accessories:

.1 to ANSI/BHMA A156.4 and CSA B651, designated by letter C and numeral identifiers listed in Hardware Schedule, size in accordance with ANSI/BHMA A156.4, table A1, finished to 630.

.2 All door closers to be heavy duty LCN 4040/4040 EDA complete with heavy duty arms, spring cushion stop (S-CUSH) and advanced variable backcheck (AVB) where noted. Closers are to be regular or parallel arm as required such that they are mounted inside the rooms wherever possible unless noted otherwise. Template all closers to allow maximum possible swing unless noted otherwise. Coordinate door closer location with overhead stops. Closers are to have separate closing, latching and backcheck valves, fully adjustable spring power.

.5 Architectural door trim:

.1 Door protection plates: kick plates to ANSI/BHMA-A156.6, Type as recommended by door supplier, 1.27 mm thick stainless steel, finished to 630.

.6 Thresholds: to ANSI/BHMA-A156.21, Type J32190, 127 mm wide x full width of door opening, extruded aluminum mill finish, plain surface.

.1 Weatherstripping: KNC W20P, at jambs, head.

.2 Sweeps: KNC W38.

.3 Astragal: ZERO #40D and #41D and #358 at head.

.4 Gasketing W-42 where listed in schedule.

2.3 FASTENINGS

.1 Use only fasteners provided by manufacturer. Failure to comply may void warranties and applicable licensed labels.

.2 Supply screws, bolts, expansion shields and other fastening devices required for satisfactory installation and operation of hardware.

.3 Exposed fastening devices to match finish of hardware.

.4 Where pull is scheduled on one side of door and push plate on other side, supply fastening devices, and install so pull can be secured through door from reverse side. Install push plate to cover fasteners.

.5 Use fasteners compatible with material through which they pass.

2.4 KEYS AND KEYING

.1 Keying systems to ANSI/BHMA A156.28.

.2 Doors, padlocks and cabinet locks to be keyed alike in groups and master keyed as noted in Hardware Schedule or as directed. Prepare detailed keying schedule in conjunction with Owner.

.3 Supply 3 master keys for each master key or grand master key group.

.4 Supply construction cores.

.5 Hand over permanent cores and keys to Owner.

.6 Cylinders to be keyed to existing system.

.7 Furnish keys in the following quantities:
.1 2 each Change keys each keyed cylinder.

.8 Keying of new cylinders into existing system is by General Contractor. General Contractor is to provide locksmith to key to existing keying system. General Contractor is to coordinate with Owner including Plant Maintenance staff for keying. Keying services to be purchased by General Contractor and is not Owners scope of work.

.10 Finish hardware supplier to provide keying schedule.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of conditions: Examine doors, frames, related items and conditions under which Work is to be performed and identify conditions detrimental to proper and or timely completion.

.1 Do not proceed until unsatisfactory conditions have been corrected.

.2 Before the installation of hardware, verify the door frames have been installed level, plumb, and square, tightly fastened to the adjacent wall construction. Confirm door frames and doors are the correct size, type, fire rating and hand.

.3 Ensure frames and doors are prepared and reinforced for hardware items as scheduled in the approved finish hardware schedule, ensure wiring is run for electrified hardware.

.4 Confirm painting and staining of doors and door frames is complete.

.5 Where the installation of finish flooring interferes with the installation of hardware strikes and other floor mounted hardware items, install finish flooring material before installing hardware items.

.6 Review each packaged hardware item to confirm the correct size, hand, finish, accessories, quality, fasteners, and optional features are included as listed in the approved finish hardware schedule.

.7 Confirm voltage of electrical architectural hardware items match the requirements of the systems detailed in the approved finish hardware schedule, elevation diagrams, and schematic wiring diagrams, confirm wire runs are completed.

3.2 HARDWARE SCHEDULE

.1 Refer to attached Hardware Schedule / Headings and read in conjunction with the Door Schedule.

.2 Indicated hardware quantities are for one door or one pair of doors only, provide this quantity for each door or pair of doors listed in Door Schedule.

.3 Hardware specified in Hardware Schedule / Headings to take precedence over specifications of this Section if in conflict.

.4 Hardware Supplier to review all specified hardware in the groups and coordinate product sizes, types, finishes, functions, closer arm types and product interfaces to ensure compatibility with local Building Codes, fire ratings, door and frame types, materials and sizes.

3.3 HARDWARE MOUNTING

.1 Mount hardware units at heights indicated in the following publications except as specifically indicated or required to comply with the governing regulations.

.1 Recommended Locations for Builder's Hardware for Standard Steel Doors and Frames, by the Door and Hardware Institute (DHI).

.2 Canadian Metric Guide to Steel Doors and Frames (Modular Construction) prepared by Canadian Steel Door and Frame Manufacturer's Association (CSDFMA), except as otherwise required or indicated in this Section and elsewhere in the Contract Documents.

.2 Do not install wall stops on gypsum board, demountable or moveable partitions unless they are previously reinforced to suit.

.3 Provide even margins between doors and jambs and doors and flooring per the recommended standards of CSDMA, NFPA 80, and in accordance and in compliance with fire labeling authority having jurisdiction.

.4 Install all hardware to the mounting height and dimensions detailed in the various manufacturer's installation mounting templates.

3.4 INSTALLATION

.1 Install each hardware item per manufacturer's instructions and recommendations. Do not install surface mounted items until finishes have been completed on the substrate. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

.2 Conform to local governing agency security ordinance.

.3 Supply metal door and frame manufacturer with complete instructions and templates for preparation of their work to receive hardware.

.4 Fasteners:

.1 Install hardware using the manufacturers fasteners provided. Drill and tap all screw holes located in metallic materials. Do not use "Riv-Nuts" or "Quick" type fasteners or similar products, unless specifically supplied by manufacturer.

.2 Ensure fasteners are installed straight. Mortised and surface applied hardware mounted to the door to have the fastener holes drilled and tapped to suit the required thread size. Avoid the use of hex nuts and bolts, through bolts, grommet nuts, and self-tapping, self-drilling screws to attached hardware items to doors, unless specifically required as the only means of fastening such as armature plates for magnetic locks or electrical door releases.

.3 The Contractor will be responsible for the installation and commissioning of any opening(s) involving electronic hardware and access control. The Contractor will coordinate the installations between the security contractor and fire alarm contractor to ensure a seamless and competent result. The Contractor will be responsible to submit portal drawings for approval on each opening with the corresponding mode of operation before commencement of the installations. The Contractor will be responsible for all wiring and terminations from the opening, up to and including the SIP box. A detailed legend and terminal strip to be provided in each SIP box to identify the final wiring terminations. The low voltage cabling being used at each opening to be in acceptance of the manufacturers published minimum requirements for proper hardware functionality. The Contractor to create a commissioning verification sheet to be signed upon the successful testing of each electronic opening. These verification sheets will be part of final as built drawings and specifications submission to the Owner.

.5 Hardware Mounting Heights:

Listed below are the locations at which hardware is to be installed, Measurements are from the bottom of the frame to the center line of each item.

Latch sets and Deadlocks	-	1025 mm to centerline of strike
Exit devices	-	1005 mm to centerline of push bar
Door Pulls	-	1070 mm

.6 Clearances:

.1 Use NFPA 80 clearances for both fire rated and non-fire rated openings. The clearance under the bottom of the door to be a maximum of 12 mm after finish floor. The clearances between the top and vertical edges of the door and the frame, and the meeting edges of doors swinging in pairs, to be 2 mm ±1.5 mm inch for steel doors and to not exceed 2 mm for wood doors. 6 mm between bottom rail of door and top of threshold or saddle, 12 mm between bottom of door and finished floor material except when hardware specifically required other clearances to function properly.

.7 Wall Mounted Door Bumpers and Holders:

.1 Ensure blocking material of enough size and type is installed within steel or wood studs at the proper height to make contract with the center of protruding door trim.

3.5 FIELD QUALITY CONTROL AND FINAL ADJUSTMENT

.1 Contractor / Installers, Field Services: After installation is complete, contractor to inspect completed door openings on site to verify installation of hardware is complete and properly adjusted, in accordance with both the Contract Documents and final shop drawings.

.1 Check and adjust closers to ensure proper operation.

.1 Adjust closer to complete full closing cycle in less than 4 to 6 seconds without abrupt change of speed between "Sweep" and "Latch" speeds.

.2 Adjust "Backcheck" according to manufacturer's instructions.

.3 Set exterior doors closers to have 3.85 Kg maximum pressure to open, interior non-rated at 2.3 Kg, rated openings at 5.44 Kg.

.2 Check latchset, lockset, and exit devices are properly installed and adjusted to ensure proper operation.

.1 Verify levers are free from binding.

.2 Ensure latchbolts and dead bolts are engaged into strike and hardware is functioning.

.3 Report findings, in writing, to Owner and hardware supplier outlining corrective actions and recommendations.

3.6 ADJUSTING CLEANING AND PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by door hardware installation.

.3 Upon completion of the project, hardware to be left clean and free from damages.

.4 Remove protective coverings from finish hardware before Substantial Completion.

.5 Final adjustments to be made to door closers, ensuring proper sweep, and latch speed after the HVAC is balanced and operational, before Substantial Completion.

.6 Clean exposed hardware in accordance with the hardware manufacturers written recommendations.

.7 Progress Cleaning: clean in accordance with Section 01 74 11 – Cleaning.

.1 Leave Work area clean at end of each day.

.2 Clean hardware with damp rag and approved non-abrasive cleaner, and polish hardware in accordance with manufacturer's instructions.

.3 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 – Cleaning.

.8 Protect locks, fire exit and panic hardware and door pull trim with kraft paper or plastic bubble materials to protect finish from damage until date of substantial completion. Remove hardware items before painting, staining or retouching doors and frames.

3.7 DEMONSTRATION

.1 Keying System Setup and Cabinet:

.1 Set up key control system with file key tags, duplicate key tags, numerical index, alphabetical index and key change index, label shields, control book and key receipt cards.

.2 Place file keys and duplicate keys in key cabinet on their respective hooks.

.3 Lock key cabinet and turn over key to Departmental Representative.

.2 Maintenance Staff Briefing:

.1 Brief maintenance staff regarding:

.1 Proper care, cleaning, and general maintenance of projects complete hardware.

.2 Description, use, handling, and storage of keys.

.3 Use, application and storage of wrenches for door closers and locksets.

.3 Demonstrate operation, operating components, adjustment features, and lubrication requirements.

3.8 INSPECTIONS

.1 Ensure that an Architectural Hardware Engineer (AHC) representing the hardware supplier conducts periodic inspections of the hardware and the installation.

.2 At the completion of the work, the manufacturer's representative shall inspect the installation and provide written confirmation to the Consultant, that the products have been installed in accordance with manufacturer's published instructions and validate warranties.

.3 Upon receipt of this report, the Consultant will inspect the installation to assure themselves of the adequacy of the work. A list will be made of any deficiencies, and a copy will be forwarded to the required parties.

3.9 DOOR HARDWARE SCHEDULE:

Appended to this Section.

END OF SECTION

Finishing Hardware Schedule

Ingleside W.W.T.P. Upgrades
Ingleside, ON

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Plans Dated: **2025/02/08 - 100%**
Submittal Date: **March 11, 2025**

GROUND FLOOR

Opening Number(s)	Qty	Location 1	To/ From	Location 2	Nominal Width	Nominal Height	Door Thickness	Door Mat'l	Frame Mat'l	Hand	Label
G3001	1	Area 3000	From	Stairs Link H - 3000	900, 900	2150	45	HM	PS	RHRA	45 MIN.
G3002	1	Exterior	From	Stairs Link H - 3000	960	2150	45	HM	PS	RHR	45 MIN.
G3003	1	Stairs Link H - 3000	To	H-3001	900, 900	2150	45	HM	PS	LHA	45 MIN.
G3004	1	Exterior	From	Stair H-3008	960	2150	45	HM	PS	LHR	
G3005	1	Stair H-3008	From	H-3001	960	2150	45	HM	PS	RHR	45 MIN.
G3006	1	Exterior	From	H-3001	3650	3650	50	ST	ST	CO	
G3007	1	Exterior	From	H-3001	960	2150	45	HM	PS	RHR	
G3009	1	Exterior	From	H-3002	2600	2438	50	ST	ST	CO	
G3008	1	Exterior	From	H-3002	960	2150	45	HM	PS	RHR	
G3010	1	Exterior	From	H-3002	2600	2438	50	ST	ST	CO	
G3011	1	Exterior	From	H-3003	960	2150	45	HM	PS	LHR	
G3012	1	Exterior	From	H-3002	960	2150	45	HM	PS	LHR	
G3013	1	Exterior	From	H-3002	3048	3048	50	ST	ST	CO	
U3010	1	Stairs	From	Blower Rm. H-3004	960	2150	45	HM	PS	LHR	45 MIN.
U3011	1	Vestibule	To	Electrical Rm H-3005	900, 900	2150	45	HM	PS	LHA	45 MIN.
U3012	1	Blower Rm.	From	Vestibule	900, 900	2150	45	HM	PS	LHRA	
U3013	1	Vestibule	To	Screening Rm. H-3006	900, 900	2150	45	HM	PS	RHA	45 MIN.
U3014	1	Exterior	From	Blower Rm.	960	2150	45	HM	PS	LHR	
U3015	1	Exterior	From	Screening Rm. H-3006	960	2150	45	HM	PS	LHR	
U3016	1	Screening Rm. H-3006	To	W/R H-3007	960	2150	45	HM	PS	LH	
G6001	1	Exterior	From	UV Room G601	1200, 1200	2000	45	HM	PS	RHRA	
G6002	1	Exterior	From	UV Room G601	960	2150	45	HM	PS	LHR	

Hardware Schedule

GROUND FLOOR

Heading #1

1 Pair of doors G3001, Area 3000 From Stairs Link H - 3000 RHRA

900, 900 x 2150 x 45 - HM DR x PS FR - 45 MIN.

6	St. Steel Hinge	NRP-FBB199 (4 1/2" x 4) US32D	C32D
1	Flush Bolt	FB31P-12-MD C32D	C32D
1	Dust Proof Strike	DP2 C26D	C26D
1	Lockset	L9070 17B 630 RHR	630
1	Master Keying	50-210-MK	
1	Const. Keying	50-211	
2	Surface Closer	4040XP EDA AL	AL
2	Mounting Bracket	MB1 / MB2 USP	CP
1	Coordinator	COR7G C26D	C26D
2	Kick Plate	GSH 80A C32D 203 x 875 mm TM	C32D
2	Overhead Door Stop	104S C32D	C32D

* Install weatherstrip before closer & OH stops for continuous seal
* Install astragal (by door and frame manufacturer on pull side of active leaf.
* Installer to file / cut strike lip flush

Heading #2

1 Pair of doors G3003, Stairs Link H - 3000 To H-3001 LHA

900, 900 x 2150 x 45 - HM DR x PS FR - 45 MIN.

6	St. Steel Hinge	NRP-FBB199 (4 1/2" x 4) US32D	C32D
1	Flush Bolt	FB31P-12-MD C32D	C32D
1	Dust Proof Strike	DP2 C26D	C26D
1	Lockset	L9070 17B 630 LH	630
1	Master Keying	50-210-MK	
1	Const. Keying	50-211	
2	Surface Closer	4040XP EDA AL	AL
2	Mounting Bracket	MB1 / MB2 USP	CP
1	Coordinator	COR7G C26D	C26D
2	Kick Plate	GSH 80A C32D 203 x 875 mm TM	C32D
2	Overhead Door Stop	104S C32D	C32D

* Install weatherstrip before closer & OH stops for continuous seal
* Install astragal (by door and frame manufacturer on pull side of active leaf.
* Installer to file / cut strike lip flush

Heading #3

1 Single door G3002, Exterior From Stairs Link H - 3000 RHR

960 x 2150 x 45 - HM DR x PS FR - 45 MIN.

3	St. Steel Hinge	NRP-FBB199 (4 1/2" x 4) US32D	C32D
1	Exit Device	98-TP-F C32D 990TP-R C26D RHR 4' Bar 960 x 2150 Door	C26D/C32D
1	Cylinder	20-021 626	626
1	Surface Closer	4040XP EDA x ST-2731 AL	AL
1	Kick Plate	GSH 80A C32D 203 x 912 mm TM	C32D
1	Overhead Door Stop	904S C32D	C32D
1	Weatherstripping	W-20S-CA - 1/960 x 2/2150 mm	CA
1	Threshold	CT-32 x 1060 mm	
1	Threshold Stop	CT-40S x 960 mm	
1	Door Sweep	W-24S-CA x 960 mm	CA

* Install weatherstrip befor closer & OH stop for continuous seal

Heading #4

1 Single door G3004, Exterior From Stair H-3008 LHR

960 x 2150 x 45 - HM DR x PS FR

3	St. Steel Hinge	NRP-FBB199 (4 1/2" x 4) US32D	C32D
1	Exit Device	98-TP-F C32D 990TP-R C26D LHR 4' Bar 960 x 2150 Door	C26D/C32D
1	Cylinder	20-021 626	626
1	Surface Closer	4040XP EDA x ST-2731 AL	AL
1	Kick Plate	GSH 80A C32D 203 x 912 mm TM	C32D
1	Overhead Door Stop	904S C32D	C32D
1	Weatherstripping	W-20S-CA - 1/960 x 2/2150 mm	CA
1	Threshold	CT-32 x 1060 mm	
1	Threshold Stop	CT-40S x 960 mm	
1	Door Sweep	W-24S-CA x 960 mm	CA

* Install weatherstrip befor closer & OH stop for continuous seal

Heading #5

1 Single door G3005, Stair H-3008 From H-3001 RHR

960 x 2150 x 45 - HM DR x PS FR - 45 MIN.

3	St. Steel Hinge	NRP-FBB199 (4 1/2" x 4) US32D	C32D
1	Exit Device	98-TP-F C32D 990TP-R C26D RHR 4' Bar 960 x 2150 Door	C26D/C32D
1	Cylinder	20-021 626	626
1	Surface Closer	4040XP EDA AL	AL
1	Kick Plate	GSH 80A C32D 203 x 922 mm TM	C32D
1	Wall Door Stop	GSH 240B C26D	C26D
3	Door Silencer	SR64 GRY	GRY

Heading #6

1 Elevation (Cased-Open) G3006, Exterior From H-3001 CO

3650 x 3650 x 50 - ST DR x ST FR

* Overhead Door

* Hardware complete by door supplier

Heading #7

1 Elevation (Cased-Open) G3009, Exterior From H-3002 CO

2600 x 2438 x 50 - ST DR x ST FR

* Overhead Door

* Hardware complete by door supplier

Heading #8

1 Elevation (Cased-Open) G3010, Exterior From H-3002 CO

2600 x 2438 x 50 - ST DR x ST FR

* Overhead Door

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* Hardware complete by door supplier

Heading #9

1 Single door G3012, Exterior From H-3002 LHR

960 x 2150 x 45 - HM DR x PS FR

* Overhead Door

---

* Hardware complete by door supplier

Heading #10

1 Elevation (Cased-Open) G3013, Exterior From H-3002 CO

3048 x 3048 x 50 - ST DR x ST FR

* Overhead Door

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* Hardware complete by door supplier

Heading #11

1 Single door G3007, Exterior From H-3001 RHR

960 x 2150 x 45 - HM DR x PS FR

3	St. Steel Hinge	NRP-FBB199 (4 1/2" x 4) US32D	C32D
1	Exit Device	98-TP C32D 990TP-R C26D RHR 4' Bar 960 x 2150 Door	C26D/C32D
1	Cylinder	20-021 626	626
1	Surface Closer	4040XP EDA x ST-2731 AL	AL
1	Kick Plate	GSH 80A C32D 203 x 912 mm TM	C32D
1	Overhead Door Stop	904S C32D	C32D
1	Weatherstripping	W-20S-CA - 1/960 x 2/2150 mm	CA
1	Threshold	CT-32 x 1060 mm	
1	Threshold Stop	CT-40S x 960 mm	
1	Door Sweep	W-24S-CA x 960 mm	CA

* Install weatherstrip before closer & OH stop for continuous seal

Heading #12

1 Single door G3008, Exterior From H-3002 RHR

960 x 2150 x 45 - HM DR x PS FR

3	St. Steel Hinge	NRP-FBB199 (4 1/2" x 4) US32D	C32D
1	Exit Device	98-TP C32D 990TP-R C26D RHR 4' Bar 960 x 2150 Door	C26D/C32D
1	Cylinder	20-021 626	626
1	Surface Closer	4040XP EDA x ST-2731 AL	AL
1	Kick Plate	GSH 80A C32D 203 x 912 mm TM	C32D
1	Overhead Door Stop	904S C32D	C32D
1	Weatherstripping	W-20S-CA - 1/960 x 2/2150 mm	CA
1	Threshold	CT-32 x 1060 mm	
1	Threshold Stop	CT-40S x 960 mm	
1	Door Sweep	W-24S-CA x 960 mm	CA

* Install weatherstrip before closer & OH stop for continuous seal

Heading #13

1 Single door G3011, Exterior From H-3003 LHR

960 x 2150 x 45 - HM DR x PS FR

3	St. Steel Hinge	NRP-FBB199 (4 1/2" x 4) US32D	C32D
1	Lockset	L9080P 17B 630 LHR	630
1	Master Keying	50-210-MK	
1	Const. Keying	50-211	
1	Surface Closer	4040XP EDA x ST-2731 AL	AL
1	Kick Plate	GSH 80A C32D 203 x 912 mm TM	C32D
1	Overhead Door Stop	904S C32D	C32D
1	Weatherstripping	W-20S-CA - 1/960 x 2/2150 mm	CA
1	Threshold	CT-32 x 1060 mm	
1	Threshold Stop	CT-40S x 960 mm	
1	Door Sweep	W-24S-CA x 960 mm	CA

* Install weatherstrip before closer & OH stop for continuous seal

Heading #14

1 Pair of doors G6001, Exterior From UV Room G601 RHRA

1200, 1200 x 2000 x 45 - HM DR x PS FR

6	St. Steel Hinge	NRP-FBB199 (5" x 4 1/2") US32D	C32D
2	Flush Bolt	FB458 C26D	C26D
1	Lockset	L9080P 17B 630 RHR	630
1	Surface Closer	4040XP EDA x ST-2731 AL * closer on active leaf only	AL
2	Overhead Door Stop	906S C32D	C32D
1	Weatherstripping	W-20S-CA - 1/2400 x 2/2000 mm	CA
1	Threshold	CT-32 x 2500 mm	
1	Threshold Stop	CT-40S x 2400 mm	
2	Door Sweep	W-24S-CA x 1200 mm	CA
1	Astragal	GSH 25-2 CP 84 c/w tamper proof screws	CP

* Install weatherstrip before closer & OH stops for continuous seal
* Install astragal on pull side of active leaf. Installer to file / cut strike lip flush

Heading #15

1 Single door G6002, Exterior From UV Room G601 LHR

960 x 2150 x 45 - HM DR x PS FR

3	St. Steel Hinge	NRP-FBB199 (4 1/2" x 4) US32D	C32D
1	Lockset	L9080P 17B 630 LHR	630
1	Master Keying	50-210-MK	
1	Const. Keying	50-211	
1	Surface Closer	4040XP EDA x ST-2731 AL	AL
1	Kick Plate	GSH 80A C32D 203 x 912 mm TM	C32D
1	Overhead Door Stop	904S C32D	C32D
1	Weatherstripping	W-20S-CA - 1/960 x 2/2150 mm	CA
1	Threshold	CT-32 x 1060 mm	
1	Threshold Stop	CT-40S x 960 mm	
1	Door Sweep	W-24S-CA x 960 mm	CA

* Install weatherstrip before closer & OH stop for continuous seal

Heading #16

1 Single door U3010, Stairs From Blower Rm. H-3004 LHR

960 x 2150 x 45 - HM DR x PS FR - 45 MIN.

3	St. Steel Hinge	NRP-FBB199 (4 1/2" x 4) US32D	C32D
1	Exit Device	98-TP-F C32D 990TP-R C26D LHR 4' Bar 960 x 2150 Door	C26D/C32D
1	Cylinder	20-021 626	626
1	Surface Closer	4040XP EDA AL	AL
1	Kick Plate	GSH 80A C32D 203 x 922 mm TM	C32D
1	Wall Door Stop	GSH 240B C26D	C26D
3	Door Silencer	SR64 GRY	GRY

Heading #17

1 Pair of doors U3011, Vestibule To Electrical Rm H-3005 LHA

900, 900 x 2150 x 45 - HM DR x PS FR - 45 MIN.

6	St. Steel Hinge	NRP-FBB199 (4 1/2" x 4) US32D	C32D
2	Flush Bolt	FB458 C26D	C26D
1	Dust Proof Strike	DP2 C26D	C26D
1	Lockset	L9080P 17B 630 LH	630
1	Surface Closer	4040XP EDA AL	AL
		* Closer on active leaf only	
1	Wall Door Stop	GSH 240B C26D	C26D
1	Overhead Door Stop	104S C32D	C32D
		* OH stop for RH leaf	
2	Kick Plate	GSH 80A C32D 203 x 935 mm TM	C32D
2	Door Silencer	SR64 GRY	GRY

* Astragal by door and frame manufacturer

Heading #18

1 Pair of doors U3012, Blower Rm. From Vestibule LHRA

900, 900 x 2150 x 45 - HM DR x PS FR

6	St. Steel Hinge	NRP-FBB199 (4 1/2" x 4) US32D	C32D
2	Flush Bolt	FB458 C26D	C26D
1	Dust Proof Strike	DP2 C26D	C26D
1	Lockset	L9080P 17B 630 LHR	630
1	Surface Closer	4040XP EDA AL	AL
		* Closer on active leaf only	
2	Overhead Door Stop	104S C32D	C32D
2	Kick Plate	GSH 80A C32D 203 x 935 mm TM	C32D
1	Astragal	GSH 25-2 CP 84 c/w tamper proof screws	CP
2	Door Silencer	SR64 GRY	GRY

* Installer to cut / file strike lip flush with inactive leaf

Heading #19

1 Pair of doors U3013, Vestibule To Screening Rm. H-3006 RHA

900, 900 x 2150 x 45 - HM DR x PS FR - 45 MIN.

6	St. Steel Hinge	NRP-FBB199 (4 1/2" x 4) US32D	C32D
2	Flush Bolt	FB458 C26D	C26D
1	Dust Proof Strike	DP2 C26D	C26D
1	Lockset	L9080P 17B 630 RH	630
1	Surface Closer	4040XP EDA AL	AL
		* Closer on active leaf only	
1	Wall Door Stop	GSH 240B C26D	C26D
1	Overhead Door Stop	104S C32D	C32D
		* OH stop for LH leaf	
2	Kick Plate	GSH 80A C32D 203 x 935 mm TM	C32D
2	Door Silencer	SR64 GRY	GRY

* Astragal by door and frame manufacturer

Heading #20

1 Single door U3014, Exterior From Blower Rm. LHR

960 x 2150 x 45 - HM DR x PS FR

3	St. Steel Hinge	NRP-FBB199 (4 1/2" x 4) US32D	C32D
1	Lockset	L9080P 17B 630 LHR	630
1	Surface Closer	4040XP EDA x ST-2731 AL	AL
1	Kick Plate	GSH 80A C32D 203 x 912 mm TM	C32D
1	Overhead Door Stop	904S C32D	C32D
1	Weatherstripping	W-20S-CA - 1/960 x 2/2150 mm	CA
1	Threshold	CT-32 x 1060 mm	
1	Threshold Stop	CT-40S x 960 mm	
1	Door Sweep	W-24S-CA x 960 mm	CA

* Install weatherstrip before closer & OH stop for continuous seal

Heading #21

1 Single door U3015, Exterior From Screening Rm. H-3006 LHR

960 x 2150 x 45 - HM DR x PS FR

3	St. Steel Hinge	NRP-FBB199 (4 1/2" x 4) US32D	C32D
1	Lockset	L9080P 17B 630 LHR	630
1	Surface Closer	4040XP EDA x ST-2731 AL	AL
1	Kick Plate	GSH 80A C32D 203 x 912 mm TM	C32D
1	Overhead Door Stop	904S C32D	C32D
1	Weatherstripping	W-20S-CA - 1/960 x 2/2150 mm	CA
1	Threshold	CT-32 x 1060 mm	
1	Threshold Stop	CT-40S x 960 mm	
1	Door Sweep	W-24S-CA x 960 mm	CA

* Install weatherstrip before closer & OH stop for continuous seal

Heading #22

1 Single door U3016, Screening Rm. H-3006 To W/R H-3007 LH

960 x 2150 x 45 - HM DR x PS FR

3	St. Steel Hinge	NRP-FBB199 (4 1/2" x 4) US32D	C32D
1	Privacy Set	L9040 17B 630 LH	630
1	Surface Closer	4040XP REG AL	AL
1	Kick Plate	GSH 80A C32D 203 x 922 mm TM	C32D
1	Wall Door Stop	GSH 250 C26D	C26D
3	Door Silencer	SR64 GRY	GRY

Part 1 General

1.1 RELATED SECTIONS

.1 Section 08 11 00 - Metel Doors and Frames.

.2 Section 08 11 16 – Aluminum Windows.

1.2 REFERENCES

.1 American Society of Civil Engineers, (ASCE).

.1 ASCE/SEI 7-22, Minimum Design Loads and Associate Criteria for Buildings and Other Structures.

.2 American Society for Testing and Materials (ASTM).

.1 ASTM C1503-24, Standard Specification for Silvered Flat Glass Mirror.

.2 ASTM D2240-15(2021), Test Method for Rubber Property - Durometer Hardness.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-12.1-2022, Safety Glazing.

.2 CAN/CGSB-12.3-M91(R2017), Flat, Clear Float Glass.

.3 CAN/CGSB-12.8-2017, Insulating Glass Units.

1.3 SYSTEM DESCRIPTION

.1 Performance Requirements:

.1 Provide continuity of building enclosure vapour and air barrier using glass and glazing materials as follow:

.1 Utilize inner light of multiple light sealed units for continuity of air and vapour seal.

.2 Limit mullion deflection to L/175; with full recovery of glazing materials.

.3 Size glass units and glass dimensions to limits established in CAN/CGSB-12.3.

.1 Design, and verify maximum glass sizes, thickness, strength, for glass types specified, to support design, and maximum allowable uniform static loads, using design factor of 2.5, in accordance with CAN/CGSB-12.3, but thickness to not be less than as indicated in this Section.

.4 Glass to withstand seismic loads as calculated in accordance with NBC and OBC.

.1 Seismic performance: glass to withstand the effects of earthquake motions determined according to ASCE/SEI 7.

.1 Importance Factor of this Building: 1 (Normal).

.2 Site Class: C.

1.4 SUBMITTALS

.1 Submit shop drawings, product data and samples in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheets.

.3 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions.

.4 Samples:

.1 Provide duplicate 300 x 300 mm samples of each glazing type.

1.5 CLOSEOUT SUBMITTALS

.1 Provide maintenance data including cleaning instructions for incorporation into manual specified in Section 01 33 00 - Submittal Procedures.

1.6 QUALITY ASSURANCE

.1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

.2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

Part 2 Products

2.1 MATERIALS: FLAT GLASS

.1 Float glass: to CAN/CGSB-12.3, Glazing quality, 6 mm thick.

.2 Safety glass (Tempered): to CAN/CGSB-12.1, transparent, 6 mm thick.

.1 Type 2-tempered.
.2 Class B-float.
.3 Category: II - 540 J impact resistance.
.4 Horizontal tempering.

.3 Low emissivity (Low E) coating on glass:

.1 Performance requirements based on PPG Solarban 60 sputtered/soft (vacuum coated), edge deleted. Other manufacturers acceptable upon compliance with specification requirements.
.2 Refer to the performance requirements specified in the vision glass insulating units.

2.2 VISION GLASS – INSULATING-GLASS UNITS

.1 Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass, qualified according to CAN/CGSB-12.8, and complying with other specified requirements.

.2 “VG” – vision glass insulating unit: to CAN/CGSB-12.8, double unit:

.1 Outer lite: Clear safety (tempered) glass.
.2 Inner lite: clear safety (tempered) glass.
.3 Glass thickness: 6 mm each light.
.4 Inter-cavity space thickness: 12 mm with low conductivity spacers, colour selected by Consultant.
.5 Overall thickness: 25 mm
.6 Low “e” glass coating: surface number 2.
.7 Inert gas fill: Argon.

.8 Glass performance:

.1 Visible light transmittance: 70%

.2 Visible Refl. out: 11%

.3 Visible Refl. In: 12%

.4 Total solar energy transmission: 33

.5 Total solar energy reflect: 29

.6 Winter nighttime U-factor: 0.24

.7 Solar heat gain coefficient: 0.38

.8 Shading coef: 0.44

.9 L.G.S. ration: 1.85

2.3 MATERIALS AND ACCESSORIES

.1 Primer, sealers, cleaners: to manufacturer's standard.

.2 Setting blocks: Neoprene, 70-90 Shore A durometer hardness to ASTM D2240, 100 mm long x 6 mm high x width to suit glass thickness.

.3 Spacer shims: Neoprene or silicone, 50-60 Shore A durometer hardness to ASTM D2240, 75 mm long x one half height of glazing stop x thickness to suit application. Self-adhesive on one face.

.4 Glazing tape:

.1 Preformed butyl compound, paper released backed.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 EXAMINATION

.1 Examine framing glazing, with Installer present, for compliance with the following:

.1 Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.

.2 Presence and functioning of weep system.

.3 Minimum required face or edge clearances.

.4 Effective sealing between joints of glass-framing members.

.2 Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 PREPARATION

.1 Clean contact surfaces with solvent and wipe dry.

.2 Seal porous glazing channels or recesses with substrate compatible primer or sealer.

.3 Prime surfaces scheduled to receive sealant.

3.4 GLAZING, GENERAL

.1 Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

.2 Glazing channel dimensions, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Site conditions during installation.

.3 Protect glass edges from damage during handling and installation. Remove damaged glass from site and legally dispose of off site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

.4 Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

.5 Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

.6 Do not exceed edge pressures stipulated by glass manufacturers for installing glass lights.

.7 Provide spacers for glass lights where length plus width is larger than 1270 mm as follows:

.1 Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.

.2 Provide 3 mm minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

.8 Provide edge blocking where indicated or needed to prevent glass lights from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

.9 Set glass lights in each series with uniform pattern, draw, bow, and similar characteristics.

.10 Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

.11 Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.5 INSTALLATION: INTERIOR - DRY METHOD (TAPE AND TAPE)

.1 Perform work in accordance with FGMA Glazing Manual for glazing installation methods.

.2 Cut glazing tape to length and set against permanent stops, projecting 1.6 mm above sight line.

.3 Place setting blocks at 1/4 points, with edge block maximum 150 mm from corners.

.4 Rest glazing on setting blocks and push against tape for full contact at perimeter of light or unit.

.5 Place glazing tape on free perimeter of glazing in same manner described.

.6 Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.

.7 Knife trim protruding tape.

.8 Install ceramic fire rated glass in UL labelled doors and UL labelled glazed steel screen frames as detailed on the drawings. Install ceramic fire rated glass in any door and steel frame that is within the line of fire separation as depicted on the drawings.

3.6 CLEANING

.1 Perform cleaning after installation to remove construction and accumulated environmental dirt.

.2 Remove traces of primer, caulking.

.3 Remove glazing materials from finish surfaces.

.4 Remove labels after work is complete.

.5 Clean glass and mirrors using approved non-abrasive cleaner in accordance with manufacture's instructions.

.6 Wash film using cleaning solution recommended by film manufacturer.

.7 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

3.7 PROTECTION OF FINISHED WORK

.1 After installation, mark light with an "X" by using removable plastic tape or paste. Do not mark heat absorbing or reflective glass units.

END OF SECTION

DIVISION 09 FINISHES

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 06 10 00 - Rough Carpentry.

.2 Section 07 21 16 - Blanket Insulation.

.3 Section 07 92 00 - Joint Sealants.

.4 Section 09 22 16 - Non-Structural Metal Framing.

.5 Section 09 91 00 – Painting.

1.2 REFERENCE STANDARDS

.1 American Society for Testing and Materials International (ASTM).

.1 ASTM C473-24, Standard Test Methods for Physical Testing of Gypsum Panel Products.

.2 ASTM C475/C475M-17(2022), Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.

.3 ASTM C840-23, Standard Specification for Application and Finishing of Gypsum Board.

.4 ASTM C919-24, Standard Practice for Use of Sealants in Acoustical Applications.

.5 ASTM C954-22, Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.

.6 ASTM C1002-22, Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.

.7 ASTM C1047-19, Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.

.8 ASTM C1177/C1177M-24, Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.

.9 ASTM C1178/C1178M-24, Standard Specification for Glass Mat Water-Resistant Gypsum Backing Board.

.10 ASTM C1186-22E01(2023), Standard Specification for Flat Fiber-Cement Sheets.

.11 ASTM C1280-18R23, Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing.

.12 ASTM C1396/C1396M-24, Standard Specification for Gypsum Board.

.13 ASTM C1629/C1629M-24, Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels.

.14 ASTM D3273-21, Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.

.2 Association of the Wall and Ceilings Industries International (AWCI).

.1 AWCI GA-214-2021 Recommended Levels of Gypsum Board Finish.

.3 Underwriters Laboratories of Canada (ULC).

.1 CAN/ULC-S604:2016, Standard for Factory-Built Type A Chimneys.

.2 CAN/ULC-S702.1:2021-AMD1, Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification First Amendment to Third Edition.

.3 CSA B149.1:20 with Ontario Amendments, Natural Gas and Propane Installation Code.

1.3 SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for gypsum board assemblies and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 DELIVERY, STORAGE AND HANDLING

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

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging.

.3 Storage and Handling Requirements:

.1 Store gypsum board assemblies' materials level off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect gypsum board assemblies from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

1.5 AMBIENT CONDITIONS

.1 Maintain temperature 10 degrees C minimum, 21 degrees C maximum for 48 hours before and during application of gypsum boards and joint treatment, and for 48 hours minimum after completion of joint treatment.

.2 Apply board and joint treatment to dry, frost free surfaces.

.3 Ventilation: ventilate building spaces as required to remove excess moisture that would prevent drying of joint treatment material immediately after its application.

Part 2 Products

2.1 MATERIALS

.1 Exterior Glass-mat Gypsum Sheathing: to ASTM C1177/C1177M, with fibreglass mat laminated to both sides, and with manufacturer's standard edges, thickness indicated, 1220 mm wide by maximum practical length.

.1 Acceptable products: CertainTeed GlasRoc Sheathing; Georgia-Pacific Gypsum DensGlass Gold; National Gypsum Gold Bond, e(2)XP; USG Securock Glass Mat Sheathing.

.2 Standard board: to ASTM C1396/C1396M, Type X, 13 and 16 mm thick as indicated, 1200 mm wide by maximum practical length, ends square cut, edges bevelled.

.3 Moisture / Mould / Abuse resistant board: to ASTM C1396/C1396M, ASTM C473, ASTM C1629, 16 mm thick, Type X, 1200 mm wide by maximum practical length.

.1 Moisture Resistance: to ASTM C473, not greater than 5% after 2 hours.

.2 Mould Resistance: to ASTM D32373, score 10.

.3 Abuse Resistance: to ASTM C1629.

.1 Abrasion: Level 3.

.2 Indentation: Level 1.

.3 Soft Body Impact: Level 2.

.4 Hard Body Impact: Level 1.

.4 Standard of Acceptance: CGC Sheetrock Mold Tough VHI Firecode X Panels.

.4 Glass mat water-resistant gypsum backing board: to ASTM C1178/C1178M, 16 mm thick, 1200 mm wide x maximum practical length. Mould resistance score 10 in accordance with ASTM D3273.

.1 Acceptable products: Custom Building Products Wonderboard Backerboard; CGC Fiberock Aqua-Tough Tile Backerboard, CertainTeed Diamondback GlasRoc Tile Backer, Georgia-Pacific DensShield Tile Backer.

.5 Fibre Cement Board: 16 mm thick, smooth (untextured) cement board to ASTM C1186. Acceptable product: Finex Inc., 1877-923-4639, info@gofinex.com.

.6 Metal furring runners, hangers, tie wires, inserts, anchors: to ASTM C1280, galvanized.

.7 Steel drill screws:

.1 For wood and metal framing: to ASTM C1002, except as indicated.

.2 For metal framing 0.91 mm and thicker: to ASTM C954.

.8 Casing beads, corner beads, control joints and edge trim: to ASTM C1047, metal, zinc-coated by hot-dip process, 0.5 mm base thickness, perforated flanges, one-piece length per location.

.9 Acoustic insulation: Batt and blanket mineral fibre: to CAN/ULC-S702.1, Type 1, Formaldehyde Free, install full depth of stud cavity or as indicated.

.10 Sealants: in accordance with Section 07 92 00 - Joint Sealants.

.11 Insulating strip: rubberized, moisture resistant, 3 mm thick closed cell neoprene strip, 12 mm wide, with self-sticking permanent adhesive on one face, lengths as required.

.12 Joint compound: to ASTM C475, asbestos-free.

.13 Joint tape:

.1 Standard board: paper.

.2 Moisture/Mould/Abuse resistant board: glass mesh.

.3 Glass mat water-resistant: glass mesh.

.4 Tile Backing Panels: As recommended by panel manufacturer.

.14 Access Doors:

.1 Access Door Type **AD1**: Wall application recessed Access Door in public areas. Designed for flush installation in gypsum board and plaster wall assemblies while providing an invisible architectural appearance. Provide Access Door with factory installed layer of 16 mm GWB.

.1 Material: mill finish aluminum.

.1 Mounting frame: recessed aluminum angle extrusion.

.2 Door: recessed aluminum angle extrusion, rounded safety corners, concealed hinges, key operated cylinder cam latch,

abloy compatible, anchor straps, fitted with layer of 16 mm GWB. Door panel: removable.

.2 Access Door Type **AD2**: Wall application recessed access door for back-of-house areas. Designed for flush installation in gypsum board and plaster wall assemblies.

.1 Material: 1.2 mm cold rolled steel, paint finish.

.1 Mounting frame: recessed 1.2 mm cold rolled steel, exposed flanged.

.2 Door: recessed aluminum angle extrusion, rounded safety corners, concealed hinges, screwdriver latch, anchor straps, fitted with layer of 16mm GWB. Door panel: removable.

.3 Access Door Type **AD3**: Floor application recessed access door for back-of-house areas. Designed for flush installation in concrete floor assemblies.

.1 Material: 6mm aluminum diamond plate, no finish.

.1 Mounting frame: recessed 50 x 50 mm x 6 mm aluminum angle.

.2 Door: recessed aluminum angle extrusion, square corners, concealed heavy duty aluminum piano hinge, 2.03 mm, recessed handle operated cam latch.

.4 Access Door Type **AD4**: Ceiling application recessed Access Door for back-of-house areas. Designed for flush installation in gypsum board and plaster wall assemblies.

.1 Material: 0.9 mm Galvannealed steel door, white powder coat primer, paint finish.

.1 Mounting frame: 1.2 mm cold rolled steel frame, recessed, 76mm deep with 25 mm exposed flange.

.2 Door: upward opening, recessed galvanneal steel, rounded safety corners, concealed piano hinge, hex head slam latch outside with self-latching ring operated slam latch inside.

.5 Sizes:

.1 For body entry: 600 x 600 mm

.2 For hand entry: 250 x 250 mm

.3 Refer to drawings for locations and sizes of all architectural access doors.

.6 All access doors to be fire rated in accordance with fire separation plans.

.7 All interior access doors to be uninsulated unless indicated otherwise by STC requirements.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for gypsum board assemblies' installation in accordance with manufacturer's written instructions.

.1 Proceed with installation only after unacceptable conditions have been remedied.

3.2 ERECTION

.1 Do application and finishing of gypsum board to ASTM C840 except where specified otherwise.

.2 Erect hangers and runner channels for suspended gypsum board ceilings to ASTM C840 except where specified otherwise.

.3 Support light fixtures by providing additional ceiling suspension hangers within 150 mm of each corner and at maximum 600 mm around perimeter of fixture.

.4 Install work level to tolerance of 1:1200.

.5 Frame with furring channels, perimeter of openings for access panels, light fixtures, diffusers and grilles.

.6 Furr for gypsum board faced vertical bulkheads within and at termination of ceilings.

.7 Acoustic insulation

.1 Install insulation to maintain continuity acoustical separation.

.2 Fit insulation closely around electrical boxes, pipes, ducts, frames and other objects in or passing through insulation.

.3 Do not compress insulation to fit into spaces.

.4 Keep insulation minimum 75 mm from heat emitting devices such as recessed light fixtures, and minimum 50 mm from sidewalls of CAN/ULC-S604 Type A chimneys and CSA B149.1 Type B and L vents.

3.3 APPLICATION

.1 Apply gypsum board after bucks, anchors, blocking, sound attenuation, electrical and mechanical work have been approved.

.2 Apply gypsum board to metal framing or furring using screw fasteners for all layers. Maximum spacing of screws 300 mm on centre.

.1 Single-Layer Application:

.1 Apply gypsum board on ceilings before application of walls to ASTM C840.

.2 Apply gypsum board vertically or horizontally, providing sheet lengths that will minimize end joints.

.2 Double-Layer Application:

.1 Install gypsum board for base layer and exposed gypsum board for face layer.

.2 Apply base layers at right angles to supports unless otherwise indicated.

.3 Apply base layer with joints over supports and face layer joints offset at least 250 mm with base layer joints.

.3 Apply water-resistant gypsum board where epoxy paint to be applied and as indicated on plans. Apply water-resistant sealant to edges, ends, cut-outs which expose gypsum core and to fastener heads.

.4 Apply glass mat water-resistant gypsum backing board where wall tiles to be applied. Apply water-resistant sealant to edges, ends, cut-outs which expose gypsum core and to fastener heads.

.1 Joint treatment: to Section 09 30 13 - Ceramic Tiling.

.5 Install ceiling boards in direction that will minimize number of end-butt joints. Stagger end joints at least 250 mm.

.6 Install gypsum board on walls vertically to avoid end-butt joints. At high walls, install boards horizontally with end joints staggered over studs, except where local codes or fire-rated assemblies require vertical application.

.7 Install gypsum board with face side out.

.8 Do not install damaged or damp boards.

.9 Locate edge or end joints over supports. Stagger vertical joints over different studs on opposite sides of wall.

3.4 APPLICATION - SEALANT

.1 STC-Rated Assemblies:

.1 Seal construction at full periphery of partitions, behind control joints, at openings, and penetrations with 12 mm continuous bead of acoustical sealant.

.2 Install acoustical sealant at each gypsum board layer in assembly except:

.1 For double-layer gypsum board application install maximum two continuous beads, one at each base layer.

.3 Comply with ASTM C919 and manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around and through assemblies, including sealing partitions above acoustical ceilings.

3.5 INSTALLATION

.1 Erect accessories straight, plumb or level, rigid and at proper plane. Use full length pieces where practical. Make joints tight, accurately aligned and rigidly secured. Mitre and fit corners accurately, free from rough edges. Secure at 150 mm on centre.

.2 Install casing beads around perimeter of suspended ceilings.

.3 Install casing beads where gypsum board butts against surfaces having no trim concealing junction and where indicated. Seal joints with sealant.

.4 Install insulating strips continuously at edges of gypsum board and casing beads abutting metal window and exterior door frames, to provide thermal break.

.5 Construct control joints of preformed units set in gypsum board facing and supported independently on both sides of joint.

.6 Locate control joints where indicated, at changes in substrate construction, at approximate 10 m spacing on runs greater than 20 m, and at approximate 15 m spacing on ceilings.

.7 Install control joints straight and true.

.8 Install access doors to electrical and mechanical fixtures specified in respective sections.

.1 Rigidly secure frames to furring or framing systems.

.9 Finish face panel joints and internal angles with joint system consisting of joint compound, joint tape and taping compound installed according to manufacturer's directions and feathered out onto panel faces.

.10 Gypsum Board Finish: finish gypsum board walls and ceilings to following levels in accordance with AWCI GA-214 Levels of Gypsum Board Finish:

.1 Levels of finish:

.1 Level 0: No tapping, finishing or accessories required.

.1 Location: temporary construction, behind solid paneling where fire or smoke seal is not required.

.2 Level 1: embed tape for joints and interior angles in joint compound. Surfaces to be free of excess joint compound; tool marks and ridges are acceptable.

.1 Location: gypsum board above ceilings, interior side of exterior walls above finished ceilings. Concealed fire separations.

.3 Level 2: embed tape for joints and interior angles in joint compound and apply one separate coat of joint compound over joints, angles, fastener heads and accessories; surfaces free of excess joint compound; tool marks and ridges are acceptable.

.1 Location: gypsum board behind rigid wall protection, and at Glass mat water-resistant gypsum backing board installed as tile backer

.4 Level 4: embed tape for joints and interior angles in joint compound and apply three separate coats of joint compound over joints, angles, fastener heads and accessories; surfaces smooth and free of tool marks and ridges.

.1 Location: where gypsum board is to be painted except as indicated below.

.11 Finish corner beads, control joints and trim as required with two coats of joint compound and one coat of taping compound, feathered out onto panel faces.

.12 Fill screw head depressions with joint and taping compounds to bring flush with adjacent surface of gypsum board so as to be invisible after surface finish is completed.

.13 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.

.14 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for surface finish.

3.6 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

.2 Waste Management: separate waste materials for reuse and recycling.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.7 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by gypsum board assemblies' installation.

3.8 SCHEDULES

.1 Construct ULC fire rated assemblies where indicated.

.2 Refer to Partition Type Schedule on drawings.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 09 21 16 - Gypsum Board Assemblies.

.2 Division 22 – Plumbing.

1.2 REFERENCE STANDARDS

.1 American Society for Testing and Materials, (ASTM).

.1 ASTM E119-24, Standard Test Methods for Fire Tests of Building Construction and Materials.

.2 ASTM C645-24, Specification for Non-structural Steel Framing Members.

.3 ASTM A653/A653M-23, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.4 ASTM E814-2017-24, Standard Test Method for Fire Tests of Penetration Firestop Systems.

.5 ASTM C1513-24, Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections.

.2 Canadian Standards Association (CSA).

.1 CSA S136-16 (R2021), North American Specification for the Design of Cold-Formed Steel Structural Members.

.2 CSA A136S1:19, Supplement 1 to the North American Specification for the Design of Cold-Formed Steel Structural Members.

.3 Definitions:

.1 Steel Thickness:

.1 Base Steel Thickness: Thickness of bare steel exclusive of coatings.

.2 Design Thickness: Target or "nominal" thickness used to determine structural properties of the cold formed Products.

.3 Minimum Thickness: Design thickness minus minimum allowable under-tolerance required by CSA S136 (95% of design thickness) or material specification; whichever is more stringent.

.4 Designation Thickness: For the purposes of this specification; thicknesses provided will be minimum base steel thicknesses in accordance with CSA S136 as interpreted by Section 01 61 00 – Common Product Requirements and determined by the following table:

Designation Thickness	Minimum Base Steel Thickness		Gauge No. (For reference Only)	Colour
(mils)	(in)	(mm)	Ga	
18	0.0179	0.455	25	Not Painted
33	0.0329	0.836	20	White
43	0.0428	1.087	18	Yellow
54	0.0538	1.367	16	Green

1.3 QUALITY ASSURANCE

.1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

.2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.3 Stud walls supporting elements other than gypsum board to be engineered. Provide signed and sealed engineering shop drawings by a professional engineer licensed in the Province of Ontario for those specific areas.

1.4 WASTE MANAGEMENT AND DISPOSAL

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

Part 2 Products

2.1 MATERIALS

.1 Non-load bearing channel stud framing: to ASTM C645, stud size indicated, roll formed from hot dipped galvanized steel sheet, for screw attachment of gypsum board. Knock-out service holes at 460 mm centres. Minimum base thickness as follows:

.1 General interior framing: minimum 0.455 mm thick (25 ga.), based on 359 N/m^2 (7.5 psf) lateral load and L/240 deflection.

.2 Jamb framing, behind abuse resistant gypsum board, wall mounted televisions, millwork: 0.912 mm.

.3 Stud framing at abuse-resistant gypsum wallboard locations: minimum 20 gauge (0.752 mm) base metal thickness steel studs.

.2 Floor and ceiling tracks: to ASTM C645, in widths to suit stud sizes, 32 mm flange height.

.3 Deflection systems:

.1 Single track: To ASTM C645, roll formed from hot dipped galvanized steel sheet, Z120 (G40) coating designation to ASTM A653/A653M, single slotted ceiling track.

.1 Movement: Allowing up to 25 mm vertical movement

.2 Dimensions: 1.09 mm thick x width required.

.3 UL classification: 1 and 2 hour fire rating, to ASTM E119 and ASTM E814 for fire and hose stream testing.

.4 Metal channel stiffener: 38 x 38 mm size, 1.4mm thick cold rolled steel, coated with rust inhibitive coating.

.5 Plenum barrier framing: 0.455 mm (25ga) studs, 41 mm x 32 mm flange, roll formed, hot dipped galvanized.

.6 Acoustical sealant: to section 07 92 00 – Joint Sealants.

.7 Insulating strip: rubberized, moisture resistant 3 mm thick foam strip, 12 mm wide, with self sticking adhesive on one face, lengths as required.

.8 Fasteners: To ASTM C1513, pan head, corrosion resistant, sized to suit application.

Part 3 Execution

3.1 ERECTION

.1 Align partition tracks at floor and ceiling and secure at 600 mm on centre maximum.

.2 Install damp proof course under stud shoe tracks of partitions on slabs on grade.

.3 Place studs vertically at 400 mm on centre and not more than 50 mm from abutting walls, and at each side of openings and corners.

- .1 Position studs in tracks at floor and ceiling.
- .2 Cross brace steel studs as required to provide rigid installation to manufacturer's instructions.

.4 Erect metal studding to tolerance of 1:1000.

.5 Attach studs to bottom track using screws.

.6 Co-ordinate simultaneous erection of studs with installation of service lines. When erecting studs ensure web openings are aligned.

.7 Co-ordinate erection of studs with installation of door / window frames and special supports or anchorage for work specified in other Sections.

.8 Provide two studs extending from floor to ceiling at each side of openings wider than stud centres specified.

- .1 Secure studs together, 50 mm apart using column clips or other approved means of fastening placed alongside frame anchor clips.

.9 Erect track at head of door/window openings and sills of sidelight/window openings to accommodate intermediate studs.

- .1 Secure track to studs at each end, in accordance with manufacturer's instructions. Install intermediate studs above and below openings in same manner and spacing as wall studs.

.10 Frame openings and around built-in equipment, cabinets, access panels, on four sides. Extend framing into reveals.

- .1 Check clearances with equipment suppliers.

.11 Reinforcing:

- .1 Provide 19 mm plywood blocking secured between studs for attachment of wall mounted items attached to steel stud partitions except where sheet steel indicated.
  - .1 Cut plywood to fill space between webs of adjacent studs, kerf plywood as required to nest in stud flanges.
  - .2 Locate where required by work of other Sections.
- .2 Provide sheet steel reinforcing where indicated for attachment of wall mounted items.
  - .1 Install stud framing behind entire perimeter of sheet steel reinforcing.
  - .2 Secure reinforcing to face of studs.
  - .3 Withstand minimum 227 kg pull force.

.12 Install steel studs or furring channel between studs for attaching electrical and other boxes.

.13 Extend partitions to ceiling height except where noted otherwise on drawings.

.14 Maintain clearance under beams and structural elements occurring above steel stud partitions to avoid transmission of structural loads to studs. Provide deflection system.

.15 Install two continuous beads of acoustical sealant under studs and tracks around perimeter of sound control partitions.

3.2 CLEANING

.1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American Society for Testing and Materials (ASTM).
- .1 ASTM C206-14(2022), Standard Specification for Finishing Hydrated Lime.
- .2 ASTM C897-15(2020), Standard Specification for Aggregate for Job-Mixed Portland Cement-Based Plasters.

.2 Canadian Standards Association (CSA).
- .1 CAN/CSA A3000:23, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
- .2 CAN/CSA-A123.2-03 (R2023), Asphalt-Coated Roofing Sheets.

Part 2 Products

2.1 MATERIALS

.1 Portland cement: Type 10 to CAN/CSA-A5.

.2 White cement: proprietary brand as commercially available conforming to CAN/CSA A5.

.3 Hydrated finishing lime: to ASTM C206, Type S.

.4 Sand: clean, well graded fresh water sand to ASTM C897.

.5 White sand: clean, well screened to ASTM C897, or proprietary white sand as commercially available.

.6 Water: clean, potable and free from deleterious matter, acids or alkalis.

.7 Metal lath: diamond mesh, 1.13 kg/0.836 m2 (2.5 lbs/yd²), galvanized for exterior work, rust inhibitive coating for interior work.

.8 Tie wire: zinc coated annealed steel wire, minimum 1.29 mm (16 gauge) diameter.

.9 Cornerite: expanded 0.405 mm (26 gauge) thick sheet steel, 64 mm legs, galvanized finish.

.10 Striplath: expanded 0.405 mm (26 gauge) thick sheet steel, 152 mm wide, galvanized finish.

.11 Fasteners: galvanized type with 76 x 76 mm size galvanized washer heads. Min 38mm embedment into concrete face. Spacing min 400 o.c. each way. For thickness of rigid insulation for length of fastener, refer to drawings.

2.2 ACCESSORIES

.1 Stucco stops: square, 0.405 mm (26 gauge) galvanized sheet steel or pure zinc, perforated or expanded flanges.

.2 Corner beads: standard 0.405 mm (26 gauge) galvanized sheet steel or pure zinc, perforated or expanded flanges.

.3 Control joints: "M" type for flat or corner application, 26 gauge galvanized steel, perforated or expanded flanges, ground depth to suit.
- .1 Acceptable material: Keene #30 Cornermaster, Keene #15 Expansion Joint.

2.3 MIXING

.1 Do not use detergent, soap, or other additives in stucco mixes.

.2 Proportion parts by volume; accurately measure ingredients, including water. Proportion successive batches alike.

.3 Adjust cement and lime content by volume based on strength, workability and finishing requirements.

.4 Scratch coat: 1 part cement; 3/4 to 1½ parts lime; 2½ to 4 parts sand (volume of sand per sum of cementitious material).

.5 Parge coat: 1 part cement; 3/4 to 1½ parts lime; 3 to 5 parts sand (volume of sand per sum of cementitious material).

Part 3 Execution

3.1 ACCESSORIES

.1 Erect accessories straight, plumb or level, rigid and at proper plane. Use full length pieces wherever possible. Make joints tight, accurately aligned and rigidly secured. Mitre and fit corners accurately, free from rough edges.

.2 Provide metal corner beads at all external angles.

.3 Provide casing beads wherever stucco terminates and abuts other surfaces and where specifically called for on drawings.

.4 Provide continuous base screed at bottom of stucco panels where panels terminate.

.5 Install fasteners with square washers to support diamond mesh through rigid insulation into concrete substrate.

3.2 CEMENT APPLICATION

.1 Scratch coat:
- .1 Apply full scratch coat in enough thickness with sufficient pressure to form positive bond. Cross scratch and allow to set.
- .2 Damp cure for not less than 48 hours. Permit to dry.

.2 Parging coat:
- .1 Apply parging coat on scratch coat no sooner than 48 hours after installation of scratch coat.
- .2 Apply over dampened scratch coat with enough pressure to form positive bond.
- .3 Bring out to grounds, straighten to true surface, and provide medium brush dash finish.
- .4 Damp cure for not less than 48 hours.

3.3 CEMENT THICKNESS

.1 Thickness of finish or top coats specified below are minimum thickness. Increase thickness as required to suit specified textured finishes.

.2 Cement parging (two coat system) on vertical surfaces on metal reinforcement on solid base:
- .1 Scratch coat: 10 mm.
- .2 Finish (parge) coat: 6 mm.
- .3 Total: 16 mm.

END OF SECTION

Part 1 General

1.1 RELATED WORK

.1 Section 03 33 00 – Cast-in-Place Concrete.

.2 Section 06 10 00 - Rough Carpentry.

.3 Division 07 – Thermal and Moisture Protection.

.4 Division 22 – Plumbing.

1.2 REFERENCES

.1 ASTM F710-22, Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring

.2 ASTM F1303-04(2021), Standard Specification for Sheet Vinyl Floor Covering with Backing.

.3 ASTMF1869-23, Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

.4 Underwriters Laboratories of Canada (ULC).

.1 CAN/ULC 102.2:2019 (R2024), Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies.

1.3 SAMPLES

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

.2 Submit duplicate 300 x 300 mm sample pieces of sheet material.

1.4 SHOP DRAWINGS

.1 Upon request, submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit manufacturer’s current printed product literature, specifications, installation instructions, and field reports.

.3 Submit shop drawings to show layout, treatment at walls, floor drains, and other objects. Indicate details of proposed treatment, where flooring material meets other floor materials.

.4 Closeout submittals: submit manufacturer’s operation and maintenance data for incorporation into manual specified in accordance with Section 01 78 00 – Closeout Submittals. Include methods for maintaining installed products and precautions against cleaning materials and methods detrimental to finishes and performance.

1.5 ENVIRONMENTAL REQUIRMENTS

.1 Maintain air temperature and structural base temperature at flooring installation area above 20 degrees Celsius for 48 hours before, during and 48 hours after installation.

.2 Should storage temperature be below 18 degrees Celsius or the floor temperature is below 18C, the flooring product to be moved to a warmer place and allowed to reach this temperature before unrolling or installation.

1.6 QUALITY ASSURANCE

.1 Sheet vinyl flooring to be installed by contractors approved by the material manufacturers and to have minimum 5 years' experience in the type of application required.

.2 Bond Test: Install multiple bond tests using 1m x 1m pieces of material adhered with the appropriate adhesive to verify quality of adhesion. Remove half of each piece after 24 hours, then the other half after 48 hours. To help assess resistance to indentation, place end user equipment onto a sample for 72 hours. Document all results.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Deliver material to project site in Storage and manufacturer's original, unopened containers with labels indicating brand names, colors, and patterns, and quality designations legible and intact.

.2 Do not open containers or remove markings until materials are inspected and accepted.

.3 Store on end and protect accepted materials in accordance with manufacturer's directions and recommendations.

.4 Unless otherwise directed, store materials in original containers at not less than 21 degrees Celsius for not less than 24 hours immediately before installation.

1.8 WARRANTY

.1 Deliver material to project site in store, and in manufacturer's original unopened containers with labels indicating brand names,

Part 2 Products

2.1 MATERIALS

.1 Resilient sheet flooring: Altro Aquarius, 2 mm thick, having a density of 2.6 kg/m. One solid colour will be selected from standard range.

.2 Adhesives: as recommended by flooring manufacturer to suit application requirements.

.3 Sub-floor filler and leveler: Portland cement base latex underlayment as recommended by flooring manufacturer for use with their product.

.4 Flash Cove Base: to ASTM F1303.

.5 Install flash cove wall base in strict accordance with manufacturer's written instructions and specifications including inside and outside corners. Provide stainless steel cap strip and plastic cove stick for flash cove base.

2.2 ACCESSORIES

.1 Provide all accessories as per manufacturer's written specifications.

.2 Vinyl welding rod: Altro Weld Rod.

.3 Cove former - sized to suit application: Altro Cove former 20R - 24 mm radius.

.4 Cap strip - sized to suit application, stainless steel.

.5 Subfloor Filler and Leveler: Use only grey Portland cement-based “moisture tolerant” underlayments, and patching compounds. Use for filling cracks, holes or leveling. White gypsum materials are not acceptable.

.6 Metal edge strips: smooth stainless steel with lip to extend over flooring.

.7 Adhesives

.1 Altrofix 30 – 2-part Polyurethane adhesive.

.2 Altrofix 31 – 2-part Polyurethane fast set version for repairs and small areas.

Part 3 Execution

3.1 INSPECTION

.1 Comply with manufacturer’s product data, including product technical bulletins, product catalog, and installation instructions.

.2 Site Verification of Conditions: verify substrate conditions, which have been previously installed under other sections, are acceptable for product installation in accordance with manufacturer’s instructions.

.3 Ensure concrete floors are dry by using test methods recommended by flooring manufacturer. Commencement of work implies acceptance of conditions.

3.2 SUB-FLOOR PREPARATION

.1 Remove substrate paint, coatings and other substances that are incompatible with adhesives or contain soap, wax, oil, solvents, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

.2 Permanent and non-permanent markers, pens, crayons, and paint to not be used to write on the back of the flooring material or used to mark the substrate as they could bleed through and stain the flooring material.

.3 Safety flooring to be installed over subfloors conforming to ASTM F710 for concrete and other monolithic floors.

.4 Always conduct moisture tests per ASTM F2170 on all concrete slabs regardless of age or grade level. Do not proceed with work until results of moisture condition tests are acceptable.

.5 Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes and other defects with sub-floor filler.

.6 Inspect and allow for smooth transition from other floor finishes to this flooring material.

.7 When patching, a moisture tolerant patching compound must always be used.

.8 Dry vacuum entire floor area immediately before application of adhesive.

.9 Ensure concrete slopes to drains.

3.3 FLOORING APPLICATION

.1 Install resilient sheet flooring in strict accordance with manufacturer's printed instructions and National Floor Covering Association, Specifications Standards Manual.

.2 Weld all seams by heat welding with Altro Weldrod™ only. Failure to install Altro Aquarius flooring in accordance with recommended procedures will void the Limited

Product Warranty.

.2 Apply adhesive uniformly using recommended trowel. Do not spread more adhesive than can be covered by flooring before initial set takes place.

.3 Lay flooring with seams parallel to building lines to produce a minimum number of seams.

.4 As installation progresses, roll flooring with 75 kg minimum roller to ensure full adhesion.

.5 Cut flooring neatly around fixed objects. Where recommended, glue 300 mm around perimeter with epoxy and seal junction.

.6 Continue flooring through areas which will be under built-in furniture.

.7 Terminate flooring at centreline of door in openings where adjacent floor finish or colour is dissimilar.

.8 Install metal edge strips at unprotected or exposed edges where flooring terminates.

.9 Drains: Fit safety flooring and mechanically fasten to drain outlets to ensure a permanent, watertight installation. New Round Drains: Install round flash clamping ring type drains to accommodate safety flooring. Install drains to fit flush with surrounding floor surface. Acceptable drain manufacturers and drain types include Wade FC-1100. Please refer to manufacturer's current Installation Guide for approved drain manufacturers and styles.

3.4 INITIAL CLEANING

.1 Remove excess adhesive from floor, base and wall surfaces without damage.
.2 Clean, floor surface to flooring manufacturer's printed instructions.

3.5 PROTECTION OF FINISHED WORK

.1 Sweep or vacuum all construction debris and dust first, then clean the flooring with AltroClean 44 /AltroClean 44 Plus using an auto scrubber.

.2 Cover and protect finished installation from damage from other trades using a non-staining, temporary floor protection system, such as reusable textured plastic sheeting.

.3 Never use tapes on the surface on the finish flooring, Sharpies, pens, crayons or construction markers on either the finish flooring or the substrate.

.4 No traffic for 24 hours after installation.

.5 No heavy traffic, rolling loads, or furniture placement for 72 hours after installation.

.6 Wait 72 hours after installation before performing initial cleaning. Start a regular maintenance program after the initial cleaning as recommended by manufacturer

END OF SECTION

Part 1 General

1.1 SECTIONS INCLUDES

.1 Sound absorptive wall panels.

.2 Miscellaneous accessories.

1.2 RELATED SECTIONS

.1 Section 04 22 00 – Unit Masonry.

.2 Section 09 91 00 – Painting.

1.3 REFERENCES

.1 American Society for Testing and Materials (ASTM).
- .1 ASTM C423-17, Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
- .2 ASTM E84-24, Standard Test Method for Surface Burning Characteristics of Building Materials.
- .3 ASTM E795-23, Standard Practices for Mounting Test Specimens During Sound Absorption Tests.

1.4 SUBMITTALS

.1 Submit manufacturer's recommended installation instructions and documentation certifying conformance with specified performance requirements.

.2 Shop Drawings: Submit drawings indicating layout for all areas to receive work of this section, including but not limited to any penetrations and/or equipment/fixtures within wall for Mechanical Process, Electrical equipment and Mechanical ductwork and/or grilles. Indicate pattern of units, cut units, details, and coordination requirements for work of other sections. Provide shop drawing indicating all four interior wall elevations.

.3 Samples: Submit for approval two samples of sound absorptive panel and suspension systems, not less than 305 mm by 457 mm in size and demonstrating colors, textures, and finishes that will be provided in the finished work.

1.5 QUALITY ASSURANCE

.1 Installer Qualifications: Installers to have demonstrated experience in assembly and installation of products like those specified in this section.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials in manufacturer's original unopened and undamaged packages with labels legible and intact.

.2 Store materials in unopened packages in a manner that will avoid damage from the environment and from construction operations.

.3 Handle in accordance with manufacturer's instructions.

1.7 ENVIRONMENTAL REQUIREMENTS

.1 Do not begin installation of acoustic panels until building has been enclosed and environmental conditions approximate interior conditions that will prevail when building in occupied.

Part 2 Products

2.1 MANUFACTURERS

.1 Acceptable Manufacturer: Eckel Noise Control Technologies, 35 Allison Drive, Morrisburg, Ontario, 613- 543-2967.

2.2 ACOUSTIC PANELS

.1 Acoustic Panels: Eckel Eckoustic Functional Panels.
- .1 Coverage:
  - .1 Total Area: As indicated on drawings.
  - .2 Panel Thickness: 70 mm "V" ridge facing.
  - .3 Width: 760 mm.
  - .4 Length:
    - .1 1525 mm.
    - .2 1830 mm.
    - .3 2440 mm.
    - .4 3050 mm.
    - .5 Custom: lengths as indicated on the drawings.

- .2 Panel Performance:
  - .1 Sound Absorption: Provide panels that are certified to meet the following minimum sound absorption for a 760 by 3050 mm panel, encapsulated in a 2.1 mil (0.05mm) flame guard polyethylene, when tested in accordance with ASTM C423 and E795:
    - .1 125 Hz: 6.2 sabins.
    - .2 250 Hz: 20.5 sabins.
    - .3 500 Hz: 35.2 sabins.
    - .4 1000 Hz: 34.5 sabins.
    - .5 2000 Hz: 31.5 sabins.
    - .6 4000 Hz: 33.1 sabins.
    - .7 NRC: 0.99, minimum.

  - .2 Fire: Provide panels that demonstrate the following performance when tested in accordance with ASTM E84:
    - .1 Flame Spread: 10 maximum.
    - .2 Smoke Density: 10 maximum.

  - .3 Panel Construction: Steel.
    - .1 Facings: 22 gage (0.76 mm) electrogalvanized steel sheet, perforated with 3/32 inch (2 mm) holes on 3/16 inch (4.8 mm) staggered centers; V-ridged on 6 inch (150 mm) centers to a depth of 2-3/4 inches (70 mm).
    - .2 Framing: 20 gage (0.9 m) electrogalvanized steel. channel shaped; supply two ¼-20 inch threaded inserts for each framing member for attachment of panel mounting brackets.
    - .3 Brackets: Provide four 11 gage (3 mm) steel brackets per unit for attachment to walls and ceilings, providing 4 inches (100 mm) of clearance between back of panel and mounting surface.

.4 Finish: Polyurethane enamel paint; factory applied.
.5 Color: White.

.4 Acoustical Insulation: (50 mm thick, fine fibered, fibrous glass, having a density of not less than 1.5 pounds per cubic foot (24 kg/cubic m), encapsulated in a 1.5 to 2 mil (0.04 to 0.05 mm) flame guard polyethylene.

.5 Anchors and Fasteners: 6 mm diameter by 25 mm long bolts (or length to suit) to attach mounting brackets to the panels, cadmium plated for steel panels, stainless steel for aluminum panels; corrosion-resistant anchors for fastening brackets to substrate, as recommended by panel manufacturer and approved by Engineer.

Part 3 Execution

3.1 EXAMINATION

.1 Examine surfaces to receive work of this section. Do not begin installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

.1 Install panels on walls and ceilings in locations and in patterns indicated on the drawings.

.2 Install each unit as indicated on the drawings and in accordance with manufacturer's printed instructions, using approved anchors and fasteners.

3.3 ADJUST AND CLEAN

.1 After installation of acoustic panel, clean all dirty or discolored surfaces, using cleaning materials and methods acceptable to manufacturer. Replace damaged components as directed by the Engineer.

.2 Remove debris caused by work of this section daily. At completion of acoustic panel installation, remove all crates, cartons, packages, and debris from the project site.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Master Painters Institute (MPI).

.1 Architectural Painting Specification Manual, latest edition at bid closing.

.2 The Society for Protective Coatings (SSPC).

.1 SSPC Painting Manuals Volume 1 & 2, latest edition at bid closing.

.3 National Fire Code of Canada 2020.

.4 Green Seal.

.1 Standard GS-11-2021, Edition 4.0, Coatings, Stains, and Sealers.

.5 Health Canada/Workplace Hazardous Materials Information System (WHMIS).

.1 Safety Data Sheets (SDS).

1.2 QUALITY ASSURANCE

.1 Contractor to have a minimum of 5 years proven satisfactory experience. When requested, provide a list of last three comparable jobs including, job name and location, specifying authority, and project manager.

.2 Qualified journeymen who have a "Tradesman Qualification Certificate of Proficiency" to be engaged in painting work. Apprentices may be employed provided they work under the direct supervision of a qualified journeyman in accordance with trade regulations.

.3 Conform to latest MPI requirements for painting work including preparation and priming.

.4 Materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, and solvents) to be in accordance with MPI Painting Specification Manual "Approved Product" listing and to be from a single manufacturer for each system used.

.5 Other paint materials such as linseed oil, shellac, and turpentine to be the highest quality product of an approved manufacturer listed in MPI Painting Specification Manual and to be compatible with other coating materials as required.

.6 Retain purchase orders, invoices and other documents to prove conformance with noted MPI requirements.

.7 Standard of Acceptance:

.1 Walls: No defects visible from 1000 mm at 90 degrees to surface.

.2 Ceilings: No defects visible from floor at 45 degrees to surface when viewed using final lighting source.

.3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

1.3 ENVIRONMENTAL PERFORMANCE REQUIREMENTS

.1 Provide paint products meeting the following environment performance requirements:

.1 VOC emissions from paints to not exceed the limits of Green Seal’s Standard GS-11.

1.4 SUBMITTALS

.1 Product Data:

.1 Submit product data and manufacturer's installation/application instructions for each paint and coating product to be used in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit Workplace Hazardous Materials Information System (WHMIS) Safety Data Sheets (SDS).

.3 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.4 Submit manufacturer's installation and application instructions.

.2 Upon completion, submit records of products used. List products in relation to finish system and include the following:

.1 Product name, type and use.

.2 Manufacturer's product number.

.3 Colour numbers.

.4 Manufacturer's Safety Data Sheets (SDS).

1.5 SAMPLES

.1 Submit three drawdowns of each product and colour combination with specified paint or coating in colours, gloss/sheen and textures required to MPI Painting Specification Manual standards, size 100 x 150 mm, mounted on 216 x 280 mm sheets, submitted on the following substrate materials:

.1 Drawdowns of opaque finishes to be applied using 4 mil WC-4 Wire-Cator on Leneta form WD plain white coated cards.

.2 3 mm plate steel for finishes over metal surfaces.

.3 50 mm concrete block for finishes over concrete masonry surfaces.

.2 When approved, sample panels to become acceptable standard of quality for appropriate on-site surface with one of each sample retained on-site.

.3 Label each card with the following:

.1 Job name.

.2 Date.

.3 Product name.

.4 Product number.

.5 Colour number as stated in the colour schedule.

.6 Name, address, and phone number of the supplying facility.

.4 Submit full range of available colours where colour availability is restricted.

1.6 EXTRA MATERIALS

.1 Submit maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Submit one - four litre can of each type and colour of primer finish coating. Identify colour and paint type in relation to established colour schedule and finish system.

.3 Deliver to Owner and store where directed.

1.7 DELIVERY, HANDLING AND STORAGE

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

.2 Labels to clearly indicate:

- .1 Manufacturer's name and address.
- .2 Type of paint or coating.
- .3 Compliance with applicable standard.
- .4 Colour number in accordance with established colour schedule.

.3 Remove damaged, opened and rejected materials from site.

.4 Provide and maintain dry, temperature controlled, secure storage.

.5 Observe manufacturer's recommendations for storage and handling.

.6 Store materials and supplies away from heat generating devices.

.7 Store materials and equipment in a well-ventilated area with temperature range 7^0C to 30^0C.

.8 Store temperature sensitive products above minimum temperature as recommended by manufacturer.

.9 Keep areas used for storage, cleaning and preparation, clean and orderly to approval of Consultant. After completion of operations, return areas to clean condition to approval of Consultant.

.10 Remove paint materials from storage only in quantities required for same day use.

.11 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling storage, and disposal of hazardous materials.

.12 Fire Safety Requirements:

- .1 Provide one 9 kg Type ABC dry chemical fire extinguisher adjacent to storage area.
- .2 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site daily.
- .3 Handle, store, use and dispose of flammable and combustible materials in accordance with the National Fire Code of Canada.

1.8 SITE REQUIREMENTS

.1 Heating, Ventilation and Lighting:

- .1 Ventilate enclosed spaces in accordance with Section 01 51 00 - Temporary Utilities.
- .2 Perform no painting work unless adequate and continuous ventilation and enough heating facilities are in place to maintain ambient air and substrate temperatures above 10^0C for 24 hours before, during and after paint application until paint has cured sufficiently.

.3 Where required, provide continuous ventilation for seven days after completion of application of paint.

.4 Provide temporary ventilating and heating equipment where permanent facilities are not available or supplemental ventilating and heating equipment if ventilation and heating from existing system is inadequate to meet minimum requirements.

.5 Perform no painting work unless a minimum lighting level of 323 Lux is provided on surfaces to be painted.

.2 Temperature, Humidity and Substrate Moisture Content Levels:

.1 Unless specifically pre-approved, perform no painting work when:

.1 Ambient air and substrate temperatures are below 10 degrees Celsius.

.2 Substrate temperature is over 32 degrees Celsius unless paint is specifically formulated for application at high temperatures.

.3 Substrate and ambient air temperatures are expected to fall outside MPI or paint manufacturer’s prescribed limits.

.4 The relative humidity is above 85 percent or when the dew point is less than 3 degrees Celsius variance between the air / surface temperatures.

.5 Rain or snow are forecast to occur before paint has thoroughly cured or when it is foggy, misty, raining or snowing at site.

.2 Perform no painting work when the maximum moisture content of the substrate exceeds:

.1 12 percent for concrete walls and masonry (concrete brick / block).

.2 15 percent for wood.

.3 12 percent for plaster and gypsum board.

.4 1.36 kg of water per 92.9 sq. m in 24 hours for concrete floors

.3 Conduct moisture tests using a properly calibrated electronic Moisture Meter, except test concrete floors for moisture using a simple "cover patch test".

.3 Surface and Environmental Conditions:

.1 Apply paint finish only in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.

.2 Apply paint only to adequately prepared surfaces and to surfaces within moisture limits noted herein.

.3 Apply paint only when previous coat of paint is dry or adequately cured.

.4 Additional Interior Application Requirements:

.1 Apply paint finishes only when temperature at location of installation can be satisfactorily maintained within manufacturer's recommendations.

.5 Additional Exterior Application Requirements:

.1 Apply paint finishes only when conditions forecast for entire period of application fall within manufacturer's recommendations.

.2 Do not apply paint when:

.1 Temperature is expected to drop below 10 degrees Celsius before paint has thoroughly cured.

.2 Substrate and ambient air temperatures are expected to fall outside MPI or paint manufacturer's limits.

.3 Surface to be painted is wet, damp or frosted.

.3 Provide and maintain cover when paint to be applied in damp or cold weather. Heat substrates and surrounding air to comply with temperature and humidity conditions specified by manufacturer. Protect until paint is dry or until weather conditions are suitable.

.4 Schedule painting operations such that surfaces exposed to direct, intense sunlight are scheduled for completion during early morning.

.5 Remove paint from areas which have been exposed to freezing, excess humidity, rain, snow or condensation. Prepare surface again and repaint.

1.9 WASTE MANAGEMENT AND DISPOSAL

.1 Collect and separate waste materials for recycle or disposal in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

.2 Paint, stain and wood preservative finishes and related materials (thinners and solvents) are regarded as hazardous products and are subject to regulations for disposal. Information on these controls can be obtained from Provincial Ministries of Environment and Regional levels of Government.

.3 Material which cannot be reused to be treated as hazardous waste and disposed of in an appropriate manner.

.4 Place materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.

.5 To reduce the number of contaminants entering waterways, sanitary/storm drain systems or into ground the following procedures to be strictly adhered to:

.1 Retain cleaning water for water-based materials to allow sediments to be filtered out.

.2 Retain cleaners, thinners, solvents and excess paint and place in designated containers and ensure proper disposal.

.3 Return solvent and oil-soaked rags used during painting operations for contaminant recovery, proper disposal, or appropriate cleaning and laundering.

.4 Dispose of contaminants in an approved legal manner in accordance with hazardous waste regulations.

.5 Empty paint cans are to be dry before disposal or recycling (where available).

.6 Where paint recycling is available, collect waste paint by type and provide for delivery to recycling or collection facility.

.7 Set aside and protect surplus and uncontaminated finish materials. Deliver to or arrange collection for verifiable re-use or re-manufacturing.

.8 Close and seal tightly partly used sealant and adhesive containers and store protected in well ventilated fire-safe area at moderate temperature.

Part 2 Products

2.1 MATERIALS

.1 Paint materials listed in the MPI Approved Products List (APL), most recent edition, are acceptable for use on this project.

.2 Grade: MPI Premium Grade coating systems.

.3 Paint materials for paint systems to be products of a single manufacturer.

.4 Conform to latest MPI requirements for all painting work including preparation and priming.

.5 Materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners and solvents): in accordance with MPI - Architectural Painting Specification Manual "Approved Product" listing.

.6 Water-borne surface coatings to not be formulated or manufactured with aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium or their compounds.

.7 Water-borne surface coatings and recycled water-borne surface coatings to have a flash point of 61 degrees Celsius or greater.

.8 Both water-borne surface coatings and recycled water-borne surface coatings to be made by a process that does not release:

.1 Matter in undiluted production plant effluent generating a 'Biochemical Oxygen Demand' (BOD) more than 15 mg/L to a natural watercourse or a sewage treatment facility lacking secondary treatment.

.2 Total Suspended Solids (TSS) in undiluted production plant effluent more than 15 mg/L to a natural watercourse or a sewage treatment facility lacking secondary treatment.

.9 Recycled water-borne surface coatings to not contain:

.1 Lead more than 600.0 ppm weight / weight total solids.

.2 Mercury more than 50.0 ppm weight / weight total product.

.3 Cadmium more than 1.0 ppm weight / weight total product.

.4 Hexavalent chromium more than 3.0 ppm weight/weight total product.

.5 Organochlorines or polychlorinated biphenyls (PCBS) more than 1.0 ppm weight / weight total product.

2.2 COLOURS

.1 Selection of colours will be from manufacturer’s full range of colours.

.2 Where specific products are available in a restricted range of colours, selection will be based on the limited range.

.3 Second coat in a three-coat system to be tinted slightly lighter colour than top coat to show visible difference between coats.

.4 Schedule: will be based upon the following colour pallet:

.1 P-1– Sherwin Williams, ? . . . .. .

.2 P-2 ? . . . . .

.3 P-3 ? . . . . .

2.3 MIXING AND TINTING

.1 Perform colour tinting operations before delivery of paint to site, in accordance with manufacturer's written instructions. On-site tinting of painting materials allowed only with Consultant’s written permission.

.2 Paste, powder or catalyzed paint mixes to be mixed in strict accordance with manufacturer's written instructions.

.3 Where thinner is used, addition to not exceed paint manufacturer's recommendations. Do not use kerosene or similar organic solvents to thin water-based paints.

.4 Thin paint for spraying in accordance with paint manufacturer's written instructions.

.5 Re-mix paint in containers before and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.

2.4 GLOSS / SHEEN RATINGS

.1 Paint gloss to be defined as the sheen rating of applied paint, in accordance with the following values:

Gloss Level Category	Units @ 60E	Units @ 85E
G1 - matte finish	0 to 5	max. 10
G2 - velvet finish	0 to 10	10 to 35
G3 - eggshell finish	10 to 25	10 to 35
G4 - satin finish	20 to 35	min. 35
G5 - semi-gloss finish	35 to 70	
G6 - gloss finish	70 to 85	
G7 - high gloss finish	> 85	

.2 Gloss level ratings of painted surfaces as specified in this Section.

2.5 EXTERIOR PAINTING SYSTEMS

.1 Structural Steel and Metal Fabrications:

.1 EXT 5.1M - Waterborne light industrial G5 coating (over waterborne primer).

.2 Galvanized Metal: not chromate passivated: doors and frames

.1 EXT 5.3G - Waterborne light industrial G5 coating.

2.6 INTERIOR PAINTING SYSTEMS

.1 Concrete horizontal surfaces: floors:

.1 INT 3.2A G1 Finish.

.2 Structural steel - beams, joists:

.1 INT 5.1C W.B. – Alkyd and Waterborne dry fall finish (with MPI #76 anticorrosive primer), G1 finish.

.3 Structural steel and metal fabrications: columns, ladders, metal fabrications not listed elsewhere:

.1 INT 5.1R - High performance architectural latex G5 finish.

.4 Galvanized metal: doors, frames, railings, misc. steel, pipes and ducts.

.1 INT 5.3M - High performance architectural latex G5 finish.

.5 Galvanized metal: overhead decking.

.1 INT 5.3H - Waterborne dry fall G3 finish.

.6 Dressed lumber: doors.

.1 INT 6.3E - Polyurethane varnish G5 finish (over stain).

.7 Plaster and gypsum board: gypsum wallboard:

.1 INT 9.2B - High performance architectural latex G4 finish.

.1 Typical Walls: G3 finish.

.2 Typical Ceilings: G2 finish.

.3 Wet and Service Areas: G5 finish.

.2 INT 9.2N – Epoxy high build, G3-4 finish.

.1 Janitor Room.

.8 Concrete Masonry Units:

.1 Washroom Walls:

.1 Primer coat: Dulux X-Pert waterborne alkyd primer sealer, 23010.

.2 Two topcoats: Dulux X-Pert waterborne Alkyd Semi Gloss, 21010.

.3 Gloss: G5.

.2 Other Walls (Interior and Exterior):

.1 Primer coat: Dulux X-Pert Int / Ext waterborne alkyd primer sealer, 23010.

.2 Two topcoats: Dulux X-Pert Waterborne Alkyd, Semi-Gloss, 22010.

.3 Gloss: G4.

Part 3 Execution

3.1 GENERAL

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

.2 Perform preparation and operations for interior painting in accordance with MPI - Architectural Painting Specifications Manual except where specified otherwise.

.3 Apply paint materials in accordance with paint manufacturer's written application instructions.

3.2 EXAMINATION

.1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted.

.1 Report to Consultant damages, defects, unsatisfactory or unfavourable conditions before proceeding with work.

.2 Conduct moisture testing of surfaces to be painted using properly calibrated electronic moisture meter, except test concrete floors for moisture using simple "cover patch test".

.1 Do not proceed with work until conditions fall within acceptable range as recommended by the manufacturer.

3.3 PROTECTION

.1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage by suitable non-staining covers or masking.

.1 Where damaged, clean and restore such surfaces as directed by Consultant.

.2 Protect items that are permanently attached such as Fire Labels on doors and frames.

.3 Protect factory finished products and equipment.

.4 Protect passing pedestrians, and public in and about the building.

3.4 PREPARATION

.1 Surface Preparation:

.1 Remove electrical cover plates, light fixtures, surface hardware on doors, bath accessories and other surface mounted equipment, fittings and fastenings before undertaking painting operations.

.1 Identify and store items in secure location and re-installed after painting is completed.

.2 Move and cover furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.

.3 As painting operations progress, place "WET PAINT" signs in occupied areas.

.2 Clean and prepare surfaces in accordance with MPI - Architectural Painting Specification Manual specific requirements and coating manufacturer's recommendations.

.3 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats.

.1 Apply primer, paint, or pretreatment as soon as possible after cleaning and before deterioration occurs.

.4 Clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with MPI requirements.

.5 Touch up of shop primers with primer as specified.

.6 Do not apply paint until prepared surfaces have been reviewed by Consultant.

3.5 APPLICATION

.1 Method of application to be approved by Consultant. Conform to manufacturer's application instructions unless specified otherwise.

.2 Brush and roller application:

.1 Apply paint in a uniform layer using brush and/or roller of types suitable for application.

.2 Work paint into cracks, crevices and corners.

.3 Brush and/or roll out runs and sags, and over-lap marks. Rolled surfaces to be free of roller tracking and heavy stipple unless approved by Consultant.

.4 Remove runs, sags and brush marks from finished Work and repaint.

.3 Spray application:

.1 Provide and maintain equipment that is suitable for intended purpose, capable of properly atomizing paint to be applied, and equipped with suitable pressure regulators and gauges.

.2 Keep paint ingredients properly mixed in containers during paint application either by continuous mechanical agitation or by intermittent agitation as frequently as necessary.

.3 Apply paint in a uniform layer, with overlapping at edges of spray pattern.

.4 Brush out immediately all runs and sags.

.5 Use brushes to work paint into cracks, crevices and places which are not adequately painted by spray.

.6 Final coat to be applied using a roller.

.4 Use dipping, sheepskins or daubers only when no other method is practical in places of difficult access and only when specifically authorized by Consultant.

.5 Apply coats of paint continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.

.6 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time as recommended by manufacturer.

.7 Sand and dust between coats to provide adequate adhesion for the next coat and to remove defects visible from 1000 mm.

.8 Finish surfaces both above and below sight lines as specified for surrounding surfaces, including such surfaces as tops of interior cupboards and cabinets and projecting ledges.

.9 Finish closets and alcoves as specified for adjoining rooms.

.10 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.

3.6 MECHANICAL/ ELECTRICAL EQUIPMENT

.1 Refer to Division 21, 22, 23 and 26 for mechanical and electrical items to be painted, identification and banding requirements.

.2 Public / Exposed areas: paint exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment with colour and finish to match adjacent surfaces, except as noted or detailed on drawings.

.3 Back-of House / Concealed areas: leave exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment in original finish and touch up scratches and marks unless required for service identification specified elsewhere.

.4 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.

.1 Do not paint over nameplates.

.2 Do not paint transformers and substation equipment.

.3 Keep sprinkler heads free of paint.

.5 Paint inside of ductwork where visible behind grilles, registers and diffusers with primer and one coat of matt black paint.

.6 Paint disconnect switches for fire alarm system and exit light systems in red enamel.

.7 Paint both sides and edges of backboards for telephone and electrical equipment before installation.

.1 Leave equipment in the original finish except for touch-up as required.

3.7 SITE TOLERANCES

.1 Standard of Acceptance:

.1 Walls: no defects visible from 1000 mm at 90 degrees to surface.

.2 Ceilings and Soffits: no defects visible from floor at 45 degrees to surface when viewed using final lighting source.

.3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

3.8 RESTORATION

.1 Clean and re-install all hardware items removed before undertaken painting operations.

.2 Remove protective coverings and warning signs as soon as practical after operations cease.

.3 Remove paint splashings on exposed surfaces that were not painted. Remove smears and spatter immediately as operations progress, using compatible solvent.

.4 Protect freshly completed surfaces from paint droppings and dust to approval of Consultant. Avoid scuffing newly applied paint.

.5 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition as approved by Consultant.

END OF SECTION

DIVISION 10 SPECIALITIES

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Complete manufacture and installation of interior signage.

.2 Related Requirements:

.1 Section 06 10 00 – Rough Carpentry

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM):

.1 ASTM D635-22, Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.

.2 ASTM D1929-23, Standard Test Method for Determining Ignition Temperature of Plastics.

.3 ASTM E84-24, Standard Test Method for Surface Burning Characteristics of Building Materials.

.4 ASTM E2072-24, Standard Specification for Photoluminescent (Phosphorescent) Safety Marketing.

.5 ASTM E2073-24, Standard Test Method for Photopic Luminance of Photoluminescent (Phosphorescent) Markings.

.2 Underwriters Laboratories (UL):

.1 UL 94-23 (R2024), Tests for Flammability of Plastic Materials for Parts in Devices and Appliances.

.2 UL 723-18 (R2023), Test for Surface Burning Characteristics of Building Materials.

1.3 PERFORMANCE REQUIREMENTS

.1 Provide signage that conforms to the requirements of all regulatory agencies holding jurisdiction.

.2 Requirements:

.1 Comply with all applicable provisions of the latest ADA Standard for Accessible Design.

.2 Character Proportion: Refer to drawings and details for letters and numbers on signs.

.3 Colour Contrast: Refer to drawings and details for characters and symbols must contrast with their background - either light characters on a dark background or dark characters on a light background.

.4 Raised Characters or Symbols: Refer to drawings and details for letters and numbers on signs must be raised 1/32 in (0.8 mm) minimum and be sans serif characters. Raised characters or symbols must be at least 5/8 in (16 mm) high but no higher than 2 in (50 mm). Symbols or pictograms on signs must be raised 1/32 in (0.8 mm) minimum.

.5 Symbols of Accessibility: Accessible facilities required to be identified must use the international symbol of accessibility.

.6 Braille: Grade I with accompanying text.

.3 Fire Performance Characteristics:

.1 Provide signage with surface burning characteristics that consist of a flame spread of 75 and a smoke development of 120 when tested in accordance to UL 723 (ASTM E 84).

.2 Self-Extinguishing: Provide signage with a CC1 classification for .060 in thick material when tested in accordance with the procedures in ASTM D 635, Standard Test Method for Rate of Burning and/or Extent and Time of Burning Plastics in a Horizontal Position.

.3 Vertical Burn: Provide material that is classified as 94V-2 for material .118 in thick or greater and 94HB for material .118 in thick or less when tested in accordance with UL 94, Tests for Flammability of Plastic Materials for Parts in Devices and Appliances.

.4 Self-Ignition Temperature: Provide material that has a self-ignition temperature of 800 degrees Fahrenheit (427 degrees Celsius) when tested in accordance with ASTM D 1929.

1.4 SUBMITTALS

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

.2 Action Submittals:

.1 Product Data: Manufacturer's data sheets on each product to be used, including:
- .1 Preparation instructions and recommendations.
- .2 Storage and handling requirements and recommendations.
- .3 Installation methods.

.2 Shop Drawings:

.1 Submit shop drawings, catalogue sheets and full-size templates.

.2 Indicate materials, thicknesses, sizes, finishes, colours, construction details, removable and interchangeable components, mounting methods, schedule of signs.

.3 Submit drawn-to-scale details for signage indicating word and letter spacing.

.3 Message List: Signage report indicating signage location, text and sign type.

.4 Samples:

.1 Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and available pictograms, characters, and Braille indications.

.2 Verification Samples: For each finish product specified, two samples, representing actual product, color, and typical pictograms, characters, and Braille indications.

.3 Informational Submittals:

.1 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.

1.5 QUALITY ASSURANCE

.1 Manufacturer Qualifications: Minimum 2 years documented experience in work of this Section.

.2 Installer Qualifications: Minimum 2 years documented experience in work of this Section.

.3 Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.

.1 Furnish signs designated by Consultant.

.2 Do not proceed with remaining work until workmanship, colour, and sheen are approved by Consultant.

.3 Refinish mock-up area as required to produce acceptable Work.

1.6 CLOSEOUT SUBMITTALS

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

1.7 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver materials in unopened factory packaging.

.3 Inspect materials at delivery to verify there are no defects or damage.

.4 Store products in manufacturer's original packaging until ready for installation in climate-controlled location away from direct sunlight.

.5 Waste Management: separate waste materials in accordance with Section 01 74 20 – Construction/Demolition Waste Management and Disposal.

.6 Store and dispose of solvent-based materials, and materials used with solvent-based materials in accordance with requirements of local authorities having jurisdiction.

Part 2 Products

2.1 PROJECT CONDITIONS

.1 Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

2.2 MANUFACTUERERS

.1 Acceptable Manufacturers:

.1 Wintle Signs: Box 642 Osgooge Ontario, K0A 2W0, Ph:613-826-0811, Cell: 613-552-1046.

.2 Acumen Visual Group, 30 Riviera Drive Markham ON Canada L3R 5M1 Phone: +1 905-947-0770 Web: www.ideasbuilt.ca

.3 Marvel Sign and Display, Inc., 99 Rodinea Road, Unit 1, Vaughan, Ontario L6A 1R3, Canada. Phone: (905) 856-6920 Email: alan@marvelsigns.ca, Web: www.marvelsigns.ca

.4 WSI Sign System Ltd. & KING Architectural Products, 31 Simpson Road, Bolton - Ontario L7E 2R6. Phone: (905) 857-2804. Web: www.king-ap.com.

.5 Nova Polymers, Inc., which is located at: 8 Evans St. Suite 201; Fairfield, NJ 07004; Toll Free Tel: 888-484-NOVA (6682); Email:request info (info@novapolymers.com); Web:www.novapolymers.com

2.3 SIGNAGE - GENERAL

.1 It is the intent of these specifications to establish a sign standard for the Owner including but not limited to, wall-mounted directional signs, primary room identification, restrooms, conference rooms and all code compliant Braille signage.

.2 Comply with all applicable provisions of the 2010 ADA Standard for Accessible Design codes that apply to the State and Local jurisdiction of the project.

.3 If required text and graphics are not indicated in specification or on drawings, obtain Owner's instructions as to text and graphics prior to preparation of shop drawings.

.4 Typography: See Drawings. Copy shall be a clean and accurate reproduction of typeface(s) specified. Upper and lower case and all caps as indicated in Sign Type drawings and Signage Schedule. Letter spacing to be set by manufacturer.

.5 Arrows, symbols and pictograms will be provided in style, sizes, colors and spacing as indicated in drawings for each sign system.

.6 Braille:

.1 Grade 1 Braille.

.7 Design:

.1 Text/Graphics Placement: As indicated on details.

.2 Font: As indicated on the details.

2.4 INTERIOR SIGNAGE

.1 Panel Material:

.1 6.35 mm thick (1/4”) black plexi door signs, white lettering.

.2 Graphics to be 0.7 mm thick vinyl

.3 Type and Colour: To be selected from manufacturer's full colour range by Consultant.

.4 Edges to be bevelled and polished

.5 Barrier Free washroom signs to have symbol and braille

.6 Size: as per details.

.7 Mounted using screws and caps.

.8 Surface burning characteristics: Flame spread/smoke developed rating less than 75/120, tested to ASTM E84 and UL 723.

.9 Rate of burning: Tested to ASTM D635 at nominal 1.5 mm (0.060 inch) thickness with resulting Classification CC1.

.10 Vertical burning: Tested to UL 94, classified as 94V-2 in thickness of 3.0 mm (0.118 inch) or greater and 94HB in thicknesses less than 3.0 mm (0.118 inch).

.11 Self-ignition temperature: 427 degrees Celsius (800 degrees Fahrenheit), tested to ASTM D1929.

2.5 ACCESSORIES

.1 Fasteners: Stainless steel screws.

2.6 FABRICATI0N

.1 Fabricate panel material in accordance with manufacturer's instructions and approved shop drawings.

.2 Characters:

.1 Height: Refer to Drawings.

.2 Style: Refer to Drawings.

.3 Width to height ratio: Refer to Drawings.

.4 Stroke width to height ratio: Refer to Drawings.

.3 Pictograms: Refer to Drawings.

.4 Provide Braille Grade indications for each character.

Part 3 Execution

3.1 EXAMINATION

.1 Do not begin installation until substrates have been properly prepared.

.2 If substrate preparation is the responsibility of another installer, notify Consultant of unsatisfactory preparation before proceeding.

3.2 PREPARATION

.1 Clean surfaces thoroughly before installation.

.2 Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, data sheets and approved shop drawings.

.2 Erect and secure signs plumb and level at elevations as directed by Consultant.

3.4 SYSTEM DEMONSTRATION

.1 Provide on-site demonstration and review of sign components to ensure signs are in full functional working order prior to completion of Work.

3.5 CLEANING

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

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

.2 Leave signs clean.

.3 Remove debris.

.4 Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Toilet partitions.

.2 Related Sections:

.1 Section 09 22 16 - Non-Structural Metal Framing.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM).

.1 ASTM A167-99(2017), Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

.2 ASTM A240/A240M-25, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.

.3 ASTM A653/A653M-23, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 Canadian Standards Association (CSA International).

.1 CSA/ASC B651:23, Accessible Design for the Built Environment.

1.3 SUBMITTALS

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

.2 Action Submittals:

.1 Shop Drawings:

.1 Indicate fabrication details, plans, elevations, hardware, and installation details.

.2 Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of product indicated.

.3 Samples:

.1 Submit duplicate representative samples of hardware items, including brackets, fastenings and trim.

.2 Submit duplicate 300 x 300 mm samples of panel showing finished edge and corner construction and core construction

.3 Informational Submittals:

.1 Manufacturer's Instructions: Submit manufacturer's installation instructions.

1.4 CLOSEOUT SUBMITTALS

.1 Submit maintenance data in accordance with Section 01 78 00 – Closeout Submittals.

.1 Provide recommended procedures for cleaning and maintenance.

1.5 QUALITY ASSURANCE

.1 Regulatory requirements: Water closet stalls designated for wheelchair access to CSA B651 and OBC 2012 barrier-free access requirements.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Minimize construction waste sent to the landfill, separate and recycle materials as specified in Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 MANUFACTURED UNITS

.1 Toilet partitions and urinal screens: Floor anchored overhead-braced, Commercial Stainless Steel Partitions. Provide smooth material, without creases or ripples.

.1 Basis of Design Product: Bradley Mills Partitions, Floor to Ceiling, Series 700.

.2 Acceptable Manufacturers:

.1 Bradley Corp.

.2 Hadrian.

.3 Finish

.1 Stainless Steel: No. 4 finish.

.2 Aluminum: Satin.

2.2 COMPONENTS

.1 Hinges: continuous stainless steel piano hinge, type 304.

.2 Latch set: built-in latch, combination door-stop keeper and bumper, stainless steel, emergency access feature.

.1 Barrier-free doors: door latch to permit activation without fingertip grip application.

.3 Wall and connecting brackets: stainless steel, manufactured institutional grade.

.4 Coat Hook (CH): Single robe hook, Bobrick B-671.

.5 Pilaster shoe: 75 mm high, 0.8 mm stainless steel to ASTM A167, Type 304.

.6 Door pull: Barrier-free type suited for out swinging doors, stainless steel.

.1 Provide interior and exterior pulls on barrier free stalls.

.7 Head rail: extruded anodized aluminum, 6063-T5 alloy, anti-grip design.

.8 Attachment: stainless steel tamperproof type screws and bolts.

2.3 FABRICATION

.1 Doors and panels: stainless steel for toilet stalls and urinal screens

.1 Doors: 1470 mm high.

.1 Standard width: 762 mm.

.2 Barrier free width: 915 mm.

.2 Panels: 1470 mm high.

.1 Provide additional widths required to suit the layout indicated.

.2 Pilasters: 152 mm wide by 2110 mm high, constructed same as door.

.1 Provide additional widths required to suit the layout indicated.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 INSTALLATION

.1 Ensure supplementary solid wood blocking and anchorage is in place.

.2 Do work in accordance with CSA/ASC B651.

3.3 ERECTION

.1 Partition erection:

- .1 Install partitions secure, plumb and square.
- .2 Leave maximum 12 mm space between wall and panel or end pilaster.
- .3 Anchor mounting brackets to:
  - .1 Masonry/concrete surfaces using screws and shields.
  - .2 Hollow walls using bolts and toggle type anchors.
- .4 Attach panel and pilaster to brackets with self-drilling screws, or with through type sleeve bolt and nut.
- .5 Provide for adjustment of floor variations with screw jack through steel saddles made integral with pilaster.
  - .1 Conceal floor fixings with stainless steel shoes.
- .6 Secure pilasters to floor with pilaster supports anchored with minimum 50mm penetration into structural floor.
- .7 Equip doors with hinges, latch and door bumper set, and coat hook as directed by Consultant.
  - .1 Mounting heights: in accordance with CSA/ASC B651.
  - .2 Adjust and align hardware for easy, proper function.
  - .3 Set door open position at 30 degrees to front.
- .8 Equip outswinging doors with door pulls on inside and outside of door in accordance with CSA/ASC B651.
- .9 Install hardware, grab bars, and other partition mounted specialities.

3.4 ADJUSTING

.1 Adjust doors and locks for optimum, smooth operating condition.

.2 Lubricate hardware and other moving parts.

3.5 CLEANING

.1 Perform cleaning after installation to remove construction and accumulated environmental dirt.

.2 Clean surfaces after installation using manufacturer's recommended cleaning procedures.

.3 Clean aluminum with damp rag and approved non-abrasive cleaner.

.4 Clean and polish hardware and stainless components.

.5 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section Includes:

.1 Washroom accessories.

.2 Related Requirements

.1 Section 06 10 00 - Rough Carpentry.

.2 Section 09 21 16 - Gypsum Board Assemblies.

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM).

.1 ASTM A167-99(2017), Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

.2 ASTM B456-17R22, Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.

.3 ASTM A653/A653M-23, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.4 ASTM A924/A924M-22a, Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

.2 Canadian Standards Association (CSA Group).

.1 CSA/ASC B651:23, Accessible Design for the Built Environment.

1.3 SUBMITTALS

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

.2 Action Submittals:

.1 Product Data:

.1 Provide manufacturer's printed product literature and data sheets and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Shop Drawings:

.1 Indicate size and description of components, base material, surface finish inside and out, hardware and locks, attachment devices, description of rough-in-frame, building-in details of anchors for grab bars.

1.4 CLOSEOUT SUBMITTALS

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

1.5 MAINTENANCE MATERIAL SUBMITTALS

.1 Tools:

.1 Provide special tools required for assembly, disassembly or removal for toilet and bath accessories in accordance with requirements specified in Section 01 78 00 - Closeout Submittals.

.2 Deliver special tools to Owner.

1.6 DELIVERY, STORAGE AND HANDLING

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

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

Part 2 Products

2.1 MATERIALS

.1 Sheet steel: to ASTM A653/A653M with ZF001 designation zinc coating.

.2 Stainless steel sheet metal: to ASTM A167, Type 304, with No. 4 finish.

.3 Stainless steel tubing: Type 304, commercial grade, seamless welded, minimum 1.2 mm wall thickness.

.4 Fasteners: concealed screws and bolts hot dip galvanized, exposed fasteners to match face of unit. Expansion shields fibre, lead or rubber as recommended by accessory manufacturer for component and its intended use.

.1 Mechanical fasteners: minimum #8 screw or minimum 4.7 mm threaded by length appropriate for substrate.

2.2 COMPONENTS (For Headworks Washroom only)

.1 Framed mirror (M1): fixed position mirror 610 x 910 stainless steel framed mirror, vandal-proof fastenings, mirror guaranteed for 10 years, center over lavatory.

.2 Soap dispenser (SD): wall mounted soap dispenser, supplied and installed by contractor.

.1 Product: 417002 by Gojo Industries Inc.

.3 Feminine napkin disposal bin (ND): Type 304, 22 gauge stainless steel with satin finish, surface mounted unit, continuous hinged lid, embossed with universally accepted symbol, removable, disposable paper liners, fitted with spring clip for deodorizer block.

.1 Acceptable product: Bobrick, Contura Series, B-270.

.4 Toilet paper dispenser (TPD):

.1 Product: B-2840 Toilet Tissue Dispenser with Utility Shelf by Bobrick.

.5 Coat Hook (CH1): surface mounted double coat hook, stainless steel with satin finish. Flange and support arm 22 gauge. Concealed, 16 gauge mounting bracket. 10 gauge cap welded to support arm. Exact location to be determined on site.

.6 Hand Dryer : Dyson Airblade, V Quiet High Voltage HU02, Nickel-307172-01.

.7 Garbage Can (WR1): Freestanding round garbage can. Bobrick B-2400 Floor-Standing Funnel Top Large-Capacity Waste Bin. Supplied and installed by contractor.

2.3 FABRICATION

.1 Weld and grind joints of fabricated components flush and smooth. Use mechanical fasteners only where approved.

.2 Wherever possible form exposed surfaces from one sheet of stock, free of joints.

.3 Brake form sheet metal work with 1.5 mm radius bends.

.4 Form surfaces flat without distortion. Maintain flat surfaces without scratches or dents.

.5 Back paint components where contact is made with building finishes to prevent electrolysis.

.6 Hot dip galvanize concealed ferrous metal anchors and fastening devices to ASTM A653/A653M.

.7 Shop assemble components and package complete with anchors and fittings.

.8 Deliver inserts and rough-in frames to job site at appropriate time for building-in. Provide templates, details and instructions for building in anchors and inserts.

.9 Provide steel anchor plates and components for installation on studding and building framing.

2.4 FINISHES

.1 Chrome and nickel plating: to ASTM B456, satin finish.

.2 Stainless steel: finish as noted.

.3 Manufacturer's or brand names on face of units not acceptable.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrates and surfaces to receive toilet and bathroom accessories previously installed under other Sections are acceptable for product installation in accordance with manufacturer's instructions prior to toilet and bathroom accessories installation.

.2 Inform Engineer of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

.1 Install and secure accessories rigidly in place as follows:

.1 Stud walls: install steel back-plate to stud prior to plaster or drywall finish. Provide plate with threaded studs or plugs.

.2 Toilet and shower compartments: use male to female through bolts.

.2 Install grab bars on built-in anchors provided by bar manufacturer.

.3 Use tamper proof screws/bolts for fasteners.

.4 Fill units with necessary supplies shortly before final acceptance of building.

3.3 ADJUSTING

.1 Adjust toilet and bathroom accessories components and systems for correct function and operation in accordance with manufacturer's written instructions.

.2 Lubricate moving parts to operate smoothly and fit accurately.

3.4 CLEANING

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

3.5 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by toilet and bathroom accessories installation.

3.6 SCHEDULE

.1 Locate accessories where indicated. Exact locations determined by Consultant.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 03 30 00 - Cast-in-Place Concrete.

1.2 DESIGN REQUIREMENTS

.1 Flagpole, base and anchorage devices to resist minimum wind velocity of 145 km/h unflagged, 100 km/h flagged.

1.3 SHOP DRAWINGS

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

.2 Indicate dimensions, finishes, base jointing, anchoring and support systems, cleats, halyard boxes, trucks, finials and base collar for flagpole.

1.4 DELIVERY AND STORAGE

.1 Spiral wrap flagpole with heavy Kraft paper, wood strip and steel band, or polyethylene wrap and pack in tubing for shipment.

.2 Deliver flagpole in 1 piece.

Part 2 Products

2.1 MATERIALS

.1 Flagpole: John Ewing cone tapered flagpole model HCA-30 c/w B7 tilt base, econoline internal halyard system (Architectural Series) capable of flying two flags, spun aluminum flash collar, all finished in manufacturer's sateen satin brush finish.

.2 Isolation coating: alkali-resistant bituminous paint or epoxy resin solution.

Part 3 Execution

3.1 INSTALLATION

.1 Shop apply isolation coating to metal surfaces of flagpole and base that will be encased in concrete.

.2 Install flagpole, base assembly and fittings to shop drawings and manufacturer's instructions.

.3 Provide ground stakes for positive lightning ground for ground set flagpole installation.

.4 Check and adjust installed fittings for smooth operation of halyards.

END OF SECTION

DIVISION 11 INDEX

FACILITY FALL PROTECTION

PART 1 GENERAL

1.1 INTENT OF SECTION

.1 Work supplied under this section includes design for roof anchors and interior wall anchors at access hatch. The Contract drawings are for reference and discussion.

1.2 RELATED SECTIONS

.1 Sections of Division 1 apply to work of this Section.

.2 Section 07 52 00 – Modified Bituminous Membrane Roofing

1.3 QUALITY ASSURANCE

.1 Installation and Design Responsibility: Work of this Section to be executed by a firm thoroughly conversant with laws, by-laws and regulations which govern, and capable of workmanship of best modern shop and field practice known to recognized manufacturers specializing in this work.

.2 Have work of this Section designed by a Professional Engineer licensed in the Province of Ontario. The work shall meet the Ministry of Labour requirements for fall arrest anchor systems. The Engineer shall be responsible for designing:

.1 Layouts and quantities, to requirements of the authorities having jurisdiction, CSA-Z91, and CSA-Z259.17 (latest editions).

.2 Co-ordination and ensure compatibility with building structure.

.3 Obtain all necessary permits and approvals from the authorities having jurisdiction.

.4 Installer Qualifications: Trained and approved by the manufacturer and having a minimum three years experience in the installation of the work described in this Section and can show evidence of satisfactory completion of projects of similar size, scope and type. If requested, provide letter of certification from manufacturer stating that installer is certified applicator of its products, and is familiar with proper procedures and installation requirements required by the manufacturer.

.5 Maintenance Seminars: Engage a factory authorized service representative to train Owner's maintenance personnel on proper procedures and schedules for adjusting, operating, troubleshooting, servicing, and maintaining the work.

.6 Pre-Installation Meeting: Two weeks prior to commencing work of roofing sections, arrange for manufacturer's technical representative to visit the site and review preparatory and installation procedures to be followed, conditions under which the work will be done, and inspect the surfaces to receive the work of this Section. Advise the Consultant of the date and time of the meeting.

.7 Manufacturer's Site Inspection: Have the manufacturer's technical representative inspect the Work at suitable intervals during application and at conclusion of the work of this Section, to ensure the Work is correctly installed. Submit manufacturer's inspection reports and verification that the work of this Section is correctly installed.

.8 Source Limitations: Obtain each type of product from a single manufacturer.

1.4 SUBMITTALS

.1 Shop Drawings: Bearing professional seal and signature of a Professional Engineer responsible for the engineering design work of this Section. Show anchor profile, layout, materials, construction, and securement method to building structure.

.2 Samples: Duplicate full size samples of each anchor type.

.3 Maintenance Manuals: Include complete written and illustrated instruction manuals relative to the care, adjustment and operation of all parts of the equipment, a complete description and listing of components, with recommended frequency of service and maintenance to ensure maximum efficiency, reliability and long life of the equipment.

.4 Fall Arrest Anchor Reports: Include approved roof layout plan, anchor details, test reports, special liability insurance certificate, warranty certificate, and authorized Letter of Acceptance from the Ministry of Labour:

.1 Special Liability Insurance: Currently dated and duly authorized certificate, indicating that the subcontractor has valid, special liability insurance policy in place to warranty the fabrication and installation of the work of this Section.

1.5 PROTECTION

.1 Protect the structure and its finishes from damage due to installation, testing and operation of work of this Section.

.2 Make good components or surfaces soiled or otherwise damaged in connection with the work of this section.

1.6 MAINTENANCE INSPECTIONS

.1 Provide three (3) years of anchor maintenance inspections as part of the Contract, from the date of the Substantial Performance, at no additional cost to the Owner. Maintenance inspections shall include but not limited to pull tests, flashing inspection and weld inspections.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Stainless Steel Plates, Round Bars and Flat Bars: Structural quality with Fy = 50,000 psi.

.2 Stainless Steel Sheet: 18 gauge, AISI type 304 stainless steel with No.4 finish.

.3 Stainless Steel Plates: New stock (not weathered or rusted), to CAN/CSA-G40.21, Grade 300W. Hot-dip galvanize steel plates after fabrication to CAN/CSA-G164.

.4 Galvanized Steel Sheet: Commercial quality, stretcher levelled, 6 mm (0.24") thick to ASTM A446 with minimized spangle zinc coating Z275 to ASTM A526.

.5 Stainless Steel Welding Materials: CAN/CSA-W59. Use electrodes compatible with and of the same properties as the stainless steel.

.6 Isolation Coating: Alkaline and acid resistant bituminous paint.

.7 Stainless Steel Lock Washers and Hex Nuts: High strength AISI 300 or 400 Series austenitic grade stainless steel types.

2.2 ACCEPTABLE PRODUCTS

.1 Roof Fall Arrest Roof Anchors:

.1 At hollow core slabs, urethane insulated, hollow steel post with base plate, stainless steel bolt with core plate, and flashing sleeve with triple pressure grommet seal. Forged eye at top of anchor. FARA-17 SS by Thaler Metal Products or consultant approved equivalent.

.2 Wall Anchors:

.1 At masonry walls, stainless steel through wall bolts back-up plate. Forged eye at top of anchor. Fara-91 by Thaler Metal Products or consultant approved equivalent.

PART 3 EXECUTION

3.1 PREPARATION

.1 Examine work of other sections where such work influences the work of this Section and report unsuitable conditions to the Consultant.

.2 Supply anchors, inserts, rough-in dimensions and templates required to be built-in by other Sections, in adequate time.

.3 Have a senior, qualified manufacturer's representative on site to direct and supervise the installation of materials which are installed by other trades.

.4 Apply isolation coating of approximately 0.76mm (30 mils) dry film thickness, or other suitable permanent separator on concealed contact surfaces of dissimilar materials, before assembly or installation where there is possibility of corrosive or electrolytic action with concrete, masonry, mortar, or steel.

3.2 INSTALLATION - EQUIPMENT

.1 Install work by the manufacturer or its authorized representative.

.2 Perform pull test on one out four anchors, in accordance with the requirements of the authorities having jurisdiction.

.3 Replace defective equipment at no cost to the Owner.

.4 Adjust operating parts to ensure smooth, efficient operation.

3.3 INSTALLATION – ROOF WORK PLANS

.1 Securely install copies of roof work plans in clear acrylic covers and all roof access locations, in accordance with the requirements of the authorities having jurisdiction.

3.4 WARRANTY

.1 Roof and Wall Anchor Systems

.1 Provide a written and signed warranty in the name of the Owner, that work of this Section shall be free of defects in materials, workmanship and installation for a period of three (3) years from the date of Substantial Performance of the Work.

.2 Defects shall include but not be limited to:

.1 Flashing failure.

.2 Weld failure.

.3 Excessive deformation of anchors or part of anchors while under imposed loading.

.4 Metal fatigue.

.2 Rooftop Attachment System

.1 Provide a written and signed warranty in the name of the Owner, that work of this Section shall be free of defects in materials, workmanship and installation for a period of twenty (20) years from the date of Substantial Performance of the Work.

END OF SECTION

DIVISION 12 METAL CASEWORK

Part 1 General

1.1 SECTION INCLUDES

.1 Painted steel cabinets and bases.

.2 Counter tops and reagent shelves.

.3 Casework hardware.

.4 Service fittings and outlets.

1.2 RELATED SECTIONS

.1 Section 06 10 00 – Rough Carpentry.

1.3 REFERENCES

.1 American Society for Testing and Materials (ASTM).
- .1 ASTM A240/A240M-25, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
- .2 ASTM A653/A653M-23, Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .3 ASTM A1008/A1008M-24, Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable.
- .4 ASTM C1036-21, Standard Specifications for Flat Glass.
- .5 ASTM C1048-18, Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass.

.2 American National Standards Institute/Builders Hardware Manufacturer's Association (ANSI/BHMA).
- .1 ANSI/BHMA A156.9-2020, Cabinet Hardware.

.3 Science Equipment and Furniture Association (SEFA).

1.4 QUALITY ASSURANCE

.1 Reinforce frame and support counters, to safely support a load of 90kg concentrated on 0.093 square metre in any area with no indentation showing on surface.

.2 Coordination:
- .1 Coordinate with other work having a direct bearing on work of this section.
- .2 Coordinate casework installation with size, location and installation of service utilities.

.3 Sequencing: Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

.4 Products of This Section: Manufactured to ISO 9001 certification requirements.

.5 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum 10 years' experience.

.6 Installer Qualifications:

.1 Installer to have a minimum of 5 years continued experience in installation or application of systems like those required for this project.

.2 Installer to be authorized by either the distributor or manufacturer. Warranty will be void if unauthorized installer executes the installation.

1.5 SUBMITTALS

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

.2 Product Data: Provide component dimensions, configurations, construction details, joint details, and attachments, utility and service requirements and locations.

.3 Test Reports: Manufacturer to submit test data and design criteria which follow the project specifications.

.4 Certificates: Certifications required in the specifications to be submitted with the original submittal package under separate cover. Certificates to be provided with the signature of a qualified individual of the supplier.

.5 Shop Drawings:
- .1 The laboratory casework manufacturer to furnish shop drawings illustrating the layout and placement of all laboratory casework and fume hoods as well as any products included in this section.
- .2 Indicate casework locations, large scale plans, elevations and cross sections.
- .3 Indicate the type and location of all service fittings and associated supply connections.
- .4 Preparation instructions and recommendations.
- .5 Storage and handling requirements and recommendations.
- .6 Provide manufacturer's instructions for installation and maintenance of all products provided and installed within this section. Instructions will be in bound form, tabbed and organized by section number.

.6 Samples: One complete set of colour chips representing the manufacturer's full range of available colours. Minimum sample size 250 mm x 76 mm.

1.6 DELIVERY, STORAGE AND PROTECTION

.1 Transport, handle, store, and protect products in accordance with Section 01 61 00 – Common Product Requirements.

.2 Packaging: Products to have packaging adequate to protect finished surfaces from soiling or damage during shipping, delivery and installation.

.3 Delivery: Casework delivery to only take place after painting, utility rough-ins and related activities are completed that could otherwise damage, soil or deteriorate casework in installation areas.

.4 Handling:
- .1 Accept casework on site and inspect on arrival for damage.
- .2 Care, such as the use of proper moving equipment, and experienced movers to be always used to avoid damaging the casework.
- .3 Until installation takes place, any wrapping, insulation or other method of protection applied to products from the factory to be left in place to avoid accidental damage.
- .4 Coordinate size of access and route to place of installation.

.5 Storage: Casework to be stored around installation. When it is necessary for casework to be temporarily stored in an area other than the installation area, the environmental conditions meet the environmental requirements specified under the Project Site Conditions article of this Section.

.6 Waste Management and Disposal: The supplier of the laboratory casework is responsible for removing any waste or refuse resulting from the installation of, or work pertaining to laboratory casework; thereby leaving the project site clean and free of debris.

1.7 PROJECT SITE CONDITIONS

.1 Building to be enclosed (windows and doors sealed and weather-tight).

.2 An operational HVAC system that maintains temperature and humidity at occupancy levels to be functional.

.3 Adjacent and related work to be complete.

.4 Ceiling, overhead ductwork and lighting to be installed.

.5 Site to be free of any further construction such as “wet work”.

.6 Required backing and reinforcements to be installed accurately and the project to be ready for casework installation.

1.8 WARRANTY

.1 Furnish a written warranty that work performed under this section to remain free from defects as to materials and workmanship for a period of two (2) years from date of shipment. Defects in materials and workmanship that may develop within this time are to be replaced without cost or expense to the Owner.

Part 2 Products

2.1 MANUFACTURERS

.1 Mott Manufacturing Ltd SIGMA Barrier Coating System.

.2 Air Master Systems Corp. and CIF Laboratory Solutions are approved alternates provided materials meet the requirements of this Section.

2.2 CASEWORK MATERIALS

.1 Sheet Steel: Mild steel, cold rolled furniture grade to requirements of ASTM A1008/A1008M, Grade C or higher, with smooth surfaces to furniture quality.

.2 Galvanized Sheet Steel: Commercial quality galvanized sheet steel to ASTM A653/A653M, Designation Z275.

.3 Stainless Steel: Sheet to ASTM A240, Type 316.

.4 Glass:
- .1 Clear float, 6 mm thick, glazing quality.
- .2 Laminated glass: Type 1 with clear PVB interlayer. Total nominal thickness of laminated glass: 6 mm.

.5 Sealant: One component, RTV silicone sealant. Colour to suit application.

.6 Resilient Base and Adhesive: Top set coved, 3 mm thick, 100 mm (4") high as indicated for base units, including pre-molded stops and external corners or colour selected by Engineer from full range. Adhesive for rubber base to be troweled on giving 100 percent coverage. Use an adhesive compatible with both surfaces, as recommended by the base manufacturer.

2.3 FABRICATION - GENERAL

.1 Fabricate casework, assembled and welded.

.2 Fabricate corners and joints without gaps or inaccessible spaces or areas where dirt or moisture could accumulate.

.3 Fabricate components and cold rolled sheet steel. From each unit rigid, not dependent on adjacent unit for rigidity.

.4 Form edges and seams smooth.

.5 Set glass in doors with gasket and removable stops to minimize rattles or vibration.

.6 Cut and drill counter tops, backs, and other components for service outlets and fixtures.

.7 Install fixtures and fittings built into or part of casework. Provide access panels for maintenance of utility service and mechanical and electrical components.

2.4 CASEWORK CONSTRUCTION

.1 Use the following materials and minimum steel thicknesses for furniture manufacturing:
- .1 3 mm (11 Ga) leveling bolt gusset plates.
- .2 1.9 mm (14 Ga) drawer slides and side suspension channels.
- .3 1.5 mm (16 Ga) for tubular rails, legs for tables, gusset plates, cabinet top and intermediate horizontal rails.
- .4 1.2 mm (18 Ga) for door and drawer fronts, cabinet floor, cabinet sides, vertical front members, cabinet toe kick, service cover panels, table and kneehole frames, front rails, gable legs and dust caps, false panels, furring and filler panels.
- .5 0.9 mm (20 Ga) for drawer backs, door backs, vertical closure channel, removable back panels, shelves, drawer bodies, drawer dividers, bin bodies, and pull-out shelves.

2.5 CABINET FRAME

.1 Provide one-piece die-formed cabinet bottom construction with return side flanges turned down. Spot weld flanges to cabinet sides. Provide sink cabinets with galvanized bottom painted to match cabinet.

.2 Cabinet bottoms to be turned down at front to form 32 mm "U" channel to accept toe kick and turn down 133 mm at back with 16 mm return to form the back lower member of cabinet base. Provide punched 19 mm diametre corner holes for access to levelers and to accept PVC press plugs. Allow for access levelers from above cabinet without removing drawers or drawer supports.

.3 Provide additional vertical 75 mm “HAT” shaped channels, spot-welded to or formed with the rear vertical corner. Channel to be provided with pre-punched holes to receive shelf clips, and slotted holes to receive drawer suspension tracks. Cabinets 762 mm wide and larger to be provided with intermediate 117 mm “HAT” channels to brace cabinet and accept shelf clips and drawer tracks.

.4 Where applicable, the front corner posts to be pre-punched and slotted to accept drawer suspension systems and suspension pull-out shelves. Front vertical posts to form inboard flush front construction for doors and drawers acting as the cabinet main member side gable tying the cabinet bottom and horizontal member together to form a rigid case. Front post rear closure channels to be “J” shaped 9 mm x 33 mm x 49 mm. Provide channel with pre-punched holes to receive shelf clips.

.5 Doors and drawers to overlay top intermediates and floor horizontal members.

.6 Top horizontal front framing member to form a “J” shaped section 75 mm wide, 10 mm return by 25 mm deep with 16 mm return.

.7 Intermediate horizontal framing members to form a “U” 32 mm high with a 25 mm return on top and 16 mm return on bottom.

.8 Top rear horizontal framing member to be 50 mm x 32 mm angle section welded to back corner lapped post and side gables with welded corner gusset plates acting as cabinet bracing and countertop material fixing member.

.9 Enclose cabinetry toe space to be 75 mm deep x 100 mm high and to act as a total enclosure to bottom of cabinet. Toe space section to key up into “U” shaped front floor member and act as reinforcement. Toe space, front floor of cabinet and corner post sections to be spot welded together forming one structural member.

.10 The toe space members, side gable returns, and back lower member to form all welded structural corner to accept leveler gussets and 10 mm levelling bolts.

.11 Cabinet construction to be electro spot-welded to form a strong well-fitted, one-piece unit.

.12 Exposed horizontal structural cabinet members between doors and drawers to be unacceptable.

2.6 CABINET HARDWARE

.1 Pulls: Provide handles for drawers and hinged doors in 100 mm satin finish aluminum.

.2 Door Hinges: Provide five knuckle-type barrel door hinges of 1.9 mm (14 Ga) steel screwed into door and fastened to cabinet side stile with two counter sunk #8-32 zinc plated machine screws & captive serrated tooth washer nuts. Standard hinge finish to be bright chrome.

.3 Locks:

.1 Removable core, 5-disc tumbler with 229 key changes on a single cut key complete with master key.

2.7 BASE CABINET

.1 Provide removable back panels for cupboard base cabinets. Provide partial back panels 229 mm in height to accommodate plumbing at sink units. When requested, provide back panels and security panels on cabinets requiring locks.

.2 Shelving edges; turned down on all four sides 25 mm and returned under on front and back 25 mm. Shelves 914 mm and longer to be provided with “HAT’ channel reinforcement at front edge.

.3 Doors:

.1 Fabricate doors of two telescoping metal panels, 19 mm thick, painted internally with a sound-deadening material extending continuously full-width, and top to bottom. Reinforce hinged side of door adequately with hinge machine screws to prevent sagging. Secure recessed hinges to cabinet posts with machine screws and concealed self-locking nuts. Provide nylon roller friction catches, mounted on horizontal top or intermediate members pull side of doors. Provide each hinged door with two rubber bumpers.

.2 Doors, drawers, tracks and back panels to be replaceable in the field without requiring special tools.

.3 All standard double door cabinets to be designed without center stiles to maximize access to the cabinet.

.4 Drawers:

.1 Fabricate drawer fronts of two telescoping metal panels painted internally and totally filled with sound-deadening material to eliminate possible drumming effect. The exterior drawer front to have a channel formation on the top edge with fully finished return edges telescoping together to form fully sounded-deadened drawer front. Removable outside panel with lip to fit over inside panel on top edge, and to lock into position at bottom with rivets to form a rigid, one-piece 19 mm thick drawer front.

.2 Conventional drawer track systems to be designed to eliminate metal surface-to-surface contact and reduce side play, while incorporating a self-closing action for 150 mm of drawer travel. Made up of custom manufactured components. Each drawer track assembly to incorporate 2 nylon rimmed, plated steel ball bearing rollers.

.3 Provide drawer operation on full extension drawer slides, load capacity 45kg (100 pounds).

.4 Drawer body to consist of one-piece construction including the bottom, two sides, back and inner front flanged end which to be welded to the interior drawer front head. Drawer bodies to have a reinforcing bend on top edges.

.5 Provide built-in stops to prevent inadvertent removal of drawers, with allowance for drawers to be removed by lifting front of drawers and pulling out.

.6 Provide drawer pulls in central location of drawer face. Two handles to be provided on units 762 mm and larger.

.5 Filler Panels:

.1 Fabricate front filler panels complete with flanges on both sides and a 75 mm x 100 mm toe space along the working face.

.2 Scribe filler panels to be flanged on one side and flat on the other, to be cut on jobsite to suit wall conditions, and to fit into double angles secured to the wall. No visible mounting screws permitted.

.3 Corner filler panels to be a 2-piece construction, one fixed panel and the other a variable panel to facilitate room dimensions. Each to have flanges and an integral 75 mm x 100 mm toe space filler to interlock with its counterpart.

.4 End closing filler panels to be flanged on one side 25 mm and secured to back of cabinet. The edge extending to wall to be flat and fit into a double angle secured to wall. No visible mounting screws permitted.

2.8 FINISHES

.1 Metal (Except Stainless Steel): Degrease and phosphate etch followed by electrostatic powder coat.

.2 Stainless Steel: No.4 finish (finish for stainless steel countertop as indicated on the drawings).

.3 Shop finish all components.

Part 3 Execution

3.1 EXAMINATION

.1 Verify existing conditions before starting work.

.2 Verify adequacy of support framing and anchors.

3.2 CASEWORK INSTALLATION

.1 Install casework, components and accessories to manufacturer instructions.

.2 Use anchoring devices to suit conditions and substrate materials encountered.

.3 Casework to be set with components plumb, straight and square, securely anchored to building structure with no distortion. Concealed shims to be used as required.

.4 Cabinets in continuous runs to be fastened together with joints flush, uniform and tight with misalignment of adjacent units not to exceed 0.06 mm.

.5 Wall casework to be secured to solid material, not lath, plastic or gypsum board.

.6 Top edge surfaces to be abutted in one true plane. Joints are to be flush and gap to not exceed 3 mm between tops.

.7 Casework and hardware to be adjusted and aligned to allow for accurate connection of contact points and efficient operation of doors and drawers without any warping or binding.

.8 Insulate to prevent electrolysis between dissimilar metals.

.9 Scribe to abutting surfaces and align adjoining components. Apply matching filler pieces where casework abuts dissimilar construction.

.10 Field weld joints in stainless steel work, without open seams. Grind smooth and polish to match adjacent surfaces.

.11 Field touch-up blemished to original finish.

3.3 COUNTERTOP INSTALLATION

.1 Countertops are to have been fabricated in lengths according to drawings, with ends abutting tightly and sealed with corrosion resistant sealant.

.2 Tops will be anchored to base casework in a single true plane with ends abutting at hairline joints with no raised edges at joints.

.3 Joints to be factory prepared having no need for in-field processing of top and edge surfaces.

.4 Joints to be dressed smoothly, surface scratches removed and entire surface cleaned thoroughly.

3.4 ADJUSTING

.1 Adjust doors, drawers, hardware, fixtures, and other moving or operating parts to function smoothly.

3.5 CLEANING

.1 Ensure all products are unsoiled and match factory finish. Remove or repair damaged or defective units.

.2 Clean all finished surfaces, including drawers and cabinet shelves, and touch up as necessary.

.3 Counter tops to be cleaned and free of grease or streaks.

3.6 PROTECTION OF FINISHED WORK

.1 Do not permit finished casework to be exposed to continued construction activity.

.2 Counter tops and ledges to be protected with 6 mm ribbed cardboard for the remainder of the construction process.

.3 Examine casework for damaged or soiled areas; replace, repair, and touch-up as required.

.4 Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

DIVISION 20 INDEX

MECHANICAL GENERAL REQUIREMENTS

PART 1 GENERAL

1.1 REFERENCES

.1 American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE)

.1 ASHRAE 90.1-2022 (SI), Standard 90.1-2022 (SI Edition) -- Energy Standard for Sites and Buildings Except Low-Rise Residential Buildings

.2 Ontario Regulation

.1 ONTARIO OBC-2012, 2012 Ontario Building Code Compendium.

1.2 GENERAL

.1 This section covers items common to all sections of Divisions 20, 21, 22 & 23.

.2 Coordinate location & installation of all equipment with all trades to ensure the equipment is serviceable.

.3 Prime mechanical contractor shall be responsible to ensure that all requirements of Divisions 20, 21, 22 & 23 are met and comply with all other divisions and contract documents.

.4 The word "provide" shall mean "supply and install".

1.3 EQUIPMENT

.1 General:

.1 Mechanical equipment that is not regulated by the Green Energy Act, shall carry a permanent label installed by the manufacturers stating the equipment complies with the requirement of ASHRAE 90.1.

.2 Provide new materials and equipment of proven design, quality and of current models with published ratings for which replacement parts are readily available.

.3 Uniformity: Use product of one manufacturer unless otherwise specified, for equipment or material of the same type of classification.

.2 Installation:

.1 Unions, flanges and/or couplings: provide for ease of maintenance and disassembly.

.2 Space for servicing, disassembly and removal of equipment and components: provide as recommended by manufacturer, Code or as indicated; whichever is the more stringent.

.3 Equipment drains: pipe to floor drains in a manner which is non-obstructing.

.4 Install equipment, rectangular cleanouts and similar items parallel to or perpendicular to building lines.

.5 Unless otherwise specified, follow manufacturer's recommendations for safety, adequate access for inspection, maintenance and repairs.

.6 Permit equipment maintenance and disassembly with minimum disturbance to connecting piping and duct systems without interference with building structure or other equipment.

.7 Lubrication: Provide accessible lubricating means for bearings, including permanent lubrication "Lifetime" bearings. Extended grease nipples to be supplied.

1.4 ANCHOR BOLTS AND TEMPLATES

.1 Supply anchor bolts and templates for installation by other divisions.

1.5 TRIAL USAGE

.1 Engineer may use equipment and systems for test purposes or for continuity of operation prior to acceptance. Supply labour, material, and instruments required for testing & operation.

.2 For continuous use, refer to Section 23 05 01 - Use of Mechanical Systems During Construction.

1.6 PROTECTION OF OPENINGS

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

1.7 ELECTRICAL

.1 Electrical work to conform to Division 26 including the following:

.1 Control wiring and conduit is specified in Division 26 except for conduit, wiring and connections below 50 V which are related to control systems. Refer to Division 26 for quality of materials and workmanship.

.2 Any costs associated with deviation of mechanical equipment rating affecting electrical Division 26 shall be carried by the mechanical contractor.

1.8 PAINTING

.1 Apply at least one coat of corrosion resistant primer paint to ferrous supports and site fabricated work.

.2 Prime and touch up marred finished paintwork to match original. Use primer or enamel to match original. Do not paint over nameplates.

.3 Restore to new condition, finishes which have been damaged too extensively to be merely primed and touched up.

.4 Hangers, supports and equipment fabricated from ferrous metals shall be given at least one coat of corrosion resistant primer paint before shipment to job site.

.5 Touch-up damaged surfaces of all mechanical equipment and materials, to the satisfaction of Engineer. Use primer or enamel to match original. Do not paint over nameplates.

1.9 SPARE PARTS

.1 Furnish spare parts, indicated in various section, and as follows:

.1 One casing joint gasket for each size pump.

.2 One glass for each gauge glass.

.3 Six fusible links for each type of fire damper.

1.10 SPECIAL TOOLS

.1 Provide one set of special tools required to service equipment as recommended by manufacturers.

1.11 WASTE MANAGEMENT AND DISPOSAL

.1 Waste Reduction Workplan (WRW):

.1 Perform work in accordance with project's WRW. If one does not exist, provide the following:

.1 Identify opportunities for reduction, re-use and/or recycling of materials.

.2 Post workplan or summary where workers on site are able to review its content.

.2 Materials Source Separation Program (MSSP):

.1 Perform all work in accordance with project's MSSP. If one does not exist, provide the following:

.1 Provide containers for collection of re-usable and/or recyclable materials.

.2 Transport off-site salvaged materials to authorized recycling facility or to users of material for re-use.

.3 Disposal of Waste:

.1 Disposal of waste, volatile materials, mineral spirits, oil, paint thinner, etc. into waterways, storm or sanitary sewers is prohibited.

.4 Storage, Handling and Protection:

.1 Store materials for re-use in a secure area as directed by project manager, where they will not be damaged. Provide protection of materials as necessary.

.2 Unless otherwise specified, removed materials become the Contractor's property. Contractor shall be responsible for transport & delivery of non-salvageable items to a licensed disposal facility.

1.12 DEMONSTRATION AND OPERATING AND MAINTENANCE INSTRUCTIONS

.1 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.

.2 Where specified elsewhere in Divisions 20, 21, 22 & 23, manufacturers to provide demonstrations and instructions.

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

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

.5 Where deemed necessary, Owner may record these demonstrations on video tape for future reference.

.6 Furnish trained instructors to instruct Owner's operating staff in the operation, maintenance and adjustment of all mechanical equipment; and instruct personnel on any changes to or modifications of any equipment made under terms of the guarantee.

.7 The instructions shall take place during regular working hours before systems are accepted and turned over to Owner's staff.

.8 Ensure that the Owner's operating personnel have received and been given opportunity to review the Operating and Maintenance Manuals prior to commencing instruction. Allow two full days on site for review of these manuals with Owner's personnel and for their instruction in operation and maintenance of all mechanical equipment.

1.13 CLOSEOUT SUBMITTALS

.1 Submit operation and maintenance data for incorporation into manual.

.2 Operation and maintenance manual (O&M) to be approved by, and final copies deposited with, Engineer before final inspection.

.3 For all equipment listed in O&M manuals provide a schedule detailing the supplied component, name, address & phone no. of equipment vendor, parts supplier and warranty agent.

.4 Operation data to include:

.1 Control schematics for each system including environmental controls.

.2 Description of each system and its controls.

.3 Description of operation of each system at various loads together with reset schedules and seasonal variances.

.4 Operation instruction for each system and each component.

.5 Description of actions to be taken in event of equipment failure.

.6 Valves schedule and flow diagram.

.5 Maintenance data shall 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.

.6 Performance data to include:

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

.2 Equipment performance verification test results.

.3 Special performance data as specified elsewhere.

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

.7 Approvals:

.1 Submit electronic format (pdf) copy of draft Operation and Maintenance Manual to Engineer for approval. Submission of individual data will not be accepted unless so directed by Engineer. PDF file to include tabs to allow navigation to each section of the manual.

.2 Make changes as required and re-submit as directed by Engineer.

.3 Upon acceptance by Engineer submit one (1) electronic format (pdf) and three (3) hardcopies of O&M manuals to Owner.

.8 Additional data:

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

1.14 ACCEPTABLE PRODUCTS

.1 Design is based on first manufacturer's name under acceptable products. Subsequent manufacturer's names indicate that those named are acceptable providing they meet specifications and space limitations and are subject to acceptance by Shop Drawing Review.

.2 All manufacturers and manufacturer representatives shall separate pricing by major piece of equipment, equipment type, and/or service when submitting to bidding contractors. Lump sum values are not to be submitted to contractors. Manufacturer & representatives providing only lump sum pricing will be disqualified from tender.

1.15 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit single electronic (pdf) copy of shop drawings and product data along with transmittal. Hard copy shop drawings shall not be accepted.

.2 Shop drawings and product data shall show:

.1 Mounting arrangements.

.2 Operating and maintenance clearances. e.g. access door swing spaces.

.3 Shop drawings and product data shall be accompanied by:

.1 Detailed drawings of bases, supports, and anchor bolts.

.2 Acoustical sound power data, where applicable.

.3 Points of operation on full equipment performance curves.

.4 Manufacturer to certify as to current model production.

.5 Certification of compliance to applicable codes.

.4 The information to be indicated on manufacturers' shop drawings submitted for review shall include the following:

.1 General arrangement drawings showing component parts. Where the equipment proposed, or a component part thereof, includes modifications to a manufacturers' standard to meet the requirements of a specification, a complete assembly drawing must be submitted.

.2 Overall dimensions, roughing-in dimensions and clearance dimensions of all major components.

.3 Mounting details and dimensions.

.4 Complete certified performance data for the specified application with particular reference to rate of flow, operating pressure and temperatures, entering and leaving conditions of air or fluid, operating weights, operating limitation, electrical characteristics and BHP requirements.

.5 Gauge of fabricated material and finish specification.

.6 Vibration isolators and resilient hangers stating locations and weight distribution.

.7 Electrical wiring diagrams, control panel boards, motor test data, motor starters and controls for electrically operated equipment furnished by mechanical trades.

.5 Review of shop drawings or detail drawings will not relieve the obligation of ensuring that the equipment, materials, or layouts meet the functional requirements of the specifications, and that all necessary mounting space and clearance requirements are met. Thus, the Engineer's review is for assistance only.

.6 No equipment will be accepted on the job site without shop drawings having been reviewed by the Engineer.

1.16 CLEANING

.1 Prior to turnover to client, clean interior and exterior of all new systems. Replace all air & hydronic filters on new & modified systems. Vacuum interior of new ductwork and air handling units.

1.17 AS-BUILT DRAWINGS

.1 Site records:

.1 Mechanical sub-contractor shall mark all changes as work progresses and as changes occur.

.2 On a weekly basis, transfer information to record set of documents, revising to show all work as actually installed.

.3 Use different colour waterproof ink for each service.

.4 Make available for reference purposes and inspection at all times.

.2 As-built drawings:

.1 Prior to start of Testing, Adjusting and Balancing (TAB), 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 TAB to be performed using as-built drawings.

.4 Following approval, submit completed hard copy as-built drawings with Operating and Maintenance Manuals.

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

1.18 CONFLICT/CO-ORDINATION DRAWINGS

.1 For congested areas, prior to installation the contractor shall prepare interference drawings indicating proposed location of all systems & equipment including ductwork, piping, fans, diffusers, conduits, lighting fixtures, etc. Prior to installation the contractor shall submit the drawings to the Engineer for review.

.2 Architectural, structural and electrical outlines may be shown to assist in coordination of work; confirm final arrangements before layout of mechanical work.

.3 Do not scale.

.4 Except where dimensioned, drawings indicate general mechanical layouts only.

.5 Provide field drawings to show relative positions of various services. Obtain approval before beginning work. As a minimum provide layout/coordination drawings for mechanical rooms & corridor ceilings. Drawings must show coordination between all equipment and systems within the given space. All sub-trades to coordinate their work in conjunction with others.

.6 Within six (6) weeks of Letter of Intent, mechanical & electrical trades to verify that proposed rooms, shafts, chases, reflected ceiling elevations, etc. provide adequate space for the installation of mechanical & electrical systems. This is to identify if there are any spatial shortcomings and to give adequate time for construction manager, consultants and trades to make any dimensional changes

and to make clear to all trades where items are to be installed. Installation and layout will not be on a first come first layout basis.

.7 Request for information (RFI) to be submitted, if necessary, with contractor's proposed solution & issue of concern. RFI's must be submitted with proposed solution and clearly identify the issues or conflicts so Engineer can respond appropriately.

.8 If this procedure is not followed the contractor shall be responsible for all modifications required to integrate the systems & equipment.

.9 When requested by the City, contractor shall provide a single line isometric drawing of the proposed plumbing vent system.

1.19 FEES AND PERMITS

.1 Pay all fees and obtain all permits, taxes relating to the mechanical scope of work.

.2 Additional costs associated with natural gas service shall be carried in the Div. 01.

.3 Water entry service charges associated with City water meter shall be carried in Div. 01. Obtain meter from site services contractor and install in accordance with City standards.

1.20 WARRANTY

.1 Unless indicated otherwise provide one (1) year warranty starting at substantial completion for all new systems including materials, equipment & labour.

1.21 LOCATION OF MECHANICAL EQUIPMENT

.1 Allow for 1500 mm of adjustment for exact location of air handling units, pumps, ducts, piping, etc. at no extra cost or credit.

1.22 ELECTRONIC DRAWINGS

.1 Goodkey, Weedmark & Associates Limited will agree to supply the mechanical drawings in the form of electronic documents for the project to the User for the convenience of the User in carrying out its work. The User shall sign a License Agreement before drawings will be released.

1.23 CUTTING, PATCHING & CORING

.1 Provide cutting, patching and coring of all walls, ceiling & concrete slabs and other surfaces as required for mechanical work. Check with Structural Engineer prior to core drilling and cutting of structure regarding building requirements and policies. Provide notification, clearance & protection.

.2 The following procedure shall be followed for cutting & core drilling:

.1 Contractor to coordinate and summarize all new cores and openings in building structure. Contractor to investigate on site and locate any existing available hole which may be re-used for new systems.

.2 Contractor to prepare a layout sketch showing all existing openings & holes and required new openings & holes, with size and locations to the closest grid line in both directions and submit for review and approval by the architect & structural engineer.

.3 Structural engineer to provide written report outlining acceptance of the openings, as well as specific requirements for reinforcing at each location.

.4 Contractor to proceed with reinforcing tracing as per report and scanning for electrical conduit. Scanning to be completed using ground penetrating Radar (GPR) technology.

.5 Contractor shall identify at each location prior to coring and cutting the location, direction and layer of each reinforcing bar and conduit.

.6 Any core or opening where reinforcing steel was cut during the cutting & coring process must be retained on site, and the Contractor must inform the engineer with the following information: size of the reinforcing bar, reinforcing layer location (top steel or bottom slab steel) and direction of the bar (east - west or north - south).

.3 Patch and make good surfaces cut, damaged or disturbed, to Engineer's approval. Match existing material, colour, finish and texture or as indicated otherwise.

.4 Provide dust tight screens or partitions to localize dust generating activities and for protection of finished areas of work, workers and public.

1.24 MECHANICAL COST BREAKDOWN

.1 Upon award of contract, provide mechanical cost breakdown as per attached schedules for engineer's review and for progress billing purposes.

.2 Costs such as site trailers, mobilization, shop drawings, engineering, etc. to be included as part of material and labour for each piece of equipment.

.3 Closeout documents including O&M manuals, as-built drawings, approved air TAB reports, seismic letters, etc. shall constitute 5% of the total mechanical construction cost and shall be approved as a single lump sum line item after submission to and final acceptance by Engineer. Contractor to indicate cost as a separate line item in Progress Billing.

.4 Proposed billings to be submitted a minimum of fourteen (14) calendar days prior to submission of first billing, for review and approval by Engineer.

.5 Equipment costs are to be broken down by system/equipment groupings and by floor and submitted with proposed billing submittal.
Example: Grilles, pumps, air handling units, VSD's to be separated.
$_____Grilles
$_____Pumps
$_____Air handling units
$_____VFD's

1.25 FINAL INSPECTION

.1 Do not request final inspection until:

.1 Deficiencies are less than 25 items.

.2 All systems have been tested and are ready for operation.

.3 All air balancing has been completed as applicable.

.4 The Owner's operating personnel have been instructed in the operation of all systems and equipment.

.5 The complete operation and maintenance data books have been delivered to the Engineer.

.6 All inspection certificates have been furnished including but not limited to seismic certification, City's final plumbing inspection.

.7 All record drawings have been completed and approved.

.8 All fire extinguishers have been installed.

.9 All spare parts and replacement parts have been provided and receipt of same acknowledged.

.10 The cleaning up is finished in all respects.

.11 Upon completion of above, contractor to request in writing for final site review with a minimal 72-hour notification.

.2 Final installation shall be subject to the approval of the Engineer.

END OF SECTION

SEISMIC RESTRAINT SYSTEMS (SRS) FOR MECHANICAL SYSTEMS

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

1.2 REFERENCES

.1 Ontario Regulation

.1 ONTARIO OBC-2012, 2012 Ontario Building Code Compendium.

1.3 DEFINITIONS

.1 SRS: acronym for Seismic Restraint System.

1.4 QUALIFICATIONS

.1 Prime mechanical contractor shall engage a Seismic Engineer who shall be responsible for all mechanical sections to ensure all mechanical sections listed in Item 1.1.1 are covered. Prime mechanical contractor shall ensure the Seismic Engineer is a Professional Engineer holding a Certificate of Authorization in the Province of Ontario with a minimum of 5 years' experience in seismic design, and is covered with a minimum of

.2 The Manufacturer shall be a member of VISCMA (Vibration Isolation and Seismic Control Manufacturers Association). They shall have a letter issued to their Supplier confirming that they have reviewed and accepted the engineering practices used by the Seismic Engineer. The letter shall also state that the manufacturer accepts the Supplier to act as their representative for the product.

.3 Acceptable Suppliers: HTS Engineering, Master Group, Walmar, E.H. Price. Alternate to be approved by Addendum (only).

1.5 GENERAL DESCRIPTION

.1 This section covers design, supply and installation of complete SRS for all systems, equipment specified for installation on this project. This includes fire protection piping & mechanical equipment and systems, both vibration isolated and statically supported.

.2 SRS to be fully integrated into & compatible with:

.1 Noise and vibration controls specified elsewhere in this project specification.

.2 Structural, mechanical, electrical design of project.

.3 During a seismic event, SRS to prevent systems and equipment from causing personal injury and from moving from normal position unless noted otherwise.

.1 All systems for buildings as listed in OBC Table 4.1.8.18 - non-structural components.

.2 Life safety systems.

1.6 SUBMITTALS

.1 Submit shop drawings and product data in accordance with Section 20 05 01 - Mechanical General Requirements.

.2 Seismic Engineer shall be a Professional Engineer specializing in design of SRS and registered in Province of Ontario. The following submittals shall bear the SRS Design Engineer's seal and signature:

.1 A complete list of documents reviewed & list of exclusion.

.2 Full details of design criteria, calculations for all equipment & associated systems.

.3 A spreadsheet identifying all equipment requiring or not requiring seismic restraints and include all calculations.

.4 Copy of shop drawings and product data sent to Structural Engineer for review of connection points to building structure.

1.7 FINAL CERTIFICATION SUBMITTAL

.1 Seismic Engineer shall be a Professional Engineer specializing in design of SRS and registered in Province of Ontario. The following shall bear the SRS Design Engineer's seal and signature:

.1 SRS installation inspections.

.2 SRS final certification letter for the project.

.2 The final certification letter shall be formatted to identify the following within the body of the letter:

.1 The date of the final inspection.

.2 A statement that lists ALL contract documents which were reviewed including but not limited to the mechanical drawings, project change orders, site instructions, etc.

.3 A statement which clearly identifies any exclusions of scope of service.

.4 A statement that certifies the complete mechanical seismic installation meets the latest version of OBC & applicable codes & standards.

1.8 MAINTENANCE DATA

.1 Provide maintenance data including monitoring requirements for incorporation into manuals specified in Section 20 05 01 - Mechanical General Requirements.

PART 2 PRODUCTS

2.1 GENERAL

.1 Definitions

.1 Seismic System: isolation and seismic restraint products supplied by one supplier.

.2 Manufacturer: manufacturer of the isolation and seismic restraint system.

.3 Supplier: manufacturers' and seismic engineer's representative

.2 Each contractor shall use one Supplier to provide seismic design, isolation, and seismic restraint.

.3 Seismic restraints are to be provided for all operational and functional components of building services in accordance with the current Ontario Building Code.

.4 The contractor shall utilize a Supplier familiar with the design of seismic systems to provide a comprehensive package of isolation and seismic restraint for the project. Provide detailed shop drawings showing the proposed restraint system for all required equipment, piping, and ductwork on the project. The shop drawings submittals shall include all items listed in Item 1.6.

.1 Acceptable Manufacturers: Kinetics / Vibron, Tecoustics, Mason, Gripple Seismic.

.2 Alternates to be approved by Addendum only.

.5 Cable restraint systems, rod stiffener clamps and seismic isolator capacities to be verified by an independent test laboratory. Connection materials and site-specific designs to be by the Seismic Engineer. The Seismic Engineer may specify material and anchors provided by the contractor where this is appropriate. It is the contractors' responsibility to ensure that the Seismic Engineers' requirements and specification have been met.

.6 At the completion of the project, the Supplier and the Seismic Engineer shall review the installations on site, and shall prepare a written report, with a sealed letter from the Seismic Engineer, certifying that the installations have been completed in accordance with their design and shop drawings. Refer to item 1.1.

2.2 SEISMIC FORCE

.1 The Importance Factor for this project is:

.1 I = 1.5 - Post-Disaster Buildings.
Note: As per OBC.

.2 The site classification for seismic site response and shear wave velocity parameters shall be as indicated on structural documents and as recorded in the geotechnical report.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install Seismic Restraint Systems in accordance with Seismic Engineer's and manufacturer's recommendations.

.2 Install SRS at least 25 mm from all other equipment, systems, services.

.3 Co-ordinate connections with all disciplines.

3.2 INSPECTION AND CERTIFICATION

.1 SRS to be inspected and certified by Manufacturer upon completion of installation.

.2 Seismic Design Engineer shall provide written report to Engineer certifying that SRS has been installed in accordance with the SRS drawings. The report shall bear the seal and signature of the SRS Design Engineer.

3.3 COMMISSIONING DOCUMENTATION

.1 Upon completion and acceptance of certification, hand over to Engineer complete set of construction documents, revised to show "as-built" conditions.

END OF SECTION

ACCESS DOORS FOR MECHANICAL SYSTEMS

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

1.2 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 20 05 01 - Mechanical General Requirements.

.2 Submit catalogue details for each type of door illustrating profiles, dimensions and methods of assembly.

PART 2 PRODUCTS

2.1 ACCESS DOORS

.1 Supply and install as necessary to gain access to all concealed mechanical equipment for operating, inspecting, adjusting, servicing.

.2 Sizes: Except as indicated otherwise, to be minimum sizes as follows:

.1 For body entry: 600 x 600 mm (24" x 24").

.2 For hand entry: 300 x 300 mm (12" x 12").

.3 Construction: Rounded safety corners, concealed hinges, screwdriver latch, anchor straps, able to open 180°.

.4 Materials

.1 Tiled or marble surfaces and other special areas: Stainless steel with brushed satin or polished finish as directed by Consultant.

.2 All other areas: Prime coated steel.

.5 Fire Rating

.1 Access doors fire rating to match that of wall, ceiling or floor the access door is installed in. Coordinate with architectural drawings.

2.2 EXCLUSIONS

.1 Lay-in tile ceilings. In this instance, use unobtrusive identification locators.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Installation in accordance with Manufacturer's installation instructions for particular surface.

3.2 LOCATION

.1 Location: Ensure that equipment is clearly within view and accessible for operating, inspecting, adjusting, servicing without the need for special tools.

END OF SECTION

DIVISION 21 INDEX

PORTABLE FIRE EXTINGUISHERS

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

1.2 REFERENCES

.1 National Fire Protection Association NFPA

.1 NFPA (Fire) 10, Portable Fire Extinguishers.

.2 Ontario Fire Code.

.3 Underwriters Laboratories of Canada

.1 CAN-ULC S508-2018, The Rating and Fire Testing of Fire Extinguishers.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 20 05 01 - Mechanical General Requirements.

1.4 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into manual specified in Section 20 05 01 - Mechanical General Requirements.

PART 2 PRODUCTS

2.1 FIRE EXTINGUISHERS

.1 (FE1) Stored pressure dry chemical type with heavy duty steel cylinder, positive on/off operation, waterproof stainless steel gauge, shut-off nozzle, ULC labelled for A, B and C class protection c/w wall mounting bracket. Size 2.25 kg, 3A-40BC rating.

.2 (FE2) Stored pressure carbon dioxide type with heavy duty steel cylinder, positive ON/OFF operation, waterproof stainless steel gauge. ULC labelled for B and C class protection. Size: 5 kg, 10-BC rating c/w wall mounting bracket.

2.2 IDENTIFICATION

.1 Identify extinguishers in accordance with recommendations of NFPA (Fire) 10, ULC S508 and Ontario Fire Code.

PORTABLE FIRE EXTINGUISHERS

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install extinguishers where indicated and at a height in accordance with NFPA (Fire) 10 and Ontario Fire Code.

END OF SECTION

DIVISION 21 INDEX

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DOMESTIC WATER PIPING - COPPER

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

1.2 REFERENCES

.1 American Society of Mechanical Engineers (ASME)

.1 ASME B16.15-2024, Cast Bronze Threaded Fittings, Classes 125 and 250.

.2 ASME B16.18-2021, Cast Copper Alloy Solder Joint Pressure Fittings.

.3 ASME B16.22-2021, Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.

.4 ASME B16.24-2021, Cast Copper Alloy Pipe Flanges and Flanged Fittings, Class 150 and 300.

.2 American Society for Testing and Materials (ASTM)

.1 ASTM A307-21, Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.

.2 ASTM B88M-20, Specification for Seamless Copper Water Tube (Metric).

.3 ASTM F492-95, Standard Specification for Propylene and Polypropylene (PP) Plastic-Lined Ferrous Metal Pipe and Fittings.

.3 American Water Works Association (AWWA)

.1 AWWA C111/A21.11-23, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

.4 Canadian Standards Association (CSA)

.1 CSA B242:05 (R2021), Groove- and Shoulder-Type Mechanical Pipe Couplings.

1.3 PRODUCT DATA

.1 Submit product data in accordance with Section 20 05 01 - Mechanical General Requirements.

PART 2 PRODUCTS

2.1 PIPING

.1 Domestic hot, cold and recirculation systems, within building.

.1 Above ground: copper tube, hard drawn, type L: to ASTM B88M.

.2 Buried or embedded: copper tube, soft annealed, type K: to ASTM B88M, in long lengths and with no buried joints.

2.2 FITTINGS

.1 Bronze pipe flanges and flanged fittings, Class 150 and 300: to ASME B16.24.

.2 Cast bronze threaded fittings, Class 125 and 250: to ASME B16.15.

.3 Cast copper, solder type: to ASME B16.18.

.4 Wrought copper and copper alloy, solder type: to ASME B16.22.

2.3 JOINTS

.1 Rubber gaskets, 1.6 mm thick: to AWWA C111/A21.11.

.2 Bolts, nuts, hex head and washers: to ASTM A307, heavy series.

.3 Solder: 95/5 lead free solder. No lead content in excess of 0.2%.

.4 Polytetrafluoroethylene (PTFE) thread seal tape: for threaded joints.

.5 Dielectric connections between dissimilar metals: dielectric fitting to ASTM F492, complete with thermoplastic liner. Bronze or brass ball valves are an acceptable dielectric fitting where applicable.

2.4 VALVES

.1 Refer to Section 23 05 23 - Valves.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install in accordance with Canadian Plumbing Code, Provincial Plumbing Code and local authority having jurisdiction.

.2 Cut square, ream and clean tubing and tube ends, clean recesses of fittings and assemble without binding.

.3 Install pipe work in accordance with Section 23 05 05 - Installation of Pipe Work, supplemented as specified herein.

.4 Assemble piping using fittings manufactured to ANSI standards.

.5 Install DCW piping below and away from DHW and DHWR and other hot piping so as to maintain temperature of cold water as low as possible.

.6 Connect to fixtures and equipment in accordance with manufacturer's written instructions unless otherwise indicated.

.7 Buried tubing:

.1 Lay in well compacted washed sand in accordance with AWWA Class B bedding.

.2 Bend tubing without crimping or constriction. No fittings permitted below grade.

.8 Install isolation valves at all branch take-offs and to isolate each piece of equipment, and as indicated.

.9 Allow for pipe offsets due to structure, equipment, duct or other pipe interferences.

3.2 PRESSURE TESTS

.1 Refer to Section 23 05 05 - Installation of Pipework.

.2 Test pressure: greater of 1½ times maximum system operating pressure or 860 kPa.

3.3 FLUSHING AND CLEANING

.1 Flush entire system for 8 h. Ensure outlets flushed for 2 h. Let stand for 24 h, then draw one sample off longest run. Submit to testing laboratory to verify that system is clean. Let system flush for additional 2 h, then draw off another sample for testing. Submit test results to Engineer.

3.4 PRE-START-UP INSPECTIONS

.1 Systems to be complete, prior to flushing, testing and start-up.

.2 Verify that system can be completely drained.

.3 Ensure that pressure booster systems are operating properly.

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

3.5 DISINFECTION

.1 Flush out, disinfect and rinse system to requirements of authority having jurisdiction and to the approval of Engineer.

.2 Coordinate with Section 33 34 00 - Water Mains and Section 22 11 15 - Domestic Water Piping Cross-Linked Polythylene (PEX).

.3 Upon completion, provide laboratory test reports on water quality for Engineer approval.

3.6 START-UP

.1 Timing: Start up after:

.1 Pressure tests have been completed.

.2 Disinfection procedures have been completed.

.3 Certificate of static completion has been issued.

.2 Provide continuous supervision during start-up.

.3 Start-up procedures:

.1 Establish circulation and ensure that air is eliminated.

.2 Check pressurization to ensure proper operation and to prevent water hammer, flashing and/or cavitation.

.3 Bring DHW storage tank up to design temperature slowly.

.4 Monitor DHW and DHWR piping systems for freedom of movement, pipe expansion as designed.

.5 Check control, limit, safety devices for normal and safe operation.

.4 Rectify start-up deficiencies.

3.7 PERFORMANCE VERIFICATION

.1 Timing:

.1 After pressure and leakage tests and disinfection completed, and certificate of completion has been issued by authority having jurisdiction.

.2 Procedures:

.1 Verify that flow rate and pressure meet Design Criteria.

.2 Adjust pressure regulating valves while withdrawal is maximum and inlet pressure is minimum.

.3 Verify performance of temperature controls.

.4 Verify compliance with safety and health requirements.

.5 Check for proper operation of water hammer arrestors. Run 10% of outlets for 10 seconds, then shut off water immediately. If water hammer occurs, replace water hammer arrestor or re-charge air chambers. Repeat for outlets and flush valves.

.6 Confirm water quality consistent with supply standards, verifying that no residuals remain as a result of flushing and/or cleaning.

.3 Reports:

.1 In accordance with Section 20 05 01 - Mechanical General Requirements: Reports, using report forms as specified in Section 20 05 01 - Mechanical General Requirements: Report Forms and Schematics.

.2 Include certificate of water flow and pressure tests conducted on incoming water service, demonstrating adequacy of flow and pressure.

END OF SECTION

DRAINAGE WASTE AND VENT PIPING - PLASTIC

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM D2564-20(2024), Specification for Solvent Cements for Poly(Vinyl-Chloride)(PVC) Plastic Piping Systems.

.2 Canadian Standards Association (CSA)

.1 CSA B1800:24, Thermoplastic Nonpressure Piping Compendium.

.3 Ontario Regulation

.1 ONTARIO OBC-2012, 2012 Ontario Building Code Compendium.

.4 Underwriters Laboratories of Canada (ULC)

.1 CAN-ULC-S102.2-2018-REV1, Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies.

.2 CAN-ULC-S115-2018, Standard Method of Fire Tests of Firestop Systems.

PART 2 PRODUCTS

2.1 PIPING AND FITTINGS

.1 Fire & smoke resistant coated DWV PVC (Polyvinyl Chloride) piping & fittings:

.1 Application: Above grade sanitary, storm & vent piping & fittings where combustible piping is permitted including OBC 3.2.6 High-rise applications and within ceiling plenums.

.2 Pipe and Fittings: Drain, waste and vent pipe and fittings shall be certified to CSA B181.2 and when used in noncombustible construction, high-rise buildings and air plenums, they shall be tested and listed in accordance with CAN-ULC-S102.2 and clearly marked with the certification logo indicating a flame-spread rating not exceeding 25 and a smoke-developed classification not exceeding 50.

.3 Acceptable material: IPEX System XFR 15/50 PVC-DWV.

.2 Gasketed DWV PVC (Polyvinyl Chloride):

.1 Application: below grade sanitary & storm piping. Not permitted above grade.

.2 Pipe and Fittings: Drain & waste pipe and fittings shall be certified to CSA B182.2. Gasketed joints shall withstand hydrostatic pressure levels of at least 100 kPa (15 psi) and a negative pressure of -75 kPa (-11 psi). Pipe connections shall be sealed via factory installed gasket without the need for solvent welding.

.3 Pipe Thickness:

.1 For pipe sizes NPS 4 to 6: DR 28.

.2 For pipe sizes NPS 8 and above: DR 35.

.4 Acceptable material: IPEX Ring-Tite.

.3 Firestopping Devices:

.1 All combustible pipe penetrations shall comply with the requirements described in the O.B.C. 3.1.9.4.(1) through (8) and provide a firestop system that has been Tested and Listed to the test Standard CAN-ULC-S115 with a pressure differential of 50 Pa. In addition, the manufacturer shall provide a documentation confirming compliance with the Listed system.

.4 Solvent Welding:

.1 Solvent cements shall be CSA certified and meet the requirements of ASTM D 2564. One-step cement may be used for sizes from NPS 1.5 to 6. Two-step cement must be used in conjunction with primer on larger pipe sizes. Proper solvent cementing procedures must be followed at all times.

.2 The manufacturer, shall be consulted prior to installation for proper solvent welding procedures and proper solvent cement requirements.

.5 Compatibility:

.1 To ensure compatibility, performance and material quality, all pipe and fitting drainage system shall be produced by the same manufacturer.

.6 Quality Control:

.1 The manufacturer of the pipe and fitting system shall be contacted prior to the installation to obtain precise installation instructions. Site meetings shall be arranged and include, the Contractor, Manufacturer and Building Inspector.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install in accordance with Canadian Plumbing Code, Provincial Plumbing Code and local authority having jurisdiction.

.2 Bedding and backfilling should be in accordance specifications. Install buried pipe on 150 mm (6") bed of compacted clean Granular A bedding compacted to 95% (min.) dry proctor density, shaped to accommodate hubs and fittings, to line and grade as indicated. The material should be placed in maximum 300 mm thick lifts.

(If trench bottom is unstable, bring to Engineers attention before bedding is laid). Limit vertical deflection and increase pipe support by compacting soil in both directions away from the pipe toward trench walls. Initial backfill to begin at springline of pipe to 300 mm (12") above pipe using compacted clean Granular A bedding compacted to 95% (min.) dry proctor density. Final backfill shall be in accordance with Geotechnical Report and as minimum utilize clean Granular A compacted to 95% dry proctor density in 300 mm thick lifts. Bedding and backfill shall be provided by this division and in accordance with Div. 02 - Site Work.

3.2 TESTING

.1 Test in accordance with OBC Part 7 requirements.

.2 Pressure test buried systems before backfilling.

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

.4 Dye Testing:

.1 The sanitary and storm plumbing systems shall be dye-tested.

.2 On storm system dye tables (Fluorescein) shall be mixed with water to the manufacturer's instructions and introduced to each roof drain. The mechanical contractor shall determine if the dissolved fluorescein passed the downstream storm manhole, indicating a "Positive" dye test.

.3 On the sanitary system, dye tablets (fluorescein) shall be placed in each plumbing fixture or at discretion of certifying engineer. The mechanical contractor shall determine if the dissolved fluorescein passed the downstream sanitary manhole indicating a "Positive" dye test.

.4 A "Negative" dye test indicates that the building system is not connected to the appropriate system and mechanical contractor shall complete corrective action.

.5 Dye testing shall be conducted by contractor following below grade rough-in and following the complete above grade installation and finish work.

.6 Contractor to retain services of an independent professional engineer registered in Ontario to witness Dye testing. Provide letter stamped by engineer certifying successful completion of test.

.5 Video Testing:

.1 Provide video scanning of underground sanitary and storm piping for review and contractor's approval prior to pouring of concrete. Repair deficiencies and re-scan as required. Submit final video to Engineer for record.

.2 Flush & video scan sanitary and storm piping for contractor's review and approval prior to building turnover. Repair deficiencies and re-scan as required. Submit final video to Engineer for record.

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 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).

END OF SECTION

DOMESTIC WATER HEATERS

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

1.2 REFERENCES

.1 American Society of Mechanical Engineers (ASME)

.1 ASME BPVC.IV-2023, 2023 ASME Boiler and Pressure Vessel Code, Section IV: Heating Boilers.

.2 Canada National Standard (CAN)/Canadian Standards Association (CSA)

.1 CSA B139 Series-19, Installation Code for Oil Burning Equipment.

.2 CSA B149.1-20, Natural Gas and Propane Installation Code.

.3 CSA B149.2:20, Propane Storage and Handling Code.

1.3 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 20 05 01 - Mechanical General Requirements.

.2 Indicate:

.1 Equipment, including connections, fittings, control assemblies and ancillaries, identifying factory and field assembled.

1.4 CLOSEOUT SUBMITTALS

.1 Provide maintenance and engineering data for incorporation into manual specified in Section 20 05 01 - Mechanical General Requirements.

PART 2 PRODUCTS

2.1 TANKLESS GAS - FIRED WATER HEATER

.1 Internally mounted, tankless, gas-fired, direct vent, water heater(s) design certified to the ANSI Z21.10.3 standard for gas-fired water heaters. Each water heater shall produce no more than 55 ppm NOx emissions when tested in accordance with the Rules and Regulations of the South Coast Air Quality Management District (SCAQMD). The water heater shall have stainless steel burners, solid brass water flow control valve, and solid brass inlet and outlet water connections, a minimum thermal efficiency rating of 94%, and a temperature thermostat with an adjustable setpoint range of 98°F to 140°F. The water heater shall be microprocessor controlled and utilize a direct electronic ignition system (with no standing pilot), fully modulating gas control valve, turbine flow meter, automatic electro-

mechanical water flow control valve, and water temperature thermistors to maintain outlet water temperature between ±2°F of setpoint temperature. Water heater(s) shall also be capable of storing and displaying a history of up to 9 diagnostic maintenance codes, via the display on the temperature thermostat controller. The following internal safety devices shall be incorporated: flame failure lockout, boiling protection lockout, thermal overheat protection, internal freeze protection for ambient temperatures as low as -30°F, and lockout protection in the event of a blocked flue. Include internal condensate neutralizer Guardian overheat film wrap (OFW) for safety.

.2 Provide concentric vent kit as per manufacturer's recommendations.

.3 Power: 120 Volt single phase.

.4 Heat exchanger shall be warranted against material defects or workmanship for a period of 12 years' from the date of purchase. All other parts shall be warranted against material defects or workmanship for a period of 5 years' from the date of purchase.

.5 Capacity: Refer to drawing schedule.

.6 Acceptable material: Rinnai, Bradford White, Rheem, Takagi, Noritz.

2.2 TRIM AND INSTRUMENTATION

.1 Drain valve: 25 mm (NPS 1) with hose end.

.2 Thermometer: 100 mm (4") dial type with red pointer and thermowell filled with conductive paste.

.3 Pressure gauge: 75 mm (3") dial type with red pointer, and shut-off cock.

.4 Thermowell filled with conductive paste for control valve temperature sensor.

.5 ASME rated temperature and pressure relief valve sized for full capacity of heater, having discharge terminating over floor drain and visible to operators.

2.3 ANCHOR BOLTS AND TEMPLATES

.1 Supply for installation by other Divisions.

.2 Size anchor bolts to withstand seismic zone 4 acceleration and velocity forces.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install in accordance with manufacturer's recommendations and authority having jurisdiction.

.2 Provide structural steel for and for instantaneous heaters.

.3 Provide insulation between tank and supports.

.4 Install oil burning domestic water heaters in accordance with CSA B139.

.5 Install natural gas fired domestic water heaters in accordance with CSA B149.1.

.6 Install propane gas fired domestic water heaters in accordance with CSA B149.2.

END OF SECTION

PLUMBING SPECIALTIES AND ACCESSORIES

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

1.2 REFERENCES

.1 American Society of Sanitary Engineering (ASSE)

.1 ASSE (Plumbing) 1013-2011, Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Fire Protection Principle Backflow Preventers.

.2 ASSE (Plumbing) 1071-2012 (R2021), Performance Requirements for Temperature Actuated Mixing Valves for Plumbed Emergency Equipment.

.2 Canadian Standards Association (CSA)

.1 CAN/CSA B64 Series-21, Backflow Preventers and Vacuum Breakers.

.2 CSA B64.10-17/B64.10.1-17 (2021), Selection and Installation of Backflow Preventers/Maintenance and Field Testing of Backflow Preventers.

.3 CSA B79-08 (R2018), Commercial and Residential Drains and Cleanouts.

.3 The Instrumentation, Systems and Automation Society (ISA)

.1 ISEA Z358.1-2014, Emergency Eyewash and Shower Equipment.

.4 NSF International (NSF)

.1 NSF/ANSI/CAN 61-2022, Drinking Water System Components - Health Effects.

.5 Ontario Regulation

.1 ONTARIO OBC-2012, 2012 Ontario Building Code Compendium.

.6 Plumbing and Drainage Institute (PDI)

.1 PDI WH201-2017, Water Hammer Arresters Standard.

1.3 SUBMITTALS

.1 Submit shop drawings and product data in accordance with Section 20 05 01 - Mechanical General Requirements.

.2 For shop drawings, indicate dimensions, construction details and materials.

.3 For product data, indicate dimensions, construction details and materials for items specified herein.

1.4 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 20 05 01 - Mechanical General Requirements.

.2 Data to include:

.1 Description of plumbing specialities and accessories, giving manufacturers name, type, model, year and capacity.

.2 Details of operation, servicing and maintenance.

.3 Recommended spare parts list.

PART 2 PRODUCTS

2.1 FLOOR DRAINS

.1 Floor drains and trench drains: to CSA B79.

2.2 CLEANOUTS

.1 Cleanout plugs: heavy cast iron male ferrule with brass screws and threaded brass or bronze plug. Sealing-caulked lead seat or neoprene gasket.

.1 Acceptable material: Watts CO-380, J.R. Smith & Zurn.

.2 Access covers:

.1 Wall access: face or wall type, tainless steel round cover with flush head securing screws, bevelled edge frame complete with anchoring lugs. Acceptable material: Watts, CO 300 (floor), Zurn.

.2 Floor access: round cast iron body and frame with adjustable secured nickel bronze top, and.

.1 Plugs: bolted bronze with neoprene gasket.

.2 Cover for unfinished concrete floors: cast iron round, gasket, vandal-proof screws. Acceptable material: Watts CO 200 XHR series, Zurn.

2.3 TRAP SEAL PRIMERS

.1 Type 1: Electronic Trap Primer - Timer Type

.1 Electronic activated type, copper construction with "O" ring seals, 13 mm (NPT ½) female inlet & 13 mm (NPT ½) female outlet drip line connection with air female inlet & 13 mm (NPT ½) female outlet drip line connection with air gap, viewing holes, and removable filter screen. Trap primer shall have no flow adjustment. Operating range shall be 138 kPa (20 psi) to 861 kPa (125 psi). Operates on pre-set 24 h clock with manual override switch/test button. Unit shall have 120 V solenoid valve and calibrated manifold for equal water distribution. One (1) to ten (10) drain taps per unit.

.2 Identify on as-built drawings the location of each trap seal primer.

.3 Ensure all trap seal primers are accessible for maintenance purposes and are connected to cold water line. Trap line shall be from top of cold water line and include a service valve. All to be installed in steel cabinet and serviceable from access door.

.4 Acceptable material: Mifab MI-100-EWC.

2.4 WATER HAMMER ARRESTORS

.1 Copper construction, bellows or piston type: to PDI-WH201.

.1 Acceptable material: Watts LF15M2 SERIES, J.R. Smith & Zurn Z-1700.

2.5 BACK FLOW PREVENTORS

.1 Reduced pressure principle type (RP):

.1 65 mm (2½"Ø) and Larger:

.1 Lead free construction, epoxy coated cast or ductile iron or 304 stainless steel body. Checks accessible for maintenance. Rated for 60°C (140°F) and 1207 kPa (175 psi). Complete with flanged end non-rising stem gate valves, air gap drain fitting and strainer. Certified to CSA B64.4. ULC listed. ASSE 1013 and NSF/ANSI/CAN 61 compliant.

.2 Acceptable material: Watts 957 or LF909, Zurn Wilkins 375 or 375 AST.

.2 All backflow preventers shall be selected and installed in accordance with OBC and CSA B64.10.

2.6 EMERGENCY WATER MIXING VALVE FOR EYE/FACE WASH

.1 General:

.1 The Emergency eye/face wash Mixing Valve shall control and maintain the temperature of the water to the station . Unit shall be self-contained and include a thermostatic water mixing valve, a dial thermometer on the outlet, angle checkstops, wall mounting bracket, piping and fittings factory assembled and tested, top or bottom inlets and top outlet, unit set for 29°C (85°F) and a maximum temperature of 32°C (90°F). Unit must be able to be set to the correct temperature for the specific contaminant but must be locked in place to prevent changing of the temperature by accident. Unit shall be able to flow a minimum flow of 15 L/min. (4 GPM) at 205 kPa (30 PSI).

.2 Construction:

.1 Solid bimetal thermostat directly linked to valve porting to control the intake of hot and cold water and compensate for supply temperature and pressure fluctuations.

.2 Locking temperature regulator to prevent accidental movement set for 29°C (85°F).

.3 Mixing valve to close down on failure of cold water supply.

.4 Internal cold water bypass capable of a minimum of 15 L/min. (4 GPM) at 205 kPa (30 PSI) upon failure of hot water supply.

.5 Adjustable high temperature limit stop.

.6 Integral wall support.

.7 Full 13 mm (½") bottom inlets and 13 mm (½") top outlet.

.8 Rough bronze finish.

.9 Dial thermometer (range -10 to 60°C (0 to 140°F)).

.10 Angle checkstops on inlets.

.11 Compliance with ISEA Z358.1 or ASSE 1071.

.12 Maximum supply temperature 82°C (180°F).

.13 Maximum supply pressure 860 kPa (125 PSI).

.14 CP- Chrome plated finish.

.15 IT- Inlet thermometers (0 to 140°F (-10 to 60°C)).

.3 Acceptable material: Leonard TA-300-LF-CP IT.

2.7 EXPANSION TANKS

.1 Horizontal or vertical steel pressurized diaphragm type expansion tank as per schedule.

.2 ASME construction, steel shell construction.

.3 Diaphragm sealed in heavy duty butyl material.

.4 Polypropylene liner material certified to NSF/ANSI/CAN 61.

.5 Working pressure: 862 kPa (150 psi) with ASME stamp and certification including Canadian Registration Number (CRN).

.6 Working temperature: 93°C (200°F).

.7 Stainless steel system connections.

.8 Air precharged to initial fill pressure of system as per schedule.

.9 Saddles for horizontal installation; base mount for vertical installation.

.10 Supports: Provide supports with hold down bolts and installation templates incorporating seismic restraint systems.

.11 Capacity: as per schedule.

.12 Acceptable materials: Amtrol ST-C series, Expanflex, Watts DETA ASME series for potable.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install in accordance with Canadian Plumbing Code, provincial codes, and local authority having jurisdiction.

.2 Install in accordance with manufacturer's instructions and as specified.

3.2 FLOOR DRAINS

.1 Floor drains to be installed at lowest point in floor and placed to ensure floor finishing is flush/slightly higher than strainer. Contractor to chip concrete around drains, lower assembly, patch concrete and provide floor finish should the installed elevation be unacceptable to Engineer.

.2 Contractor to provide suitable means of protecting floor drains and cleanouts from damage during construction. Contractor to be responsible for turning over facility to Owner with floor drains and strainers in new condition. Damaged material shall be replaced with new at contractor's expense.

3.3 CLEANOUTS

.1 In addition to those required by code, and as indicated, install at base of soil and waste stacks, and rainwater leaders.

.2 Bring cleanouts to wall or finished floor unless serviceable from below floor.

.3 Building drain cleanout and stack base cleanouts: line size to maximum NPS 4.

3.4 WATER HAMMER ARRESTORS

.1 Install on branch supplies to fixtures or group of fixtures.

3.5 BACK FLOW PREVENTORS

.1 Pipe discharge to terminate over nearest drain.

.2 Test and certify each backflow preventor and provide report for inclusion in the commissioning report.

.3 Acceptable testing contractor shall be Pennex.

3.6 TRAP SEAL PRIMERS

.1 Install for floor drains and elsewhere, as indicated.

.2 Install soft copper tubing to floor drain.

.3 Identify on as-built drawings the location of each trap seal primer.

.4 Ensure all trap seal primers are accessible for maintenance purposes. Install access doors if required.

.5 Install a minimum of 300 mm above the flood level rim of the fixture served, or greater as recommended by manufacturer's installation instructions.

3.7 START-UP

.1 Timing: Start-up only after:

.1 Pressure tests have been completed.

.2 Disinfection procedures have been completed.

.3 Certificate of static completion has been issued.

.4 Water treatment systems operational.

.2 Provide continuous supervision during start-up.

3.8 TESTING AND ADJUSTING

.1 Timing:

.1 After start-up deficiencies rectified.

.2 After certificate of completion has been issued by authority having jurisdiction.

.2 Application tolerances:

.1 Pressure at fixtures: ±70 kPa.

.2 Flow rate at fixtures: ±20%.

.3 Adjustments:

.1 Verify that flow rate and pressure meet design criteria.

.2 Make adjustments while flow rate or withdrawal is (1) maximum and (2) 25% of maximum and while pressure is (1) maximum and (2) minimum.

.4 Floor drains:

.1 Verify operation of trap seal primer.

.2 Prime, using trap primer. Adjust flow rate to suit site conditions.

.3 Check operations of flushing features.

.4 Check security, accessibility, removeability of strainer.

.5 Clean out baskets.

.5 Backflow preventers:

.1 Test tightness, accessibility for O&M of cover and of valve.

.2 Simulate reverse flow and back-pressure conditions to test operation of vacuum breakers, backflow preventers.

.3 Verify visibility of discharge from open ports.

.6 Roof drains:

.1 Check location at low points in roof.

.2 Check security, removeability of dome.

.3 Adjust weirs to suit actual roof slopes, meet requirements of design.

.4 Clean out sumps.

.5 Verify provisions for movement of roof systems.

.7 Access doors:

.1 Verify size and location relative to items to be accessed.

.8 Cleanouts:

.1 Verify covers are gas-tight, secure, yet readily removable.

.9 Water hammer arrestors:

.1 Verify proper installation of correct type of water hammer arrester.

.10 Wall, Ground hydrants:

.1 Verify complete drainage, freeze protection.

.2 Verify operation of vacuum breakers.

END OF SECTION

PLUMBING FIXTURES AND TRIM

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CAN/CSA B45 Series-02 (R2018), Plumbing Fixtures.

.2 CAN/CSA B125-01, Plumbing Fittings.

.3 CSA B651-18, Accessible Design for the Built Environment.

.2 Ontario Regulation

.1 ONTARIO OBC-2012, 2012 Ontario Building Code Compendium.

1.3 SHOP DRAWINGS

.1 Submit shop drawings and product data in accordance with Section 20 05 01 - Mechanical General Requirements.

.2 Indicate, for all fixtures and trim:

.1 Dimensions, construction details, roughing-in dimensions.

.2 Factory-set water consumption per flush at recommended pressure.

.3 (For water closets, urinals): minimum pressure required for flushing.

1.4 CLOSEOUT SUBMITTALS

.1 Provide maintenance data including monitoring requirements for incorporation into manuals specified in Section 20 05 01 - Mechanical General Requirements.

.2 Include:

.1 Description of fixtures and trim, giving manufacturer's name, type, model, year, capacity.

.2 Details of operation, servicing, maintenance.

.3 List of recommended spare parts.

PART 2 PRODUCTS

2.1 MANUFACTURED UNITS

.1 Fixture piping.

.1 Hot and cold water supplies to each fixture:

.1 Supply stops shall be all brass with full turn brass seams and washer replaceable attachment shall be IPS inlet x compression OD outlet to fixture. All fixture stop valves shall be screw driver type.

.2 Chrome plated in all exposed places.

.2 Waste:

.1 Cast brass adjustable style P-trap with cleanout on each fixture not having integral trap.

.2 Chrome plated in all exposed places.

.3 Sink and lavatory heavy gauge P-traps shall be cast brass adjustable style with 17 ga. seamless brass wall bend. Attachment nuts shall be brass, no zinc allowed. P-traps to be removable/union type or to include cleanout.

.4 Lavatory strainers shall be chrome plated cast brass with 17 ga. seamless brass tailpiece.

.5 All barrier-free lavatories and sinks shall have chrome plated offset tail piece in addition to P-trap with cleanout. Insulate P-trap and hot & cold water pipes with pre-formed & finished surface insulation. Armaflex insulation and tape not acceptable.

.2 Fixtures:

.1 Manufacture in accordance with CSA B45.

.2 All products, where applicable, shall be marked with manufacturer's name or product #.

.3 Trim, fittings: manufacture in accordance with CAN/CSA B125.

.4 Number, locations: Architectural drawings to govern.

.5 Fixtures in any one location to be product of one manufacturer and of same type.

.6 Trim in any one location to be product of one manufacturer and of same type unless otherwise indicated.

.7 Reference drawing schedule for configuration and type.

2.2 CARRIERS

.1 Provide for all wall mounted plumbing fixtures.

2.3 ROUGHING-IN OF FIXTURES

.1 Rough-in for equipment supplied by other to be complete with valved supplies, wastes and vents, capped and associated fitting piping & reducers.

2.4 PLUMBING FIXTURES

.1 Reference fixture schedule on drawings.

2.5 ACCEPTABLE MATERIALS

.1 Water Closets, Urinals, Lavatories, Sinks: American Standard, Crane, Kohler, Comtrac, Zurn, Toto, Moen.

.2 Stainless Steel Sinks: Franke, Kindred, Architectural Metal Industries, Novanni.

.3 Group Fountains: Bradley, Acorn.

.4 Faucets: Delta Commercial, Crane, T&S Brass, Chicago Faucets, American Standard, Moen, Sloan, Zurn.

.5 Flush Valves: Delta Commercial, Crane, Sloan, Zurn, American Standard, Toto, Moen.

.6 Emergency Fixtures: Haws, Bradley, Guardian.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Mounting heights:

.1 Standard: to comply with manufacturer's recommendations unless otherwise indicated or specified.

.2 Wall-hung fixtures: as indicated on architectural elevations.

.3 Physically handicapped: to comply with most stringent of either OBC or CAN/CSA B651.

3.2 URINALS

.1 Urinal waste pipe & fittings shall be DWV PVC equivalent to IPEX System 15 in accordance with specification Section 22 13 18 - Drainage Waste and Vent - Plastic. Extend plastic piping up to combined waste from adjacent lavatory or other plumbing fixtures allowing dilution of waste.

3.3 ADJUSTING

.1 Conform to water conservation requirements specified in this section.

.2 Adjustments:

.1 Adjust water flow rate to design flow rates and sensors.

.2 Adjust pressure to fixtures to ensure no splashing at maximum pressures.

.3 Adjust flush valves to suit actual site conditions.

.3 Checks:

.1 Water closets: flushing action.

.2 Aerators: operation, cleanliness.

.3 Vacuum breakers, backflow preventers: operation under all conditions.

END OF SECTION

DIVISION 23 INDEX

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USE OF MECHANICAL SYSTEMS DURING CONSTRUCTION

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

1.2 USE OF SYSTEMS

.1 Use of new permanent heating and ventilating systems for supplying temporary heat and ventilation is permitted only under the following conditions:

.1 Entire system is complete, pressure tested, cleaned, flushed out.

.2 Building has been closed in. Areas to be heated/ventilated are clean and will not thereafter be subjected to dust-producing processes.

.3 There is no possibility of damage from any cause.

.4 Supply ventilation systems are protected by 60% filters, which shall be inspected daily, changed every 2 weeks or more frequently as required.

.5 All systems will be:

.1 operated as per manufacturer's recommendations or instructions.

.2 operated by Contractor.

.3 monitored continuously by Contractor.

.6 Warranties and guarantees do not commence until equipment is turned over to owner.

.7 Regular preventive and all other manufacturers recommended maintenance routines are performed by Contractor at his own expense and under supervision of Engineer.

.8 Before turn-over to owner, entire system to be refurbished, cleaned internally and externally and restored to "as- new" condition. Filters in air and water systems are to be replaced.

.2 Filters referred to herein are over and above those specified elsewhere in this specification.

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

PART 2 PRODUCTS

2.1 NOT USED

.1 Not used.

USE OF MECHANICAL SYSTEMS DURING CONSTRUCTION

PART 3 EXECUTION

3.1 NOT USED

.1 Not used.

END OF SECTION

INSTALLATION OF PIPEWORK

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

1.2 REFERENCES

.1 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

PART 2 PRODUCTS

2.1 NOT USED

.1 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.

.3 Use double swing joints when equipment mounted on vibration isolation and when piping subject to movement.

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 or specified otherwise.

.2 Install drain valve at low points in piping systems, at equipment at section isolating valves and at base of all risers.

.3 Pipe each drain valve discharge separately to above floor drain. Discharge to be visible.

.4 Drain valves: NPS ¾ full port ball valves unless indicated otherwise, with hose end male thread, cap and chain.

3.4 AUTOMATIC AIR VENTS

.1 Install automatic air vents at high points of piping systems.

.2 Install full port ball at each automatic air vent.

.3 Air vents must have minimum connection of 13 mm (½").

3.5 DIELECTRIC COUPLINGS

.1 General: Compatible with system, to suit pressure rating of system.

.2 Locations: Where dissimilar metals are joined.

.3 NPS 2 and under: isolating unions or bronze valves.

.4 Over NPS 2: Isolating flanges.

3.6 PIPEWORK INSTALLATION

.1 Screwed fittings to be jointed with polytetrafluoroethylene (PTFE) thread seal tape.

.2 Protect openings against entry of foreign material.

.3 Install so that equipment can be isolated and removed without interruption to operation of any other equipment or systems.

.4 Assemble piping using fittings manufactured to ANSI standards.

.5 Weldolets sockolets Saddle type branch fittings may be used on mains if branch line is no larger than half the size of the main. Hole saw (or drill) and ream main so as to maintain full inside diameter of branch line prior to welding saddle. Provide isolation valves at each branch connection.

.6 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.

.7 Install concealed pipework so as to minimize furring space, maximize headroom, conserve space.

.8 Except where indicated otherwise, slope piping in direction of flow for positive drainage and venting.

.9 Except where indicated, install so as to permit separate thermal insulation of each pipe.

.10 Group piping wherever possible and as indicated.

.11 Ream pipes, remove scale and other foreign material before assembly.

.12 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.

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 all round 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 to CAN/CGSB-1.181.

.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 PRESSURE TESTING OF EQUIPMENT AND PIPEWORK

.1 Advise Engineer 48 hours minimum prior to performance of pressure tests.

.2 Pipework: Fill system with water. Ensure all air is removed from system. Boost pressure to test pressure using water only. Pressurization with air or nitrogen is not allowed. Test to 1½ times normal operating pressure to a maximum of the piping systems working pressure including devices (i.e.: valves, fittings, accessories). Minimum test pressure to be 862 kPa (125 psi).

.3 Maintain specified test pressure without loss for four (4) hours minimum. Temperature of system to remain constant during entire duration of test.

.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 Engineer.

.6 Bear costs for repairs or replacement, retesting, and making good. Engineer to determine whether repair or replacement is appropriate.

.7 Insulate or conceal work only after review and approval of tests results by Engineer.

END OF SECTION

MOTORS, DRIVES AND GUARDS FOR MECHANICAL SYSTEMS

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

1.2 REFERENCES

.1 American Society of Heating, Refrigeration and Air-Conditioning Engineers.

.1 ASHRAE 90.1-2022 (I-P), Energy Standard for Buildings Except Low-Rise Residential Buildings.

.2 Electrical Equipment Manufacturers' Advisory Council (EEMAC)

.3 National Electrical Manufacturers Association (NEMA)

.1 NEMA MG 1-2021, Motors and Generators.

.4 Ontario Regulation

.1 ONTARIO OBC-2012, 2012 Ontario Building Code Compendium.

1.3 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 20 05 01 - Mechanical General Requirements.

1.4 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for motors, drives and guards for incorporation into manual specified in Section 20 05 01 - Mechanical General Requirements.

PART 2 PRODUCTS

2.1 GENERAL

.1 Motors to be premium efficiency, in accordance with NEMA 1 premium motor standards and the requirements of ASHRAE 90.1.

2.2 MOTORS

.1 Provide premium efficiency motors for mechanical equipment to NEMA MG 1 Part 31.

.2 Motors efficiency must exceed the following:

Open Drip-Proof (ODP) Type			
Motor Size	Speed (RPM)		
HP	1200	1800	3600
NEMA Premium Nominal Efficiency			
1 & below	82.5%	85.5%	77.0%
1.5	86.5%	86.5%	84.0%
2	87.5%	86.5%	85.5%
3	88.5%	89.5%	85.5%
5	89.5%	89.5%	86.5%
7.5	91.0%	91.0%	88.5%
10	91.7%	91.7%	89.5%
15	91.7%	93.0%	90.2%
20	92.4%	93.0%	91.0%
25	93.0%	93.6%	91.7%
30	93.6%	94.1%	91.7%
40	94.1%	94.1%	92.4%
50	94.1%	94.5%	93.0%
60	94.5%	95.0%	93.6%
75	94.5%	95.0%	93.6%
100	95.0%	95.4%	93.6%
125	95.0%	95.4%	94.1%
150	95.4%	95.8%	94.1%
200	95.4%	95.8%	95.0%
Totally Enclosed Fan-Cooled (TEFC) Type			
Motor Size	Speed (RPM)		
HP	1200	1800	3600
NEPA Premium Nominal Efficiency			
1 & below	82.5%	85.5%	77.0%
1.5	87.5%	86.5%	84.0%
2	88.5%	86.5%	85.5%
3	89.5%	89.5%	86.5%
5	89.5%	89.5%	88.5%
7.5	91.0%	91.7%	89.5%
10	91.0%	91.7%	90.2%
15	91.7%	92.4%	91.0%
20	91.7%	93.0%	91.7%
25	93.0%	93.6%	91.7%
30	93.0%	93.6%	91.7%
40	94.1%	94.1%	92.4%
50	94.1%	94.5%	93.0%
60	94.5%	95.0%	93.6%
75	94.5%	95.4%	93.6%
100	95.0%	95.4%	94.1%
125	95.0%	95.4%	95.0%
150	95.8%	95.8%	95.0%

.3 Motors under 373 W (½ HP): speed as indicated, continuous duty, built-in overload protection, resilient mount, single phase, 120 V, unless otherwise specified or indicated.

.4 Motors 373 W (½ HP) to 14.92 kW (20 HP): EEMAC Class B/F, squirrel cage induction, speed as indicated, continuous duty, drip proof, ball bearing, maximum temperature rise 45°C/60°C over ambient of 30°C, 3 phase, 600 V, unless otherwise specified or indicated.

.5 Motors coupled with VFD shall be premium efficiency, inverter duty type to NEMA MG 1 Part 31 and shall have as a minimum EEMAC Class F insulation. Inverter ready motors shall not be acceptable.

.6 Motors coupled with VFD's shall include a shaft grounding ring.

.7 Motors located outside to be TEFC type, unless located in insulated weatherproof enclosure.

2.3 BELT DRIVES

.1 Fit reinforced belts in sheave matched to drive. Multiple belts to be matched sets.

.2 Use cast iron or steel sheaves secured to shafts with removable keys unless otherwise specified.

.3 For motor under 7.5 kW (10 HP): standard adjustable pitch drive sheaves, having ±10% range. Use mid-position of range for specified r/min.

.4 For motors 7.5 kW (10 HP) and over: sheave with split tapered bushing and keyway having fixed pitch unless specifically required for item concerned. Provide sheave of correct size to suit balancing.

.5 Correct size of sheave to be determined during start-up and commissioning.

.6 Minimum drive rating: 1½ times nameplate rating on motor. Keep overhung loads within manufacturer's design requirements on prime mover shafts.

.7 Motor slide rail adjustment plates to allow for centre line adjustment.

2.4 DRIVE GUARDS

.1 Provide guards for unprotected drives.

.2 Guards for belt drives;

.1 Expanded metal screen welded to steel frame.

.2 Minimum 1.6 mm (16 ga.) sheet metal tops and bottoms.

.3 38 mm (1½") dia. holes on both shaft centres for insertion of tachometer.

.4 Removable for servicing.

.5 OSHA approved.

.6 Sized to allow either sheave to be increased by two sizes.

.3 Provide means to permit lubrication and use of test instruments with guards in place.

.4 Install belt guards to allow movement of motors for adjusting belt tension.

.5 Plenum fan assembly must have an enclosed safety screen as per OSHA standards.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Fasten securely in place.

.2 Ensure motor installation is easily removable for servicing.

END OF SECTION

THERMOMETERS AND PRESSURE GAUGES

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

1.2 REFERENCES

.1 American Society of Mechanical Engineers (ASME).

.1 ASME B40.100-2022, Pressure Gauges and Gauge Attachments.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-14.4-M88, Thermometers, Liquid-in-Glass, Self Indicating, Commercial/Industrial Type.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 20 05 01 - Mechanical General Requirements.

.2 Indicate on manufacturers catalogue literature the following:

.1 Thermometers.

.2 Pressure gauges.

.3 Ball valve.

.4 Syphons.

.5 Wells.

1.4 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into manual specified in Section 20 05 01 - Mechanical General Requirements.

PART 2 PRODUCTS

2.1 GENERAL

.1 Thermometers and pressure gauges to operate at mid point of scale or range.

2.2 DIRECT READING THERMOMETERS

.1 Industrial, variable angle type, liquid filled, 125 mm scale length: to CAN/CGSB-14.4.

.1 Acceptable Materials: Ashcroft, Taylor, Winters, Weiss, H.O. Trerice.

.2 Low light compatible solar powered display, durable NEMA-5 ABS case, 32 mm (1¼") UNF swivel nut, 19 mm (¾"), NPT with brass thermowell, 6 sec. read interval, -45°C (-50°F) to 160°C (320°F) range, accurate to 0.1°, switchable metric/imperial scale, vari-angle connection, ±1% accuracy, 4-20 mA output, 90 mm (3.5") stem, one (1) year warranty.

.1 Acceptable material: Winters Model TSD, Therice Model Solar Therm, Precision.

2.3 THERMOMETER WELLS

.1 For copper pipe use copper or bronze. For steel pipe use brass.

2.4 PRESSURE GAUGES

.1 Liquid filled, 112 mm, dial type: ASME B40.100, Grade 2A, having ½ of 1% accuracy over entire range, stem mounting.

.1 Acceptable Materials: Ashcroft, Taylor, Winters, Weiss, H.O. Trerice.

.2 Provide ball valve and snubber for pulsating operation (pumps).

PART 3 EXECUTION

3.1 GENERAL

.1 Install so they can be easily read from floor or platform. If this cannot be accomplished, install remote reading units.

.2 Install between equipment and first fitting or valve.

3.2 THERMOMETERS

.1 Install in wells on all piping. Provide heat conductive material for inside of well.

.2 Install in locations as indicated and on inlet and outlet of:

.1 Coils.

.3 Use extensions where thermometers are installed through insulation.

3.3 PRESSURE GAUGES

.1 Install in following locations:

.1 Suction and discharge of pumps.

.2 Inlet and outlet of coils.

.3 In other locations as indicated.

.2 Pressure gauges are to be manifolded between inlet and outlet of device (coil, pump, strainer, HX, etc.) unless otherwise indicated. Provide ball type isolation valve between pressure gauge and device.

END OF SECTION

VALVES

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

1.2 REFERENCES

.1 American Society of Mechanical Engineers (ASME).

.1 ASME B1.20.1-2013 (R2018), Pipe Threads, General Purpose (Inch).

.2 ASME B16.1-2020, Gray Iron Pipe Flanges and Flanged Fittings, Class 25, 125 and 250.

.3 ASME B16.34-2020, Valves - Flanged, Threaded and Welding End.

.2 American Society for Testing and Materials (ASTM).

.1 ASTM A126-04(2023), Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.

.2 ASTM B16/B16M-24, Standard Specification for Free-Cutting Brass Rod, Bar and Shapes for Use in Screw Machines.

.3 ASTM B62-17, Specification for Composition Bronze or Ounce Metal Castings.

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

.1 MSS SP-67-2022, Butterfly Valves.

.2 MSS SP-80-2019, Bronze Gate Globe, Angle and Check Valves.

1.3 PRODUCT DATA

.1 Submit product data in accordance with Section 20 05 01 - Mechanical General Requirements.

.2 Submit data for all valves specified in this section.

1.4 CLOSEOUT SUBMITTALS

.1 Submit maintenance data for incorporation into manual specified in Section 20 05 01 - Mechanical General Requirements.

1.5 ACCEPTABLE MANUFACTURERS

.1 Refer to Acceptable Products Table in Part 3 of this section.

PART 2 PRODUCTS

2.1 GENERAL

.1 All valves of the same type to be from one manufacturer.

.2 All valves to have CRN registration numbers.

2.2 GATE VALVES

.1 NPS 2 and under, bronze, solid wedge disc:

.1 Standard specification: MSS SP-80.

.2 Bonnet: with hex. shoulders.

.3 Connections: with hex. shoulders.

.4 Inspection and pressure testing: to MSS SP-80. Tests to be hydrostatic.

.5 Packing: high grade non-asbestos packing.

.6 Handwheel: non-ferrous. Nut: bronze to ASTM B62.

.7 Body: with long disc guides, screwed bonnet with stem retaining nut.

.2 NPS 2½ - 8, cast iron, bronze iron trim, solid wedge disc:

.1 Body and multiple-bolted bonnet: with bosses in body and bonnet for taps and drains, full length disc guides designed to ensure correct re-assembly.

.2 Disc: solid offset taper wedge, bronze to ASTM B62 up to and including NPS 3, bronze rings rolled into cast iron disc on other sizes, secured to bronze stem to ASTM B62.

.3 Seat rings: renewable bronze to ASTM B62, screwed into body.

.4 Stem: bronze to ASTM B62.

2.3 CHECK VALVES

.1 NPS 2 and under, bronze swing type, bronze disc:

.1 Standard specification: MSS SP-80.

.2 Connections: with hex. shoulders.

.3 Body: Y-pattern with integral seat at 45°, screw-in cap with hex head.

.4 Disc and seat: renewable rotating disc, two-piece hinge disc construction; seat: regrindable.

.2 NPS 2½ and over, cast iron:

.1 Body and bolted cover: with tapped and plugged opening on each side for hinge pin.

.1 Up to NPS 16: cast iron to ASTM A126 Class B.

.2 NPS 18 and over: cast iron to ASTM A126 Class C.

.2 Disc: Rotating for extended life.

.1 Up to NPS 6: bronze to ASTM B62.

.2 NPS 8 and over: bronze-faced cast iron.

.3 Seat rings: renewable bronze to ASTM B62 screwed into body.

.4 Hinge pin, bushings: renewable bronze to ASTM B62.

2.4 SEWAGE CHECK VALVES

.1 NPS 1¼ to 3 full flow no restriction cast iron type:

.1 Application: Vertical or horizontal sewage installation.

.2 Neoprene polyester reinforced flapper with cast iron & non-corrosive metal backing plates and stainless-steel hardware.

.3 Corrosion resistant powder coated epoxy finish.

.4 Rated at 345 kPa (50 psi) at 54°C (130°F).

2.5 BALL VALVES

.1 NPS 4 and under:

.1 Body and cap: cast high tensile bronze to ASTM B62 or brass to ASTM B16/B16M C36000.

.2 Stem: tamperproof ball drive.

.3 Stem packing nut: external to body.

.4 Ball and seat: replaceable chrome plated brass solid full port ball and Teflon seats.

.5 Stem seal: TFE with external packing nut.

.6 Operator: removable lever handle c/w handle extension to accommodate insulation thickness.

2.6 BUTTERFLY VALVES

.1 NPS 2½ and over, lug body, dead end type:

.1 To MSS SP-67, Class 150, 1.4 Mpa WOG, cast iron or semi-steel body, ductile iron or bronze disc, stainless steel stem, replaceable EPDM liner and nylon coated ductile iron seat, locking handle.

.2 Operators:

.1 NPS 2½ to 5: locking type lever handle.

.2 NPS 6 and over: gear operator.

2.7 LUBRICATED PLUG VALVES

.1 Valve:

.1 Body: cast iron to ASTM A126 Class B semi-steel.

.2 Plug: cylindrical or tapered, with regular Venturi or round pattern port - 90° from full open to fully closed.

.3 Number of ports: 2.

.4 Ends: with hexagon shoulders, ends screwed to ASME B1.20.1 up to NPS 3; Flanged to ASME B16.1 NPS 4 and over.

.5 Lubrication system, nickel-plated.

.6 Lubricant: to suit type, temperature and pressure of contained fluid.

.7 Feeding system: lubricant forced into lubrication grooves between seating surfaces of plug and body to form positive seal, leakproof operation, and corrosion preventing film. Lubricant receptacle to hold additional lubricant. Lubricant screw for lubrication. Check valve to prevent reverse flow of lubricant. O-rings between body and plug.

.2 Operator: manual - lever.

.3 Accessories: lubricant gun.

.4 Testing: to ASME B16.34.

PART 3 EXECUTION

3.1 ACCEPTABLE PRODUCTS TABLE

.1

Domestic, Chilled & Heating Water/Glycol up to 200 psi							
Valve Type			Crane	Jenkins	Toyo	Victaulic	Kitz
Ball	NPS 4 & under	Solder	9202 (up to 3")	202J (up to 3")	5049A	-	59
		Threaded	9201 (up to 4")	201J (up to 4")	5044A	722	58
Butterfly	NPS 2½ & over	Flanged	44BXZ	2232EJ	928 BESL/G	-	6122 EL/G
		Grooved (steel)	-	-		Vic-300	-
		Grooved (copper)	-	-		Vic-608	-
Check	NPS 2 & under	Solder	1342	4093J	237	-	23
		Threaded	37	4037	236	-	22
	NPS 2½ & over	Flanged	373	587J	435	-	78
		Grooved	-	-		716	-

Water Entry							
Valve Type			Watts	Kitz	Toyo		
Gate	NPS 4 & over	Flanged	4080 SYRW	72	400A		
Natural Gas							
Valve Type			Crane	Jenkins	Toyo	Kitz	
Ball	3" & under	Threaded	9201	201J	5044A	58	
			Newman Milliken	Kitz			
Lubricated Plug	¾" - 2"	Threaded	170M			150 SCTDZM	
Lubricated Plug	2" & over	Flanged	171M	150 SCTAM-FS			

3.2 INSTALLATION

.1 Install rising stem valves in upright position with stem above horizontal.

.2 Handwheel with chain operators are to be installed on all valves more than 3 metres above floor.

.3 Remove internal parts before soldering or brazing.

.4 Install all valves such that adequate clearance is provided to allow for obstruction free operation.

.5 Install valves at all branch take-offs and to isolate each piece of equipment, and as indicated.

.6 For all threaded valves provide one screwed union beside each valve to allow easy replacement of valve.

.7 Install all valves as per manufacturer's recommendation.

END OF SECTION

BASES, HANGERS AND SUPPORTS

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

1.2 REFERENCES

.1 American Society of Mechanical Engineers (ASME)

.1 ASME B31.1-2024

.2 American Society for Testing and Materials (ASTM)

.1 ASTM A123/A123M-24, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.2 ASTM A125-24, Specification for Steel Springs, Helical, Heat-Treated.

.3 ASTM A153/A153M-23, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

.4 ASTM A563/A563M-24, Specification for Carbon and Alloy Steel Nuts (Metric).

.5 ASTM D1929-23, Standard Test Method for Determining Ignition Temperature of Plastics.

.6 ASTM E84-24, Standard Test Method for Surface Burning Characteristics of Building Materials.

.7 ASTM E96/E96M-24a, Standard Test Methods for Water Vapour Transmission of Materials.

.3 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)

.1 MSS SP-58-2018, Pipe Hangers and Supports - Materials, Design, Selection, Manufacture, Application, and Installation.

.4 Underwriter's Laboratories of Canada (ULC).

1.3 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 ASME B31.1 or MSS SP-58.

.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 SP-58.

1.4 DESIGN FOR SEISMIC EVENTS

.1 Design supports, platforms, hangers, racks to withstand seismic events as specified Section 20 05 49.01 - Seismic Restraint Systems (SRS).

1.5 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 20 05 01 - Mechanical General Requirements.

.2 Submit shop drawings and product data for following items:

.1 All bases, hangers and supports.

.2 Connections to equipment & structure.

.3 Structural assemblies.

1.6 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 20 05 01 - Mechanical General Requirements.

PART 2 PRODUCTS

2.1 GENERAL

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

.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 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 maximums: Malleable iron C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip.

.1 Rod: 9 mm UL listed.

.2 Cold piping NPS 2½ or greater, all hot piping: Malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, UL listed to MSS SP-58.

.3 Upper attachment structural: Suspension from upper flange of I-Beam.

.1 Cold piping NPS 2 maximums: Ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, UL listed to MSS SP-58.

.2 Cold piping NPS 2½ or greater, all hot piping: Malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nut UL listed.

.4 Upper attachment to concrete:

.1 Ceiling: Carbon steel welded rod, clevis plate, clevis pin and cotters with forged weldless steel nut.

.2 Concrete wedge anchor with knockout protector plate UL listed to MSS SP-58. Anchor installation to be via concrete pre-drilling. Impact inserts type anchor not allowed.

.5 Manufacturer assemblies:

.1 Sway braces for seismic restraint systems: to Section 20 05 49.01 - Seismic Restraint Systems (SRS).

.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 black.

.2 Attachments for copper piping: copper plated black steel.

.3 Use insulation shields for hot pipework.

.4 Oversize pipe hangers and supports.

.8 Adjustable clevis: material to MSS SP-58 UL listed, clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis. Ensure "U" has hole in bottom for riveting to insulation shields.

.9 Yoke style pipe roll: carbon steel yoke, rod and nuts with cast iron roll, to MSS SP-58.

.10 U-bolts: carbon steel to MSS SP-58 with 2 nuts at each end to ASTM A563.

.1 Finishes for steel pipework: black.

.2 Finishes for copper, glass, brass or aluminum pipework: black, with formed portion epoxy coated.

.11 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP-58, Type 43.

.1 Finish: Hot dipped galvanized steel.

.2 Acceptable material: Tolco or approved equal.

2.3 INSULATED PIPE SADDLES

.1 Insulated saddles shall be installed by the mechanical contractor when setting pipe elevation at all pipe support locations on insulated systems operating between -290°F and +250°F including:

.1 Domestic cold water, heat recovery glycol

.2 Domestic hot water, heat recovery glycol

.2 Composition includes:

.1 Rigid phenolic foam insulation that meets ASTM E84 (25/50 flame spread/smoke developed requirement) with density of:

.1 3.75 PCF (0.17 Btu-in./hr.-ft.²-°F @ 75°F mean) for pipe sizes up to 10" IPS

.2 5 PCF (0.20 Btu-in./hr.-ft.²-°F @ 75°F mean) for piping 11" IPS to 30" IPS

.2 Zero perm rated (ASTM E96), abuse-resistant vapour barrier jacket with 1½" wide longitudinal self-sealing acrylic tape closure system.

.3 Pipe insulation protection shield, manufactured from carbon steel with a G90 galvanized finish, centred and adhered to bottom with a minimum of 1.5" jacketed insulation extending from each side to allow proper circumferential closure at butt joints with 3" wide zero perm tape. Shields shall be 20 gauge thick up to 3½" piping, 18 gauge for piping from 4" to 10" diameter.

.4 Acceptable Material: Multiglass M-Saddle, Buckaroos Cooldry or approved equivalent.

2.4 INSULATION PROTECTION SHIELDS

.1 Insulated cold piping: 64 kg/m³ density insulation plus insulation protection shield to: MSS SP-58, galvanized sheet carbon steel. Length designed for maximum 3 m span.

.2 Insulated hot piping: 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-58.

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 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.

.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. Submit calculations with shop drawings.

2.8 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

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

.2 For attachment to concrete, provide concrete wedge anchors with knockout protection plate UL listed. Anchor installation to be via concrete pre-drilling. Impact inserts type anchor not allowed.

2.9 HOUSEKEEPING PADS

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

2.10 ROOF MOUNTED SUPPORTS

.1 Portable Support System: Engineered, portable system specifically designed for installation without the need for roof penetrations or flashings, and without damage to the roofing membrane.

.1 Design system using high density polypropylene bases and structural steel framing.

.2 Custom design system to fit piping, conduits, equipment, or walkways to be installed and actual conditions of service and loading.

.3 Piping Supports: Provide suitable hangers and supports.

.4 Pipe support system shall have seismic ratings and meet Section 20 05 49.01 - Seismic Restraint Systems (SRS).

.2 Bases: Injection molded high density polypropylene with UV-inhibitors or recycled rubber conforming to the following:

.1 Moisture content: Negligible.

.2 Shrinkage/swelling due to moisture: Negligible.

.3 Density: 894 kg/m^3 (55.8 lbs./ft.^{3}).

.4 Insect resistance: No known insect damage potential.

.5 Chemical resistance (oil, brake fluid, gasoline, diesel, antifreeze, battery acid, sulfuric acid: no visual or physical change apparent.

.6 Flammability: No ignition after 10 minutes, 25 kW/m, when tested in accordance with ASTM D1929.

.7 Sized as required by loading conditions and as indicated on the drawings.

.8 Shop fabricated with inserts for square tubing or threaded rods as required.

.9 Colour: Integral black colour as molded.

.3 Steel Framing:

.1 Strut Types: 1-5/8 in. (41.3 mm) B22TH or 1-7/8 in. (47.6 mm) BTS22H, as required for loading conditions.

.2 Thickness: 12 gauge (2.7 mm).

.3 Form: Roll-formed 3-sided or tubular shape, perforated with 9/16 in. (14.3 mm) holes at 1-7/8 in. (47.6 mm) centres on three (3) sides.

.4 Finish: Hot dip galvanize in accordance with ASTM A123/A123M after fabrication, free of roughness, whiskers, unsightly spangles, icicles, runs, barbs, sags, droplets, and other surface blemishes.

.4 Pipe Supports and Hangers: Conform to MSS SP-58 and as follows:

.1 Fabricate of carbon steel where framing is carbon steel; fabricate of stainless steel where framing is stainless steel; finished same as framing.

.2 Sizes 2½ in. (63 mm) and smaller: Single roller supports for piping subject to expansion and contraction; 3-sided channels and pipe clamps.

.3 Sizes 3 in. (76 mm) and larger: Rollers, clevis hangers, or band hangers, to allow for expansion and contraction without movement of the bases or framing.

.5 Accessories: Clamps, bolts, nuts, washers, and other devices as required for a complete system:

.1 Carbon steel: Hot-dip galvanized in accordance with ASTM A153/A153M.

.2 Stainless steel: mill finish.

.6 Acceptable material: Portable Pipe Hangar Model PPH-D, Miro Industries Model 8-DS, Mifab CPORT-2015, Big Foot Systems, or approved equal.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install in accordance with: manufacturer's instructions and recommendations.

.2 Vibration Control Devices:

.1 Install on piping systems at pumps and 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.

.8 When attaching to open web steel joists provide additional hangers for pipes with diameters of 75 mm or greater in order to reduce the magnitude of the concentrated load and spread the load to the joists equally. In these cases, the allowable spacing of hangers for pipes permitted under ASME/MSS SP-58 will be reduced and additional hangers will be required as directed by steel fabricator and/or structural engineer.

.9 Locate hangers at the top of open web steel joists where the horizontal and diagonal members meet at a joint.

.10 All installations must be in conjunction with Section 20 05 49.01 - Seismic Restraint System.

3.2 HANGER SPACING

.1 Plumbing piping: most stringent requirements of Manufacturer's recommendations, Canadian Plumbing Code, Provincial Code, or authority having jurisdiction.

.2 Fire protection: to applicable fire code.

.3 Gas & fuel piping: to applicable code.

.4 Copper piping: up to NPS ½: every 1.5 m.

.5 Flexible joint roll groove pipe: in accordance with table below, but not less than one hanger at joints.

.6 Within 300 mm of each elbow.

Maximum Pipe Size NPS	Maximum Spacing Steel	Maximum Spacing Copper	Maximum Spacing XFR
up to 1¼	2.1 m	1.8 m	1.6 m
1½	2.7 m	2.4 m	1.6 m
2	3.0 m	2.7 m	1.8 m
2½	3.6 m	3.0 m	1.8 m
3	3.6 m	3.0 m	2.2 m
4	4.2 m	3.6 m	2.6 m
6	5.1 m		3.1 m

.7 Pipework greater than NPS 12: to MSS SP-58.

3.3 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.

.4 Plumbing contractor shall install insulated pipe saddles at all hanger locations. Insulated saddle jackets to be sealed, ready for integration into insulation system.

3.4 HORIZONTAL MOVEMENT

.1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4° 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.

3.5 FINAL ADJUSTMENTS

.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: Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.

.4 Beam clamps: Hammer jaw firmly against underside of beam.

END OF SECTION

MECHANICAL IDENTIFICATION

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

1.2 REFERENCES

.1 Canadian General Standards Board (CGSB).

.1 CAN/CGSB-24.3-92, Identification of Piping Systems.

.2 Canadian Standards Association (CSA).

.1 CSA B149.1-20, Natural Gas and Propane Installation Code.

.2 CSA Z7396.1:22, Medical Gas Pipeline Systems - Part 1: Pipelines for Medical Gases, Medical Vacuum, Medical Support Gases, and Anaesthetic Gas Scavenging Systems.

.3 National Fire Protection Association

.1 NFPA (Fire) 13, Installation of Sprinkler Systems, 2015 Edition.

1.3 PRODUCT DATA

.1 Submit product data in accordance with Section 20 05 01 - Mechanical General Requirements.

.2 Product data to include paint colour chips, all other products specified in this section.

1.4 SAMPLES

.1 Submit samples in accordance with Section 20 05 01 - Mechanical General Requirements.

.2 Samples to include nameplates, labels, tags, lists of proposed legends.

PART 2 PRODUCTS

2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES

.1 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.

.2 Construction:

.1 1/8" thick laminated plastic, matte finish, with square corners, letters accurately aligned, and machine engraved into core.

.3 Sizes:

.1 Conform to following table:

Size #	Height Sizes (mm)	No. of Lines (mm)	Height No. of Letters
1	40	1	20
2	75	1	50

.2 Use maximum of 25 letters/numbers per line.

.4 Locations:

.1 Terminal cabinets, control panels: Use size #1.

.2 Equipment in Mechanical Rooms: Use size #2.

2.3 PIPING SYSTEMS GOVERNED BY CODES

.1 Identification:

.1 Natural gas: To CSA B149.1.

.2 Sprinklers: To NFPA (Fire) 13.

.3 Medical Gas: To CSA Z7396.1.

2.4 IDENTIFICATION OF PIPING SYSTEMS

.1 Identify contents by background colour marking, legend; direction of flow by arrows. To CAN/CGSB-24.3 except where specified otherwise.

.2 Legend:

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

.3 Arrows showing direction of flow:

.1 Continuous wrap full diameter of pipe at each end of pipe identification markers.

.4 Extent of background colour marking:

.1 To full circumference of pipe or insulation.

.2 Length to accommodate full length of legend and arrows.

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

.1 Pipes and tubing ¾" 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 300°F and intermittent temperature of 400°F.

.6 Colours and Legends:

.1 Where not listed, obtain direction from Engineer.

.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
Glycol heating supply	Yellow	GLYCOL SUPPLY
Glycol heating return	Yellow	GLYCOL RETURN
Domestic hot water supply	Green	DOM. HW SUPPLY
Domestic cold-water supply	Green	DOM. CWS
Storm water	Green	STORM
Sanitary	Green	SAN.
Radioactive Sanitary	Green	SAN. RADIOACTIVE
Engine exhaust	Yellow	ENGINE EXHAUST
Natural gas	to Codes	

2.5 IDENTIFICATION DUCTWORK SYSTEMS

.1 150 mm (6") high stencilled letters and directional arrows 150 mm (6") long x 50 mm (2") high.

.2 Colours: Black, or co-ordinated with base colour to ensure strong contrast.

2.6 MECHANICAL EQUIPMENT, VALVES CONTROLLERS, PUMPS, BOILERS, FAN COIL, ETC.

.1 Lamicoid tag with 13 mm (½") 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.

.3 Brass tags with 13 mm (½") stamped identification data filled with black paint.

.4 Brass tags to be stamped with system identification and valve number system as outlined below:

SYSTEM	BRASS TAG STAMP
Domestic Cold Water	DC-1,2, ...
Domestic Hot Water	DH-1,2, ...
Storm	ST-1,2, ...
Sanitary	SA-1,2, ...
Heating Water	HW-1,2, ...
Glycol Heating	GH-1,2, ...
Natural Gas	NG-1,2, ...
Refrigerant	Re-1,2, ...

2.7 CONTROLS COMPONENTS IDENTIFICATION

.1 Identify all systems, equipment, components, controls, sensors with system nameplates specified in this section.

.2 Inscriptions to include function and (where appropriate) fail-safe position.

2.8 LANGUAGE

.1 Identification to be in English.

PART 3 EXECUTION

3.1 TIMING

.1 Provide identification only after all painting specified in Architectural section is complete re: Interior Painting has been completed.

3.2 INSTALLATION

.1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.

.2 Provide ULC and CSA registration plates as required by respective agency.

3.3 NAMEPLATES

.1 Locations:

.1 In conspicuous location to facilitate easy reading and identification from operating floor.

.2 Standoffs:

.1 Provide for nameplates on hot and/or insulated surfaces.

.3 Protection:

.1 Do not paint, insulate or cover in any way.

3.4 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS

.1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels: at least one is visible from any one viewpoint in operating areas and walking aisles. At not more than 17 m (55 ft.) 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, other confined spaces, at entry and exit points, and at each access opening.

.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.

.10 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.

.11 At branch take-offs on both main and branch.

3.5 MECHANICAL EQUIPMENT, 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 Engineer. Provide one copy (reduced in size if required) in each operating and maintenance manual.

.3 Number valves in each system consecutively.

.4 Where equipment is above accessible ceiling, provide coloured self-adhesive 13 mmØ dots to identify location of equipments.

END OF SECTION

TESTING, ADJUSTING AND BALANCING (TAB) OF MECHANICAL SYSTEMS

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

1.2 REFERENCES

.1 Associated Air Balance Council/Canadian Associated Air Balance Council (AABC/CAABC).

.2 National Balancing Council (NBC).

1.3 GENERAL

.1 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do all other work as specified in this section.

1.4 QUALIFICATIONS OF TAB PERSONNEL

.1 Names of all personnel it is proposed to perform TAB to be submitted to and approved by Engineer within 90 days of award of contract.

.2 Provide documentation confirming qualifications, successful experience.

1.5 PURPOSE OF TAB

.1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads

.2 Adjust and regulate equipment and systems so as to meet specified performance requirements and to achieve specified interaction with all other related systems under all normal and emergency loads and operating conditions.

.3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.

1.6 EXCEPTIONS

.1 TAB of systems and equipment regulated by codes, standards to be to satisfaction of authority having jurisdiction.

1.7 CO-ORDINATION

.1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule so as to ensure completion before acceptance of project.

.2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.

.3 Coordinate TAB with controls, mechanical and electrical contractors.

1.8 PRE-TAB REVIEW

.1 Review contract documents before project construction is started and confirm in writing to Engineer adequacy of provisions for TAB and all other aspects of design and installation pertinent to success of TAB.

.2 Review specified standards and report to Engineer in writing all proposed procedures which vary from standard.

.3 During construction, co-ordinate location and installation of all TAB devices, equipment, accessories, measurement ports and fittings.

1.9 START-UP

.1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.

.2 Follow special start-up procedures specified elsewhere in Divisions 20, 21, 22 & 23.

1.10 OPERATION OF SYSTEMS DURING TAB

.1 Operate systems for length of time required for TAB and as required by Engineer for verification of TAB reports.

1.11 START OF TAB

.1 Notify Engineer 7 days prior to start of TAB.

.2 Start TAB only when building is essentially completed, including:

.1 Installation of ceilings, doors, windows, other construction affecting TAB.

.2 Application of weatherstripping, sealing, caulking.

.3 All pressure, leakage, other tests specified elsewhere in Divisions 20, 21, 22 & 23.

.4 All provisions for TAB installed and operational.

.3 Start-up, verification for proper, normal and safe operation of all mechanical and associated electrical and control systems affecting TAB including but not limited to:

.1 Proper thermal overload protection in place for electrical equipment.

.2 Air systems:

.1 Filters in place, clean.

.2 Duct systems clean.

.3 Ducts, air shafts, ceiling plenums are airtight to within specified tolerances.

.4 Correct fan rotation.

.5 Fire, smoke, volume control dampers installed and open.

.6 Coil fins combed, clean.

.7 Access doors, installed, closed.

.8 All outlets installed; volume control dampers open.

1.12 APPLICATION TOLERANCES

.1 Do TAB to following tolerances of design values:

.1 All other HVAC systems: +5%, -5%.

.2 Hydronic systems: ±10%.

1.13 ACCURACY TOLERANCES

.1 Measured values to be accurate to within ±2% of actual values.

1.14 INSTRUMENTS

.1 Prior to TAB, submit to Engineer list of instruments to be used together with serial numbers.

.2 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.

.3 Calibrate within 3 months of TAB. Provide certificate of calibration to Engineer.

1.15 SUBMITTALS

.1 Submit, prior to commencement of TAB:

.2 Proposed methodology and procedures for performing TAB if different from referenced standard.

1.16 PRELIMINARY TAB REPORT

.1 Submit for checking and approval of Engineer, prior to submission of formal TAB report, sample of rough TAB sheets. Include:

.1 Details of instruments used.

.2 Details of TAB procedures employed.

.3 Calculations procedures.

.4 Summaries.

1.17 TAB REPORT

.1 Format to be in accordance with AABC/CAABC.

.2 TAB report to show all results in SI units or Imperial (IP), to match drawings and specifications, and to include:

.1 Project record drawings.

.2 System schematics.

.3 Submit pdf electronic copy of TAB Report to Engineer for verification and approval.

1.18 VERIFICATION

.1 All reported results subject to verification by Engineer.

.2 Provide manpower and instrumentation to verify up to 30% of all reported results.

.3 Number and location of verified results to be at discretion of Engineer.

.4 Bear costs to repeat TAB as required to satisfaction of Engineer.

.5 At request of commissioning agent, provide manpower and instrumentation to verify an additional 30% of all reported results.

1.19 SETTINGS

.1 After TAB is completed to satisfaction of Engineer, replace drive guards, close all access doors, lock all devices in set positions and ensure sensors are at required settings.

.2 Permanently mark all settings to allow restoration at any time during life of facility. Markings not to be eradicated or covered in any way.

1.20 COMPLETION OF TAB

.1 TAB to be considered complete only when final TAB Report received and approved by Engineer.

1.21 SYSTEMS

.1 Quality assurance: Perform TAB of complete mechanical systems over entire operating range in accordance with most stringent conditions of AABC/CAABC & NBC.

.2 Air Systems: Include both specified and measured data.

.1 Air Handling Equipment:

.1 Maximum air flow volume.

.2 Fan total pressure.

.3 Motor volts, amps and power.

.4 Minimum outside air volume.

.5 Fan rotational speed.

.6 Fan Power, calculate fan efficiency.

.7 Inlet and outlet dry bulb, wet bulb and dewpoint temperatures.

.8 Equipment static pressure profile.

.9 Noise.

.10 Vibration.

.2 Duct Air Quantities - Mains and Branches:

.1 Duct size.

.2 Number of pressure/velocity readings per traverse.

.3 Sum of velocity measurements.

.4 Average velocity.

.5 Duct air flow volume.

.6 Barometric pressure and duct air temperature.

.3 Air Outlets:

.1 Outlet location and designation.

.2 Manufacturers catalogue identification and type.

.3 Air outlet flow factors. Use 1.0 when flow hood is used.

.4 Air flow volumes.

.5 Deflector vane or diffuser cone settings.

.3 Hydronic Systems: Include both specified and measured data.

.1 Pumps:

.1 Discharge and suction pressures, at design flow and no flow.

.2 Fluid flow rate. Calculate from pump curves if metering not provided.

.3 Motor volts, amps, power.

.4 RPM.

.5 Noise.

.6 Vibration.

.2 Piping Systems:

.1 Supply and return of each primary loop.

.2 Supply and return of each secondary loop.

.3 Make-up water inlet.

.4 Domestic hot water recirculation.

.3 Air Heating and Cooling Coils:

.1 Coil type and identification, location and designation.

.2 Entering and leaving air dry and wet bulb temperatures.

.3 Air static pressure drop.

.4 Air flow volume.

.5 Barometric pressure.

.6 Air side heat transfer rate.

.7 Fluid used. Identify fluid used; water, % water/ethylene glycol mixes, steam, etc.

.8 Fluid flow rate.

.9 Fluid Specific Heat, at mean temperature.

.10 Fluid Specific Gravity, at mean temperature.

.11 Fluid side heat transfer rate.

PART 2 PRODUCTS

2.1 NOT USED

.1 Not used.

PART 3 EXECUTION

3.1 BALANCING AND ADJUSTING PREPARATION

.1 Perform testing, adjusting and balancing work after equipment and systems starting procedures have been properly completed.

.2 Perform balancing during heating and cooling season of first year of operation, and at times when directed by Engineer, to ensure proper settings of controls under both summer and winter peak load conditions.

.3 Vary load to verify operation of system under partial load conditions. Test start-up, shut-down, emergency conditions, safety controls operation and automatic and manual resets and interlocks.

.4 Cap all instrument test ports. Obtain caps from sheet metal contractor and install.

.5 Allow for ultrasonic flow measurement where hydronic flow measurements are required, but circuit balancing valves are not provided.

END OF SECTION

THERMAL INSULATION FOR DUCTING

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM).

.1 ASTM B209/B209M-21a, Specification for Aluminum and Aluminum Alloy Sheet and Plate.

.2 ASTM C335/C335M-23, Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.

.3 ASTM C449-07(2024), Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-51.10-92, Mineral Fibre Board Thermal Insulation.

.2 CAN/CGSB-51.11-92, Mineral Fibre Thermal Insulation Blanket.

.3 CGSB 51-GP-52Ma, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.

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

.4 Underwriters Laboratories (UL)

.1 UL 723, Tests for Surface Burning Characteristics of Building Materials.

.5 Underwriters Laboratories of Canada (ULC)

.1 CAN-ULC-S102-2018-REV1, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

1.3 DEFINITIONS

.1 For purposes of this section:

.1 "CONCEALED" - insulated mechanical services and equipment in suspended ceilings and non-accessible chases and furred-in spaces.

.2 "EXPOSED" - will mean "not concealed" as defined herein.

.3 Insulation systems - insulation material, fasteners, jackets, and other accessories.

.2 TIAC Codes:

.1 CRD: Code Round Ductwork,

.2 CRF: Code Rectangular Finish.

1.4 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 20 05 01 - Mechanical General Requirements.

.2 Submit for approval manufacturer's catalogue literature related to installation, fabrication for duct jointing recommendations.

1.5 SAMPLES

.1 Submit samples in accordance with Section 20 05 01 - Mechanical General Requirements, if requested by Consultant.

.2 Submit for approval: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed. Mount sample on ½" plywood board. Affix typewritten label beneath sample indicating service.

1.6 MANUFACTURER'S INSTRUCTIONS

.1 Submit manufacturer's installation instructions in accordance with Section 20 05 01 - Mechanical General Requirements, if requested by Engineer.

.2 Installation instructions to include procedures to be used, installation standards to be achieved.

1.7 QUALIFICATIONS

.1 Installer to be specialist in performing work of this section and have at least 5 years' successful experience in this size and type of project, qualified to standards.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.2 Protect from weather and construction traffic.

.3 Protect against damage from any source.

.4 Store at temperatures and conditions required by manufacturer.

PART 2 PRODUCTS

2.1 FIRE AND SMOKE RATING

.1 In accordance with CAN-ULC-S102:

.1 Maximum flame spread rating: 25.

.2 Maximum smoke developed rating: 50.

2.2 INSULATION

.1 Mineral fibre as specified herein 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/C335M.

.3 TIAC Code C-1: Rigid mineral fibre board to CAN/CGSB-51.10, with factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this Section).

.4 TIAC Code C-2: Mineral fibre blanket to CAN/CGSB-51.11 faced with factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this section).

.1 Mineral fibre: to CAN/CGSB-51.11.

.2 Jacket: to CGSB 51-GP-52Ma.

.3 Maximum "k" factor: to CAN/CGSB-51.11.

.4 Density: 24 kg/m³.

2.3 JACKETS

.1 Aluminum:

.1 To ASTM B209 with moisture barrier as scheduled in PART 3 of this section.

.2 Thickness: 0.50 mm sheet.

.3 Finish: Stucco embossed.

.4 Jacket banding and mechanical seals: 19 mm (¾") wide, 0.5 mm thick stainless steel.

2.4 ACCESSORIES

.1 Vapour retarder lap adhesive: Water based, fire retardant type, compatible with insulation.

.2 Indoor Vapour Retarder Finish: Vinyl emulsion type acrylic, compatible with insulation.

.3 Insulating Cement: hydraulic setting on mineral wool, to ASTM C449.

.4 Tape: self-adhesive, aluminum, reinforced, 75 mm (3") wide minimum.

.5 Contact adhesive: quick-setting

.6 Tie wire: 1.5 mm stainless steel.

.7 Banding: 19 mm (¾") wide, 0.5 mm thick stainless steel.

.8 Facing: 25 mm (1") galvanized steel hexagonal wire mesh stitched on one face of insulation.

.9 Fasteners: 2 mm diameter pins with 38 mm (1½") diameter clips, length to suit thickness of insulation.

PART 3 EXECUTION

3.1 PRE- INSTALLATION REQUIREMENTS

.1 Pressure testing of ductwork systems to be complete, witnessed and certified.

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

3.2 INSTALLATION

.1 Install in accordance with TIAC National Standards.

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

.3 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.

.1 Hangers, supports to be outside vapour retarder jacket.

.4 Supports, Hangers in accordance with Section 23 05 29 - Bases, Hangers and Supports

.1 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork.

.5 Fasteners: At 300 mm (12") oc in horizontal and vertical directions, minimum two rows each side.

3.3 DUCTWORK INSULATION SCHEDULE

.1 Insulation types and thicknesses: Conform to following table:

	TIAC Code	Vapour Retarder	Thickness mm (in.)
Cold and dual temperature supply air ducts in concealed ceiling space and all-round cold ducts including silencers	C-2	yes	25 (1")
Outside air ducts to mixing plenum	C-1	yes	50 (2")
Exhaust ducts within 3 m from roof/ exterior wall penetration	C-1	yes	50 (2")
Acoustically lined ductwork inside building	none		

.2 Exposed round ducts 600 mm and larger, smaller sizes where subject to abuse:

.1 Use TIAC code C-1 insulation, scored to suit diameter of duct.

.3 Finishes: Conform to following table:

	TIAC Code	
	Rectangular	Round
Indoor, concealed	none	none
Indoor, exposed within mechanical room	CRF/1	CRD/1

END OF SECTION

THERMAL INSULATION FOR PIPING

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM) (latest edition).

.1 ASTM C335/C335M-23, Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.

.2 ASTM C449-07(2024), Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-51.9-92 Mineral Fibre Thermal Insulation for Piping and Round Ducting.

.2 CAN/CGSB-51.12-95, Cement, Thermal Insulating and Finishing.

.3 CGSB 51-GP-52Ma, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.

.3 Manufacturer’s Trade Associations (latest edition).

.1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards.

.4 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC S102-2018-REV1, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

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 Codes:

.1 CPF: Code Piping Finish.

1.4 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 20 05 01 - Mechanical General Requirements.

.2 Submit for approval manufacturer's catalogue literature related to installation, fabrication for pipe, fittings, valves and jointing recommendations.

1.5 SAMPLES

.1 Submit samples in accordance with Section 20 05 01 - Mechanical General Requirements.

.2 Submit for approval: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed. Mount sample on 12 mm (½") plywood board. Affix typewritten label beneath sample indicating service.

1.6 MANUFACTURER'S INSTRUCTIONS

.1 Submit manufacturer's installation instructions in accordance with Section 20 05 01 - Mechanical General Requirements.

.2 Installation instructions to include procedures to be used, installation standards to be achieved.

1.7 QUALIFICATIONS

.1 Installer to be specialist in performing work of this section and have at least 5 years' successful experience in this size and type of project, qualified to standards.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.2 Protect from weather, construction traffic.

.3 Protect against damage from any source.

.4 Store at temperatures and conditions required by manufacturer.

PART 2 PRODUCTS

2.1 FIRE AND SMOKE RATING

.1 In accordance with **ULC S102**:

.1 Maximum flame spread rating: 25.

.2 Maximum smoke developed rating: 50.

2.2 INSULATION

.1 Mineral fibre as specified herein 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/C335M.

.3 TIAC Code A-3: Rigid moulded mineral fibre with factory applied vapour retarder jacket (as scheduled in PART 3 of this section).

.1 Mineral fibre: to CAN/CGSB-51.9.

.2 Jacket: to CGSB 51-GP-52Ma.

.3 Maximum "k" factor: to CAN/CGSB-51.9.

2.3 INSULATION SECUREMENT

.1 Tape: Self-adhesive, aluminum, reinforced, 50 mm wide minimum.

.2 Contact adhesive: Quick setting.

.3 Canvas adhesive: Washable.

.4 Tie wire: 1.5 mm diameter stainless steel.

.5 Bands: Stainless steel, 19 mm wide, 0.5 mm thick.

2.4 CEMENT

.1 Thermal insulating and finishing cement:

.1 To **CAN/CGSB-51.12**.

.2 Hydraulic setting or Air drying on mineral wool, to ASTM C449.

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 JACKETS

.1 PVC:

.1 Ontario Building Code compliant for 25/50 flame spread and smoke developed.

.2 Minimum thickness 0.38 mm.

.3 Colour white unless otherwise specified.

.4 Non yellowing UV stabilized.

.5 Minimum service temperatures: -20°C.

.6 Maximum service temperature: 65°C.

.7 Moisture vapour transmission: 0.02 perm.

.8 Fastenings:

.1 Use solvent weld adhesive compatible with insulation to seal laps and joints.

.2 Tacks.

.3 Pressure sensitive vinyl tape of matching colour.

PART 3 EXECUTION

3.1 PRE- INSULATION 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.

3.2 INSTALLATION

.1 Install in accordance with TIAC National Standards.

.2 Apply materials in accordance with manufacturer's instructions and this specification.

.3 All roof drain bodies shall be thermally insulated with 50 mm thick mineral fibre blanket faced with factory applied vapour retarder jacket.

.4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.

.1 Hangers, supports to be outside vapour retarder jacket.

.2 Saddles to have ridges to limit movement while in hanger.

.3 To be edge flared to prevent cutting/damage to insulation coverage.

.5 Supports, Hangers:

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

.2 Butt insulation up to insulated saddle and seal to saddle jacket as per TIAC code requirement.

3.3 REMOVABLE, PREFABRICATED, INSULATION AND ENCLOSURES

.1 Application: At expansion joints, valves, primary flow measuring elements flanges and unions at equipment.

.2 Design: To permit movement of expansion joint and to permit periodic removal and replacement without damage to adjacent insulation.

.3 Insulation:

.1 Insulation, fastenings and finishes: same as system.

.2 Jacket: PVC.

3.4 INSTALLATION OF ELASTOMERIC INSULATION

.1 Insulation to remain dry at all times. Overlaps to manufacturer's instructions. Ensure tight joints.

.2 Provide vapour retarder as recommended by manufacturer.

3.5 PIPING INSULATION SCHEDULES

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

.2 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.

.3 Thickness of insulation to be as listed in following table:

Application	Temp °C	TIAC code	Pipe sizes (NPS) and insulation thickness (mm)			
			½ to 1¼	1½ to 3	4 to 6	8 & over
Glycol Heating	up to 60	A-3	25	38	38	38
Domestic Cold Water		A-3	25	25	25	25
Storm Piping		A-3	25	25	25	25

.4 Finishes:

.1 Exposed piping & fittings in mechanical rooms: PVC.

.5 Storm piping & fittings to be insulated from all roof drain bodies to storm piping at grade level.

.6 Domestic hot & cold piping shall be completely thermally insulated to fixtures, except exposed supply assembly at fixtures.

END OF SECTION

PIPING, VALVES & FITTINGS - GAS

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

1.2 REFERENCES

.1 American Society of Mechanical Engineers (ASME)

.1 ASME B16.5-2020, Pipe Flanges and Flanged Fittings, NPS ½ through NPS 24, Metric/Inch.

.2 ASME B16.20-2023, Metallic Gaskets for Pipe Flanges.

.3 ASME B16.21-2021, Nonmetallic Flat Gaskets for Pipe Flanges.

.4 ASME B18.2.1-2012 (R2021), Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series).

.5 ASME BPVC.IV-2023, 2023 ASME Boiler and Pressure Vessel Code, Section IV: Heating Boilers.

.2 American Society for Testing and Materials (ASTM)

.1 ASTM A47/A47M-99(2022)e1, Specification for Ferritic Malleable Iron Castings.

.2 ASTM A53/A53M-24, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.

.3 Canadian Standards Association (CSA)

.1 CSA B149.1-20, Natural Gas and Propane Installation Code.

.2 CSA B149.2:20, Propane Storage and Handling Code

.3 CSA W47.1:19 (R2024), Certification of Companies for Fusion Welding of Steel Structures.

1.3 PRODUCT DATA

.1 Submit product data in accordance with Section 20 05 01 - Mechanical General Requirements.

.2 Indicate on manufacturers catalogue literature following: - valves.

1.4 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into manual specified in Section 20 05 01 - Mechanical General Requirements.

PART 2 PRODUCTS

2.1 PIPE

.1 Above ground steel pipe: to ASTM A 53/A 53M, Grade B Schedule 40, Electric-resistance welded (non-seamless) as follows:

.1 NPS ½ to 2, screwed outside, with socket welded within the building.

.2 NPS ½ to 2, screwed, socket welded where concealed within the building.

.3 NPS 2½ and over, welded.

2.2 JOINTING MATERIAL

.1 Screwed fittings: pulverized lead paste.

.2 Welded fittings: to CSA W47.1.

.3 Flange gaskets: to ASME B16.21 or ASME B16.20.

2.3 FITTINGS

.1 Steel pipe fittings, screwed, flanged or welded:

.1 Malleable iron: screwed, banded, Class 150.

.2 Steel pipe flanges and flanged fittings: to ASME B16.5.

.3 Steel butt-welding fittings.

.4 Unions: malleable iron, brass to iron, ground seat, to ASTM A47/A47M.

.5 Bolts and nuts: to ASME B18.2.1.

.6 Nipples: Schedule 40, to ASTM A53/A53M.

2.4 VALVES

.1 Provincial Code approved, lubricated plug or ball type as per specification Section 23 05 23 - Valves.

2.5 ROOF PIPE SUPPORTS

.1 Non seismic, surface mounted 300 x 300 x 65 mm high wide body 100% recycled rubber base, UV resistant, pipe supports with 14-gauge galvanized steel strut & strut pipe clamp, two (2) 13 mm dia. electro zinc plated all threaded rod risers (200-400 mm high rods). Maximum load: 364 kg (800 lbs.). Provide tape between pipe & strut clamps. Acceptable material: Mifab C-Port #CEW.

.2 Seismic supports, as per CSA B149.1 and as per Section 20 05 49.01 - Seismic Restraint Systems (SRS) for Mechanical Systems.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install in accordance with ASME BPVC.IV, regulations of Province having jurisdiction, except where specified otherwise, and manufacturers recommendations.

.2 Make required piping connections recommended by equipment manufacturer.

.3 Maintain clearances as indicated or if not indicated, as recommended by manufacturer installation instruction for operation, servicing and maintenance without disruption of operation of any other equipment/system.

.4 All equipment, venting and gas assembly work shall be installed & certified by a provincially certified gas fitter I Level mechanic.

3.2 PIPING

.1 Install in accordance with applicable Provincial/Territorial Codes.

.2 Install in accordance with CSA B149.1 and CSA B149.2.

.3 Assemble piping using fittings manufactured to ASME standards.

.4 Connect to equipment in accordance with manufacturer's instruction unless otherwise indicated.

.5 Slope piping down in direction of flow to low points as per Gas Utilization Code.

.6 Install drip points:

.1 At all low points in piping system.

.2 At each connection to equipment.

.7 Use eccentric reducers at pipe size change installed to provide positive drainage.

.8 Provide clearance for access and for maintenance.

.9 Ream pipes, clean scale and dirt, inside and out.

.10 Install piping to minimize pipe dismantling for equipment removal.

.11 Install buried piping within sand backfilled compacted trench with tracer wire (minimum AWG 14 and coated) extend up above grade at both ends of run. Allow for 3rd party inspection prior to backfill.

.12 Relief valve piping shall terminate outdoors with clearances to openings, intakes, etc. in accordance with CSA B149.1

3.3 VALVES

.1 Install valves with stems upright or horizontal unless otherwise approved by Engineer.

.2 Install valves at all branch take-offs to isolate each piece of equipment, and as indicated.

.3 Vent reliefs at pressure regulating valves to outdoors and minimum 3 metres for intakes.

.4 All valves on exterior of building or where prone to vandalism, install lubricated plug type valve, regardless of size.

.5 Shut off valves shall be installed at each kitchen equipment (in addition to main kitchen shutoff) upstream of gas connector. Shut off valves should be visible, easily accessible and installed at eye level in accordance with Gas Code.

3.4 TESTING

.1 Test system in accordance with CSA B149.1 and CSA B149.2.

.2 On new natural gas service authority having jurisdiction shall conduct a field review of all new equipment appliance venting & piping systems and submit a certificate of acceptance from a Certified G-1 Gas Fitter.

3.5 PURGING

.1 Purge after pressure test in accordance with CSA B149.1 and CSA B149.2.

.2 Following testing, purge air from all natural gas lines to all new and existing equipment including boilers, water heaters, rooftop units, etc. Start-up all new and existing equipment to ensure operational.

3.6 PRE-START-UP INSPECTIONS

.1 Check vents from regulators, control valves, terminate outside building in approved location, protected against blockage, damage.

.2 Check gas trains, entire installation is approved by authority having jurisdiction.

3.7 CLEANING AND START-UP

.1 In accordance with requirements of CSA B149.1 & CSA B149.2.

END OF SECTION

COPPER PIPING AND FITTINGS - HYDRONIC SYSTEMS

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

1.2 REFERENCES

.1 American Society of Mechanical Engineers (ASME)

.1 ASME B16.15-2024, Cast Bronze Threaded Fittings: Classes 125 and 250.

.2 ASME B16.18-2021, Cast Copper Alloy, Solder Joint Pressure Fittings.

.3 ASME B16.22-2021, Wrought Copper and Copper-Alloy Solder Joint Pressure Fittings.

.2 American Society for Testing and Materials (ASTM)

.1 ASTM B32-20, Specification for Solder Metal.

.2 ASTM B88M-20, Specification for Seamless Copper Water Tube Metric.

.3 ASTM E202-24, Test Methods for Analysis of Ethylene Glycols and Propylene Glycols.

.3 American Welding Society (AWS)

.1 AWS A5.8/A5.8M, Specification Filler Metals for Brazing and Bronze Welding.

1.3 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 20 05 01 - Mechanical General Requirements.

1.4 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into manual specified in Section 20 05 01 - Mechanical General Requirements.

PART 2 PRODUCTS

2.1 PIPING

.1 Type L hard drawn copper: to ASTM B88M.

2.2 FITTINGS

.1 Cast bronze threaded fittings: to ASME B16.15.

.2 Wrought copper and copper alloy solder joints pressure fittings: to ASME B16.22.

.3 Cast copper alloy solder joint pressure fittings: to ASME B16.18.

2.3 DI-ELECTRIC COUPLINGS

.1 Provide wherever pipes of dissimilar metals are jointed.

.2 For pipe sizes 2 NPS and under, provide di-electric unions or couplings.

2.4 JOINTS

.1 Solder, tin-antimony, 95:5: to ASTM B32.

.2 Silver solder BCUP: to AWS A5.8.

.3 Brazing: as indicated.

.4 Application: All closed loop hydronic systems; refer to Section 23 21 13.02 - Steel Piping and Fittings - Hydronic Systems.

2.5 VALVES

.1 Refer to Section 23 05 23 - Valves.

PART 3 EXECUTION

3.1 PIPING INSTALLATION

.1 Connect to equipment in accordance with manufacturer's instruction unless otherwise indicated.

.2 Install concealed pipes close to building structure to keep furring space to minimum. Install to conserve headroom and space. Run exposed piping parallel to walls. Group piping wherever practical.

.3 Slope piping in direction of drainage and for positive venting.

.4 Use eccentric reducers at pipe size change installed to provide positive drainage or positive venting.

.5 Provide clearance for installation of insulation and access for maintenance of equipment, valves and fittings.

.6 Ream pipes, clean scale and dirt, inside and outside, before and after assembly.

.7 Assemble piping using fittings manufactured to ASME standards.

.8 Saddle type branch fittings may be used on mains if branch line is no larger than half the size of main. Hole saw or drill and ream main to maintain full inside diameter of branch line prior to welding saddle.

3.2 TESTING

.1 Test system in accordance with Section 23 05 05 - Installation of Pipework.

.2 For glycol systems, retest with specified quality of glycol after cleaning. Repair any leaking joints, fittings or valves.

3.3 BALANCING

.1 Install flow measuring stations and flow balancing valves as indicated.

.2 Refer to Section 23 05 93 - Testing Adjusting and Balancing (TAB) of Mechanical Systems for applicable procedures.

3.4 GLYCOL CHARGING

.1 Provide mixing tank and positive displacement pump for glycol charging.

.2 Retest for concentration to ASTM E202 after cleaning.

.3 Provide report to Engineer.

END OF SECTION

STEEL PIPING AND FITTINGS - HYDRONIC SYSTEMS

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

1.2 REFERENCES

.1 American Society of Mechanical Engineers (ASME).

.1 ASME B16.1-2020, Gray Iron Pipe Flanges and Flanged Fittings, Class 25, 125 and 250.

.2 ASME B16.3-2021, Malleable-Iron Threaded Fittings, Classes 150 and 300.

.3 ASME B16.5-2020, Pipe Flanges and Flanged Fittings, NPS ½ through NPS 24, Metric/Inch.

.4 ASME B16.9-2024, Factory-Made Wrought Steel Buttwelding Fittings.

.5 ASME B18.2.1-2012 (R2021), Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series).

.6 ASME B18.2.2-2022, Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange and Coupling Nuts (Inch Series).

.2 American Society for Testing and Materials (ASTM).

.1 ASTM A47/A47M-99(2022)e1, Specification for Ferritic Malleable Iron Castings.

.2 ASTM A53/A53M-24, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless.

.3 American Water Works Association (AWWA)

.1 AWWA C111/A21.11-23, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

.4 Canadian Standards Association (CSA).

.1 CSA W47.1:19 (R2024), Certification of Companies for Fusion Welding of Steel.

1.3 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 20 05 01 - Mechanical General Requirements.

1.4 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 20 05 01 - Mechanical General Requirements.

PART 2 PRODUCTS

2.1 PIPE

.1 Steel pipe: to ASTM A 53/A 53M, Electric Resistance Welded (ERW) Grade B, non-seamless as follows:

.1 NPS 2½ to 10, Schedule 40.

.2 NPS 12 and over, standard schedule.

2.2 PIPE JOINTS

.1 Application: Hydronic water & glycol systems: NPS 2½ and over.

.1 NPS 2 and under: shall be copper - refer to Section 23 21 13.01 - Copper Piping and Fittings - Hydronic Systems.

.2 Heating and glycol systems: Grooved joints are not accepted.

.3 NPS 2½ to 4: Threaded, welded, flanged or grooved (except heating and glycol systems).

.4 NPS 6 and over: Welded, flanged or grooved (except heating and glycol systems).

.5 Welding fittings and flanges to CSA W47.1. Reference Section 23 05 17 - Pipe Welding.

.6 Flanges: raised face, weld neck.

.7 Flange gaskets: to AWWA C111/A21.11.

.8 Pipe thread: taper.

.9 Bolts and nuts: to ASME B18.2.1 and ASME B18.2.2.

2.3 DI-ELECTRIC COUPLINGS

.1 Provide wherever pipes of dissimilar metals are jointed.

.2 For pipe sizes 2 NPS and under, provide di-electric unions or couplings.

2.4 FITTINGS

.1 Screwed fittings: malleable iron, to ASME B16.3, Class 150.

.2 Pipe flanges and flanged fittings:

.1 Cast iron: to ASME B16.1, Class 125.

.2 Steel: to ASME B16.5.

.3 Butt-welding fittings: steel, to ASME B16.9.

.4 Unions: malleable iron, to ASTM A47/A47M and ASME B16.3.

2.5 VALVES

.1 Refer to Section 23 05 23 - Valves.

PART 3 EXECUTION

3.1 PIPING INSTALLATION

.1 In accordance with Section 23 05 05 - Installation of Pipework.

.2 For welding procedures, reference Section 23 05 17 - Pipe Welding.

3.2 TESTING

.1 Test system in accordance with Section 23 05 05 - Installation of Pipework.

3.3 BALANCING

.1 Refer to Section 23 05 93 - Testing Adjusting and Balancing for applicable procedures.

END OF SECTION

HYDRONIC SPECIALTIES

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

1.2 REFERENCES

.1 American Society of Mechanical Engineers (ASME).

.1 ASME BPVC.VIII.1-2023, 2023 ASME Boiler and Pressure Vessel Code Section VIII, Division 1 - Rules for Construction of Pressure Vessels.

.2 Canadian Standards Association (CSA)

.1 CSA C22.2 No. 68-18 (R2023), Motor-Operated Appliances (Household and Commercial).

1.3 PRODUCT DATA

.1 Submit product data in accordance with Section 20 05 01 - Mechanical General Requirements.

1.4 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 20 05 01 - Mechanical General Requirements.

1.5 CLOSEOUT SUBMITTALS

.1 Submit maintenance data in accordance with Section 20 05 01 - Mechanical General Requirements.

PART 2 PRODUCTS

2.1 EXPANSION TANKS

.1 Horizontal or vertical steel pressurized removable bladder and/or diaphragm type expansion tank as per schedule.

.2 Bladder in EPDM suitable for 115°C (240°F) operating temperature (water and glycol).

.3 Diaphragm sealed in elastomer EPDM suitable for 115°C operating temperature.

.4 Working pressure: 862 kPa (125 psi) with ASME stamp and certification including Canadian Registration Number (CRN).

.5 Air precharged to initial fill pressure of system as per schedule.

.6 Saddles for horizontal installation. Base mount for vertical installation.

.7 Supports: Provide supports with hold down bolts and installation templates incorporating seismic restraint systems.

.8 Capacity: as per schedule.

.9 Acceptable materials: Amtrol, Expanflex, Bell & Gossett, Armstrong.

2.2 AUTOMATIC AIR VENT

.1 System vents (hot water, glycol & chilled water):

.1 Industrial float vent: cast iron body and NPS ¾ connection and rated at 1034 kPa working pressure.

.2 Float: solid material suitable for 115°C working temperature.

.3 Acceptable materials: Spirax/Sarco Model 13WS.

.2 Coil Vents (all equipment headers & high points in system):

.1 Industrial float vent: brass alloy body and NPS ½ connection and rated at 1034 kPa working pressure.

.2 Float: stainless steel with viton rubber valve seal suitable for 115°C working temperature.

.3 Acceptable materials: Spirax/Sarco Model AE30.

2.3 WATER MAKE-UP COMBINATION LOW PRESSURE RELIEF AND REDUCING VALVE

.1 Adjustable pressure setting: to capacities as per schedule.

.2 Low inlet pressure check valve.

.3 Removable strainer.

.4 Working pressure: 1034 kPa.

2.4 IN-LINE AIR & DIRT SEPARATOR

.1 Full flow air eliminator for removal of air and microbubbles and separates dirt simultaneously, c/w manual bleed valve. Mild steel construction, with centre line inlet and outlet ports, copper wire woven mesh & copper tubes inside housing to fill unit entirely, integrated or separate venting mechanism on top, side valve for floating liquids and debris, and bottom flange c/w threaded blow-down. Maximum working pressure 1034 kPa (150 psi), maximum working temperature 132°C (270°F), maximum pressure drops 3 kPa (1 ft.) of water. Provide pipe reducers as required.

.2 Acceptable material: Spirotherm Spirovent Dirt Drain, Bell & Gossett CRS Series.

2.5 COMBINATION HYDRAULIC SEPARATOR & AIR/DIRT ELIMINATOR

.1 Furnish and install as shown on the drawings and schedule a full flow coalescing type combination air eliminator, dirt separator, hydraulic separator for the hot and chilled water systems. Selection shall be based upon system flows with pipe size as a minimum in accordance with the basis of design.

.2 Separator shall be fabricated steel, rated for 150 psig working pressure, stamped and registered in accordance with ASME BPVC.VIII.1 for unfired pressure vessels, and include three performance chambers within the vessel. One chamber above the higher nozzle set for air elimination, one below the lower nozzle set for dirt separation, and one between the nozzles for hydraulic separation. The vessel diameter, height above and below the nozzles, and distance between the nozzles must be equal to the basis of design.

.3 Unit shall include internal elements filling the entire vessel to suppress turbulence and provide air elimination efficiency of 100% free air, 100% entrained air, and 99.6% dissolved air at the installed location. Dirt separation efficiency shall be a minimum of 80% of all particles 30 micron and larger within 100 passes. The elements must consist of a copper core tube with continuous wound copper wire medium permanently attached and followed by a separate continuous wound copper wire permanently affixed.

.4 Each unit shall have a separate venting chamber to prevent system contaminants from harming the float and venting valve operation. At the top of the venting chamber shall be an integral full port float actuated brass venting mechanism.

.5 Provide removal head to facilitate internal element inspection or cleaning if required. Elements shall include tube sheets top and bottom and be manufactured as a bundle for ease of removal. Verify space required for bundle removal.

.6 Acceptable material: Spirovent Quad® Series VDX VXN for removable head as manufactured by Spirotherm, Inc.

2.6 FLOW MEASURING DEVICE (FMD)

.1 Provide FMD to measure heating and chilled water loop flow.

.2 Design & Construction:

.1 Devices shall be Venturi type. Devices shall have a precision formed throat and have a stated catalogue accuracy of 3% of full scale. The induced differential readings (flow signal) shall be greater than two feet water column at the design flow with the valve in the wide-open position. The permanent pressure loss at the design flow shall not exceed two feet of water in the wide-open position. The valves are to have differential readout ports fitted with a check valve and protective cap and are to have a memory stop to allow complete shut-off and return to set position without losing the set point.

.2 All valves shall be factory leak tested at 100 psi air under water.

.3 Devices with sweat or NPT connections ½" to 2" 400 psig at 250°F. Devices with flanged connections 2" to 14" 240 psig at 250°F.

.3 Installation:

.1 The straight pipe required to achieve 3% F.S. accuracy shall be incorporated as an internal part of the ½" to 2" Venturi and valve assembly. Five pipe diameters of straight pipe are required from a control valve for sizes 2 12" to 14" Venturis.

.4 Acceptable material: IMI Hydronic Engineering Flowset Model VF.

2.7 PIPELINE STRAINER

.1 NPS ½ to 2: threaded connections:

.1 Wye-pattern, lead-free cast iron body.

.2 Screen: 304 stainless steel #20 mesh.

.3 Maximum working pressure: 2.75 MPa (400 psi) at 66°C (15°F) and 1.70 MPa (250 psi) at 208°C (406°F).

.4 Tapped retainer cap.

.2 NPS ½ to 2: solder connections:

.1 Wye-pattern, lead-free cast iron Silicon alloy body and cap.

.2 Screen: 304 stainless steel #20 mesh.

.3 Maximum working pressure: 2.75 MPa (400 psi) at 99°C (210°F) and 0.85 MPa (125 psi) at 178°C (353°F.)

.4 Tapped retainer cap and closure plug.

.3 NPS 2½ to 12: class 125, flanged connections:

.1 Wye-pattern, lead-free cast iron body.

.2 Screen: stainless steel with perforations between 5 mm and 6 mm.

.3 Maximum working pressure: 1.4 MPa (200 psi) at 99°C (210°F) and 0.85 MPa (125 psi) at 178°C (353°F).

.4 Cast iron flange retainer cap with gasket tapped for closure plug.

.5 Drain/blow-off connection furnished with closure plug.

.4 Acceptable material: Crane, Watts, Victaulic, Kitz, Jenkins, Toyo, Conbraco.

2.8 GLYCOL MAKE-UP PACKAGE (GMU) FOR SMALL SYSTEMS

.1 The contractor shall supply and install, as indicated on the plans and in the specifications, a prefabricated, automatic and autonomous make-up package for the glycol system.

.2 The package shall be wall mounted to operate on a standard 120 V, 15 Amp, 60 Hz electrical circuit, and to maintain a fill pressure in the glycol systems as indicated.

.3 It shall feature a cut-off and alarm arrangement which will stop the pump in case of excessive pressure, or a low solution level, and activate dry contact alarm

.4 A translucent 25L (6 USgal) polyethylene solution container, complete with lid, shall be mounted on the pumping assembly and shall include a strainer and a shut off valve. Built-in glycol solution recovery line shall be piped in from the system relief valve outlet to the solution container, through its lid in such a way that the lid can be removed for filling and mixing.

.5 The assembly shall be mounted in a sturdy steel wall bracket. It shall include a 0.04 L/s (0.7 USGPM) at free flow pump, 120 V to 24 VDC 50W AC motor, a magnetic starter, a pressure tank with a pressure control, a priming valve, a PRV, a shut-off valve and a pressure gauge. It shall be connected to the system with a 6 mm (¼") NPT connection.

.6 Acceptable material: Axiom MF 200 with SMW003 wall bracket & RIA10-1 low level alarm panel & remote contacts.

2.9 GLYCOL MAKE-UP PACKAGE (GMU) FOR LARGE SYSTEMS

.1 The contractor shall supply and install, as indicated on the plans and in the specifications, a prefabricated, automatic and autonomous make-up package for the glycol system.

.2 System shall include 208 litre (55 US gallon) storage/mixing tank with cover; pump suction hose with inlet strainer; pressure pump with thermal cut-out; integral pressure switch; integral check valve; cord and plug; manual diverter valve for purging air and agitating contents of storage tank; pressure regulating valve adjustable (35 -380 kPa; 5 - 55 psig) complete with pressure gauge; union connection; 12 mm (½") x 900 mm (36") long flexible connection hose; low level pump cut-out; low level alarm panel c/w remote monitoring dry contacts and selectable audible alarm. Pressure pump shall be capable of running dry without damage. Power supply 115/60/1 0.7 A. Unit shall be completely pre-assembled and certified by a recognized testing agency to CSA C22.2 No. 68. Pump performance: 0.06 L/s (1.0 gpm) @ 345 kPa (50 psig). Self priming up to 2.1 m (7 ft.).

.3 A 25 mm (1") Ø glycol solution recovery line shall be piped in from the system relief valve outlet to the solution container, through its lid in such a way that the lid can be removed for filling and mixing.

.4 Acceptable material: Axiom SF100.

2.10 ETHYLENE PROPYLENE GLYCOL

.1 Provide pre-mixed ethylene propylene glycol in 45% concentration by weight as specified in schedules on drawings for glycol heating cooling system. Acceptable material: Dowfrost or equal.

PART 3 EXECUTION

3.1 GENERAL

.1 Install as indicated and to manufacturer's recommendations.

.2 Run drain lines and blow off connections to terminate above nearest drain.

.3 Maintain proper clearance to permit service and maintenance.

.4 Should deviations beyond allowable clearances arise, request and follow Engineer's directive.

.5 Check shop drawings for conformance of all tappings for ancillaries and for equipment operating weights.

.6 During filling of hydronic systems or equipment, vent systems & equipment properly to remove air prior to opening equipment piping to overall system. Air propagating to system, will be the responsibility of contractor to remove.

3.2 STRAINERS

.1 Install in horizontal or down flow lines.

.2 Ensure clearance for removal of basket.

.3 Install ahead of each pump.

.4 Install ahead of each automatic control valve larger than NPS 1 and radiation except at radiation and as indicated.

3.3 AUTOMATIC AIR VENTS

.1 Install automatic air vents at high points of piping systems.

.2 Install full port ball at each automatic air vent.

.3 Air vents must have minimum connection of 13 mm (½").

3.4 EXPANSION TANKS

.1 Adjust expansion tank pressure to suit design criteria.

.2 Provide isolation valve on water inlet and drain valve between isolation valve and tank.

.3 Install tee connection at air inlet to tank c/w pressure gauge and isolation valves for pressure gauge and fill connection.

.4 Charge tank with nitrogen to required minimum operating pressure.

3.5 PRESSURE SAFETY RELIEF VALVES

.1 Water run discharge pipe to terminate above nearest drain.

.2 Glycol run discharge pipe to terminate at glycol tank.

END OF SECTION

PUMPS - HYDRONIC SYSTEMS

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 20 05 01 - Mechanical General Requirements.

.2 Submit manufacturer's detailed composite wiring diagrams for control systems showing factory installed wiring and equipment on packaged equipment or required for controlling devices or ancillaries, accessories and controllers.

.3 Submit product data of pump curves for review showing points of operation.

.4 Indicate piping, valves and fittings shipped loose by packaged equipment supplier, showing their final location in field assembly.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 20 05 01 - Mechanical General Requirements.

1.4 MOTORS

.1 Provide motors in accordance with Section 20 05 01 - Mechanical General Requirements, and hereafter.

PART 2 PRODUCTS

2.1 VERTICAL IN-LINE CIRCULATORS

.1 Casing: volute cast iron closed-coupled up to 3.73 kW (5 HP), split coupled 5.6 kW (7.5 HP) & above with tapped openings for venting, draining and gauge connections, flanged suction and discharge connections. Casing radially splits to allow removal of rotating element without disturbing the pipe connections. Casing shall be ductile iron for pressure to 2585 kPa (375 psi) at 65.5°C (150°F).

.2 Impeller: brass or bronze, fully enclosed type and secured to pump shaft with stainless steel hardware. Impeller to be dynamically balanced.

.3 Shaft: stainless steel with bronze sleeve bearing integral thrust collar.

.4 Coupling: rigid high tensile aluminum alloy spacer.

.5 Seals shall be stainless steel outside multi-spring balanced type with Viton secondary seal; on all heating water or glycol heating solutions, seal shall be

Tungsten Carbide, seat gasket, stainless steel spring & hardware. Seal vent line shall be factory installed and piped from seal area to the pump suction connection.

.6 Motor:

.1 High efficiency motor to Section 23 05 13 - Motors, Drives and Guards for Mechanical Systems.

.2 Motor power requirements shown on the pump schedule are the minimum acceptable and have been sized for continuous operation without exceeding the full load nameplate rating over the entire pump curve, exclusive of service factor.

.7 Discharge Spool Section: Cast iron or steel flanged spool section sized to pump discharge outlet, factory painted and suitable for pump working pressure.

.8 Provide seismic rated floor mounting brackets, secured to pump flanges.

.9 Pressure: suitable for 1205 kPa (175 psi) working pressure up to 65.5°C (150°F). Hydro statically tested to 15% maximum working pressure.

.10 Capacity: Refer to schedule on drawing.

.11 Acceptable material: ITT Bell & Gossett, Armstrong, Taco.

2.2 END SUCTION DIFFUSER

.1 Body: Cast or ductile iron.

.2 Guide Vanes: Cast or ductile iron.

.3 Strainer: Stainless steel, 3 mm perf.

.4 Start-up Strainer: Fine mesh galvanized steel.

.5 Pressure & temperature rating to match that of associated pump.

.6 Flanged connections.

.7 Supplied by pump manufacturer, as indicated on pump schedule.

PART 3 EXECUTION

3.1 INSTALLATION

.1 In line circulators: install as indicated by flow arrows. Support at inlet and outlet flanges or unions. Install with bearing lubrication points accessible. Install motor in orientation as recommended by manufacturer.

.2 Ensure that pump body does not support piping or equipment. Provide stanchions or hangers for this purpose. Refer to manufacturer's installation instructions for details.

.3 Check rotation prior to start-up.

.4 Install ball valves on pump suction & discharge tap-ins for pressure gauge.

.5 All pumps to be installed in accordance with Hydraulic Institute Standards.

.6 Provide flexible connectors on suction and discharge of all pumps with exception of in-line circulators.

.7 On vertical in-line pumps, where specified, replace flush line filter following commissioning & startup.

3.2 START-UP

.1 General

.1 In accordance with manufacturer's recommendations & Hydraulic Institute Standards.

.2 Procedures:

.1 Before starting pump, check that over-temperature and other protective devices are installed and operative.

.2 After starting pump, check for proper, safe operation.

.3 Check installation, operation of mechanical seals. Adjust as necessary.

.4 Check base for free-floating, no obstructions under base.

.5 Run-in pumps for 12 continuous hours.

.6 Verify operation of over-temperature and other protective devices under low- and no-flow condition.

.7 Eliminate air from scroll casing.

.8 Adjust water flow rate through water-cooled bearings.

.9 Adjust flow rate from pump shaft stuffing boxes to manufacturer's recommendation.

.10 Adjust alignment of piping and conduit to ensure true flexibility at all times.

.11 Eliminate cavitation, flashing and air entrainment.

.12 Adjust pump shaft seals, stuffing boxes, glands.

.13 Measure pressure drop across strainer when clean and with flow rates as finally set.

.14 Replace seals if pump used to degrease system or if pump used for temporary heat.

.15 Verify lubricating oil levels.

.16 Remove end suction diffuser start-up strainers after one week of pump operation.

3.3 PERFORMANCE VERIFICATION (PV)

.1 General

.1 In accordance with manufacturer's recommendations.

.2 Exclusions:

.1 Performance verification does not apply to small in-line circulators.

.3 Assumptions: These PV procedures assume that:

.1 Manufacturer's performance curves are accurate.

.2 Valves on pump suction and discharge provide tight shut-off.

.4 Net Positive Suction Head (NPSH):

.1 Application: Measure NPSH for pumps which operate on open systems and with water at elevated temperatures.

.2 Measure using procedures prescribed in the Standard.

.3 Where procedures do not exist, discontinue PV, report to Engineer and await instructions.

END OF SECTION

DUCTWORK LOW PRESSURE - METALLIC TO 500 PA

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CSA B228.1-1968, Pipe, Ducts and Fittings for Residential Type Air Conditioning Systems.

.2 National Fire Protection Association (NFPA)

.1 NFPA (Fire) 90A, Installation of Air Conditioning and Ventilating Systems, 2024 Edition.

.2 NFPA (Fire) 90B, Installation of Warm Air Heating and Air Conditioning Systems, 2024 Edition.

.3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

.1 SMACNA 016-2012, HVAC Air Duct Leakage Test Manual, 2nd Edition.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 20 05 01 - Mechanical General Requirements.

.2 Indicate following:

.1 Sealants

.2 Tape

.3 Proprietary Joints

1.4 CERTIFICATION OF RATINGS

.1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

PART 2 PRODUCTS

2.1 SEAL CLASSIFICATION

.1 Classification as follows:

Maximum System Total Pressure Pa	SMACNA Seal Class
500	A

Maximum System Total Pressure Pa	SMACNA Seal Class
250	A
125	A

.2 Seal classification:

.1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant.

.3 Application:

.1 All new & existing supply ductwork.

.2 All new return & exhaust ductwork.

2.2 SEALANT

.1 Sealant: Indoor/outdoor water-based duct sealant c/w UV inhibitors. Flame spread rating of 0. Smoke developed rating of 0. Temperature range of -20°F to +200°F.

.1 Acceptable material: Carlisle Hardcast CCWI-181, or equal.

2.3 DUCT LEAKAGE

.1 In accordance with SMACNA 016.

2.4 FITTINGS

.1 Fabrication: to SMACNA.

.2 Radiused elbows:

.1 Rectangular: standard radius: 1.5 times width of duct.

.2 Round: 1.5 times diameter.

.3 Mitred elbows, rectangular:

.1 To 400 mm (16"): with single thickness turning vanes.

.2 Over 400 mm (16"): with double thickness turning vanes.

.4 Branches:

.1 Rectangular main and branch: with 45° entry on branch.

.2 Round main and branch: enter main duct at 45° with conical connection.

.3 Provide volume control damper in branch duct near connection to main duct.

.5 Transitions:

.1 Diverging: 20° maximum included angle.

.2 Converging: 30° maximum included angle.

.6 Offsets:

.1 Full radiused elbows.

.7 Obstruction deflectors: maintain full cross-sectional area. Maximum included angles: as for transitions.

2.5 FIRESTOPPING

.1 Retaining angles all around duct, on both sides of fire separation.

.2 Firestopping material and installation must not distort duct.

2.6 ALUMINUM DUCTWORK EXHAUST

.1 Material: Aluminum type: 3003-H-14. Thickness, fabrication and reinforcement: to ASHRAE & SMACNA. Joints: to ASHRAE & SMACNA.

2.7 HANGERS AND SUPPORTS

.1 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct. Maximum size duct supported by strap hanger: 500 mm (20").

.2 Hanger configuration: to SMACNA.

.3 Hangers: stainless steel angle with black steel rods to SMACNA and following table:

Duct Size (in).	Angle Size (in).	Rod Size (in).
up to 30	1 x 1 x 1/8	¼
31 to 42	1½ x 1½ x 1/8	¼
43 to 60	1½ x 1½ x 1/8	05-Feb
61 to 84	2 x 2 x 1/8	05-Feb
85 to 96	2 x 2 x 1/5	05-Feb
97 and over	2 x 2 x ¼	05-Feb

.4 Upper hanger attachments:

.1 For concrete: manufactured concrete inserts.

.2 For steel joist: manufactured joist clamp or steel plate washer.

.3 For steel beams: manufactured beam clamps.

PART 3 EXECUTION

3.1 GENERAL

.1 Do work in accordance with NFPA (Fire) 90A, NFPA (Fire) 90B, CSA B228.1 and SMACNA.

.2 Do not break continuity of insulation vapour barrier with hangers or rods. Insulate strap hangers 100 mm (4") beyond insulated duct.

.3 Support risers in accordance with ASHRAE and SMACNA.

.4 Install breakaway joints in ductwork on each side of fire separation.

.5 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.

.6 Manufacture duct in lengths to accommodate installation of acoustic duct lining.

.7 Install escutcheon sheet metal angles on both sides of exposed rectangular or round ducts on both sides of non-rated partitions. Seal void with acoustic sealant.

3.2 HANGERS

.1 Strap hangers: install in accordance with SMACNA.

.2 Angle hangers: complete with locking nuts and washers.

.3 Hanger spacing: in accordance with SMACNA as follows:

Duct Size mm (in.)	Spacing m (ft.)
to 1500 (60)	3 (10)
1525 (61) and over	2.5 (8)

3.3 SEALING

.1 Apply sealant to outside of joint to manufacturer's recommendations.

3.4 LEAKAGE TESTS

.1 In accordance with SMACNA 016.

.2 Do leakage tests for supply duct; maximum leakage rate 1% at 1½ times operating static pressure.

.3 Make trial leakage tests as instructed to demonstrate workmanship.

.4 Install no additional ductwork until trial test has been passed.

.5 Test section minimum of 100 ft. long with not less then 3 branch takeoffs and two 90° elbows.

.6 Complete test before insulation or concealment.

END OF SECTION

DUCT ACCESSORIES

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CSA B228.1-1968, Pipe, Ducts and Fittings for Residential Type Air Conditioning Systems.

.2 Sheet Metal and Air Conditioning Contractors' National Association (SMACA)

1.3 PRODUCT DATA

.1 Submit product data in accordance with Section 20 05 01 - Mechanical General Requirements.

.2 Indicate the following:

.1 Flexible connections.

.2 Duct access doors.

.3 Instrument test ports.

1.4 CERTIFICATION OF RATINGS

.1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

PART 2 PRODUCTS

2.1 GENERAL

.1 Manufacture in accordance with CSA B228.1.

2.2 FLEXIBLE CONNECTIONS

.1 Frame: galvanized sheet metal frame 0.6 mm thick with fabric clenched by means of double locked seams.

.2 Material:

.1 Fire resistant, self extinguishing, neoprene coated glass fabric, temperature rated at -40°C to +90°C, density of 1.3 kg/m².

2.3 ACCESS DOORS IN DUCTS

.1 Non-insulated ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame.

.2 Insulated ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame and 25 mm thick rigid glass fibre insulation.

.3 Gaskets: neoprene.

.4 Hardware:

.1 Up to 300 x 300 mm: 2 sash locks complete with safety chain.

.2 301 to 450 mm: 4 sash locks complete with safety chain.

.3 451 to 1000 mm: piano hinge and minimum 2 sash locks.

.4 Doors over 1000 mm: piano hinge and 2 handles operable from both sides.

.5 Hold open devices.

2.4 INSTRUMENT TEST PORTS

.1 1.6 mm thick steel zinc plated after manufacture.

.2 Cam lock handles with neoprene expansion plug and handle chain.

.3 28 mm minimum inside diameter. Length to suit insulation thickness.

.4 Neoprene mounting gasket.

.5 Acceptable material: Duro Dyne IP1 or IP2.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Flexible connections:

.1 Install in following locations:

.1 Inlets and outlets to supply air units and fans.

.2 Inlets and outlets of exhaust and return air fans.

.3 As indicated.

.2 Length of connection: 100 mm.

.3 Minimum distance between metal parts when system in operation: 75 mm.

.4 Install in accordance with recommendations of SMACNA.

.5 When fan is running:

.1 Ducting on each side of flexible connection to be in alignment.

.2 Ensure slack material in flexible connection.

.2 Access doors and viewing panels:

.1 Size:

.1 450 x 450 mm for person size entry.

.2 450 x 450 mm for servicing entry.

.3 300 x 300 mm for viewing.

.4 As indicated.

.2 Location:

.1 At fire and smoke dampers.

.2 At control dampers.

.3 At devices requiring maintenance.

.4 At locations required by code.

.5 At reheat coils.

.6 Elsewhere as indicated.

.3 Instrument test ports.

.1 General:

.1 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.

.2 Locate to permit easy manipulation of instruments.

.3 Install insulation port extensions as required.

.4 Locations.

.1 For traverse readings:

.1 At ducted inlets to roof and wall exhausters.

.2 At inlets and outlets of other fan systems.

.3 At main and sub-main ducts.

.4 And as indicated.

.2 For temperature readings:

.1 At outside air intakes.

.2 In mixed air applications in locations as approved by Engineer.

.3 At inlet and outlet of coils.

.4 Downstream of junctions of two converging air streams of different temperatures.

.5 And as indicated.

END OF SECTION

DAMPERS - BALANCING

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

1.2 REFERENCES

.1 Sheet Metal and Air Conditioning Contractors' National Association (SMACA)

.1 SMACNA 1966-2020, HVAC Duct Construction Standards - Metal and Flexible, 4th Edition.

1.3 PRODUCT DATA

.1 Submit product data in accordance with Section 20 05 01 - Mechanical General Requirements.

PART 2 PRODUCTS

2.1 GENERAL

.1 Manufacture to SMACNA standards.

2.2 SINGLE BLADE DAMPERS

.1 Of same material as duct, but one sheet metal thickness heavier. V-groove stiffened.

.2 Size and configuration to recommendations of SMACNA, except maximum height 100 mm (4").

.3 For rectangular ducts adjustable lever with shaft extension to accommodate insulation thickness.

.4 For round branch ducts adjustable lever with shaft extension to accommodate insulation thickness.

.5 Inside and outside nylon end bearings.

.6 Channel frame of same material as adjacent duct, complete with angle stop.

2.3 MULTI-BLADED DAMPERS

.1 Factory manufactured of material compatible with duct.

.2 Opposed blade: configuration, metal thickness and construction to recommendations of SMACNA.

.3 Maximum blade height: 100 mm (4").

.4 Bearings: self-lubricating nylon.

.5 Linkage: shaft extension with locking quadrant.

.6 Channel frame of same material as adjacent duct, complete with angle stop.

.7 Maximum leakage: 0.07% at 750 Pa.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install where indicated.

.2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.

.3 For supply, return and exhaust systems, locate balancing dampers in each branch duct.

.4 Runouts to registers and diffusers: install single blade damper located as close as possible to main ducts.

.5 All dampers to be vibration free.

.6 Ensure damper operators are observable and accessible.

END OF SECTION

DAMPERS - OPERATING

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

1.2 PRODUCT DATA

.1 Submit product data in accordance with Section 20 05 01 - Mechanical General Requirements.

.2 Indicate the following:

.1 Performance data.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 20 05 01 - Mechanical General Requirements.

1.4 CERTIFICATION OF RATINGS

.1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURER

.1 Tamco, Nailor, Ruskin, Ventex/Alumavent, Greenheck, E.H. Price.

2.2 MULTI-LEAF DAMPERS

.1 Parallel blade type as indicated.

.2 Extruded aluminum, interlocking blades, complete with extruded vinyl seals, spring stainless steel side seals, extruded aluminum frame.

.3 Pressure fit self-lubricated bronze bearings.

.4 Linkage: plated steel tie rods, brass pivots and plated steel brackets, complete with plated steel control rod.

.5 Control Damper Operators:

.1 Electronic:

.1 Push-pull proportional type as indicated.

.2 Spring return for "fail-safe" in 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: as required for application.

.5 Operating range: 0 - 20 V DC.

.6 Acceptable material: Belimo.

.6 Performance:

.1 Leakage Class: 1A.

.2 Pressure drop: at full open position to be less than 4 Pa differential across damper at 5 m/s.

.7 Acceptable material:

.1 Exhaust & Intake: Tamco 9000, Ventex.

.2 Return: Tamco 1000, Ventex.

2.3 BACK DRAFT DAMPERS

.1 Automatic gravity operated, multi leaf, aluminum construction with nylon bearings, spring assisted.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install where indicated, and when supplied by others.

.2 Install in accordance with recommendations of SMACNA and manufacturer's instructions.

.3 Seal multiple damper modules with silicon sealant.

.4 Ensure dampers are observable and accessible.

END OF SECTION

DAMPERS - FIRE

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

1.2 REFERENCES

.1 National Fire Protection Association (NFPA)

.1 NFPA (Fire) 90A, Installation of Air Conditioning and Ventilating Systems, 2024 Edition.

.2 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S112:2010-R2021, Standard Test Method of Fire Test of Fire-Damper Assemblies.

1.3 PRODUCT DATA

.1 Submit product data in accordance with Section 20 05 01 - Mechanical General Requirements.

.2 Indicate the following:

.1 Fire dampers.

.2 Fire stop flaps.

.3 Operators.

.4 Fusible links.

1.4 MAINTENANCE MATERIALS

.1 Provide maintenance materials in accordance with Section 20 05 01 - Mechanical General Requirements.

1.5 CERTIFICATION OF RATINGS

.1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards.

PART 2 PRODUCTS

2.1 FIRE DAMPERS

.1 Fire dampers: arrangement Type B or C, listed and bear label of ULC, meet requirements of NFPA (Fire) 90A authorities having jurisdiction. Fire damper assemblies to be fire tested in accordance with CAN-ULC-S112.

.2 Mild steel, factory fabricated for fire rating requirement to maintain integrity of fire wall and/or fire separation.

.3 Top hinged: offset single damper, round or square; interlocking type; sized to maintain full duct cross section as indicated.

.4 Fusible link actuated having negator-spring- closing operator.

.5 Fusible link actuated, weighted to close and lock in closed position when released.

.6 40 x 40 x 3 mm retaining angle iron frame, on full perimeter of fire damper, on both sides of fire separation being pierced. Install as per manufacturer's installation instructions.

.7 Rating: 1½ hr.

.8 Acceptable material: NCA, Nailor, United Enertech, Ruskin, Ventex/Alumavent, Greenheck, E.H. Price.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install in accordance with NFPA (Fire) 90A and in accordance with conditions of ULC listing.

.2 Maintain integrity of fire separation.

.3 After completion and prior to concealment obtain approvals of complete installation from authority having jurisdiction.

.4 Install access door adjacent to each damper. See Section 23 33 00 - Duct Accessories.

.5 Provide sealing and fire stopping of sleeve at smoke dampers only and in accordance with manufacturer's installation instruction.

.6 Ensure access door/panels, fusible links, and/or damper operators are easily observed and accessible.

.7 Assist with integrated system testing and commissioning of fire and smoke dampers with Div. 26 and authority have jurisdiction. See Specification Section 01 91 25 - Integrated Systems Testing.

END OF SECTION

COMMERCIAL FANS

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

1.2 REFERENCES

.1 Air Movement and Control Association (AMCA)

.1 AMCA 99-16, Standards Handbook.

.2 ANSI/AMCA 210-16, Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating.

.3 ANSI/AMCA 300-24, Reverberant Room Method for Sound Testing of Fans.

.4 ANSI/AMCA 301-22, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

.2 American Bearing Manufacturers Association (ABMA)

.1 ABMA 9:2015 (R2020), Load Ratings and Fatigue Life for Ball Bearings.

.2 ABMA 11:2014 (R2020), Load Ratings and Fatigue Life for Roller Bearings.

.3 American Society of Heating, Refrigeration and Air-Conditioning (ASHRAE)

.1 ASHRAE/AMCA 51-2016, Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating.

.4 Canadian Standards Association (CSA).

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 20 05 01 - Mechanical General Requirements.

.2 Provide:

.1 Fan performance curves showing point of operation, kW (BHP) and efficiency.

.2 Sound rating data at point of operation.

1.4 OPERATION AND MAINTENANCE DATA

.1 Provide operation and maintenance data for incorporation into manual specified in Section 20 05 01 - Mechanical General Requirements.

.2 Furnish list of individual manufacturer's recommended spare parts for equipment such as bearings and seals, and addresses of suppliers, together with list of

specialized tools necessary for adjusting, repairing or replacing, for placement into operating manual.

1.5 MAINTENANCE MATERIALS

.1 Provide maintenance materials in accordance with Section 20 05 01 - Mechanical General Requirements.

1.6 CERTIFICATION OF RATINGS

.1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered from independent testing agency signifying adherence to codes and standards in force.

.2 Provide confirmation of testing.

PART 2 PRODUCTS

2.1 FANS GENERAL

.1 Capacity: flow rate, total static pressure, bhp, efficiency, revolutions per minute, power, model, size, sound power data and as indicated on schedule.

.2 Statically and dynamically balanced. Constructed in conformity with AMCA 99.

.3 Sound ratings: comply with ANSI/AMCA 301, tested to ANSI/AMCA 300. Unit shall bear AMCA certified sound rating seal.

.4 Performance ratings: based on tests performed in accordance with ANSI/AMCA 210, and ASHRAE 51, unit to bear AMCA certified rating seal.

.5 Performance ratings: based on tests performed in accordance with ANSI/AMCA 210, and ASHRAE 51. Unit shall bear AMCA certified rating seal, except for propeller fans smaller than 300 mm diameter.

.6 Bearings: sealed lifetime oilite ball bearings heavy duty grease lubricated ball or roller bearings of self aligning type with oil retaining dust excluding seals and a certified minimum rated life of 200,000 h in accordance with ABMA L50 life standard. Bearings to be rated and selected in accordance with ABMA 9 and ABMA 11.

.7 Motors:

.1 In accordance with Section 23 05 13 - Motors, Drives and Guards for Mechanical Systems as specified supplemented herein.

.2 For use with variable speed controllers where applicable.

.3 Sizes as indicated.

.4 Two speeds with two windings and speeds where applicable.

.5 Two speeds with split winding, where applicable.

.8 Accessories and hardware: matched sets of V-belt drives, adjustable slide rail motor bases, belt guards, coupling guards fan inlet and/or outlet safety screens as

indicated and as specified in Section 23 05 13 - Motors, Drives and Guards for Mechanical Systems.

.9 Factory primed before assembly in colour standard to manufacturer.

.10 Scroll casing drains: as indicated.

.11 Bearing lubrication systems plus extension lubrication tubes where bearings are not easily accessible.

.12 Vibration isolation: to Section 23 05 48 - Vibration Isolation and Seismic Control.

.13 Flexible connections: to Section 23 33 00 - Duct Accessories.

2.2 UPBLAST ROOF EXHAUSTER

.1 Spun aluminum, upblast exhaust fans shall be belt drive or direct type as per equipment schedule. The fan wheel shall be centrifugal backward inclined, constructed of aluminum and shall include a wheel cone carefully matched to the inlet cone for precise running tolerances. Wheels shall be statically and dynamically balanced. The fan housing shall be constructed of heavy gauge aluminum with a rigid internal support structure and a birdscreen.

.2 Motors shall be heavy duty ball bearing type, carefully matched to the fan load, and furnished at the specified voltage, phase and enclosure. Drive frame assembly shall be constructed of heavy gauge steel. Motors and drives shall be mounted on vibration isolators, out of the airstream. Fresh air for motor cooling shall be drawn into the motor compartment through a large space between the fan shroud and the motor cover. Motors and drives shall be readily accessible for maintenance.

.3 Precision ground a polished fan shafts shall be mounted in permanently sealed, lubricated pillow block ball bearings. Drives shall be sized for a minimum of 150% of driven horsepower. Pulleys shall be of the cast type, keyed and securely attached to the wheel and motor shafts.

.4 Motor pulleys shall be adjustable for final system balancing. A conduit chase shall be provided through the base to the motor compartment for ease of electrical wiring.

.5 All fans shall come with prefabricated insulated roof curb and backdraft damper.

.6 All fans shall bear the AMCA Certified Ratings Seal for sound and air performance.

.7 Each fan shall bear a permanently affixed manufacturer's engraved metal nameplate containing the model number and individual serial number for future identification.

.8 Performance: as indicated on drawing schedule.

.9 Acceptable material: Greenheck, PennBarry, Loren Cook, Twin City Fan, Soler & Palau.

2.3 CABINET FANS DIRECT DRIVE

.1 Fan shall have true centrifugal wheel (or wheels).

.2 Fans shall have acoustically insulated housings c/w eggcrate type inlet grille and shall have air deliveries and Sone levels as indicated. All fans shall bear the AMCA Certified Ratings Seal and the UL label. Manufacturer shall submit vibration amplitudes and magnetic motor hum levels in decibels.

.3 Integral backdraft damper shall be totally chatter-proof with no metal-to-metal contact.

.4 Entire fan, motor, and wheel assembly shall be easily removable without disturbing the housing. Motor speeds shall not exceed 1500 RPM, and all fan motors shall be c/w motor overload, suitably grounded, and mounted on rubber-in-shear vibration isolators.

.5 Fans shall be equipped with CSA motor rated disconnect switches.

.6 Supply variable speed controller and turn over to Div. 26 for installation and wiring.

.7 Supply line voltage thermostat and turn over to Div. 26 for installation and wiring where indicated.

.8 Performance: as indicated on drawing schedule.

.9 Acceptable material: PennBarry, Greenheck, Loren Cook, Twin City.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install in accordance with manufacturer's instructions.

3.2 ANCHOR BOLTS AND TEMPLATES

.1 Size anchor bolts to withstand seismic acceleration and velocity forces as specified in Section 20 05 49.01 - Seismic Restraint System (SRS) for Mechanical Systems.

END OF SECTION

GRILLES, REGISTERS, & DIFFUSERS

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

1.2 PRODUCT DATA

.1 Submit product data in accordance with Section 20 05 01 - Mechanical General Requirements.

.2 Indicate the following:

.1 Capacity.

.2 Throw and terminal velocity.

.3 Noise criteria.

.4 Pressure drops.

.5 Neck velocity.

1.3 MAINTENANCE MATERIALS

.1 Provide maintenance materials in accordance with Section 20 05 01 - Mechanical General Requirements.

.2 Include:

.1 Keys for volume control adjustment.

.2 Keys for air flow pattern adjustment.

1.4 MANUFACTURED ITEMS

.1 Grilles, registers and diffusers of same generic type to be product of one manufacturer.

1.5 CERTIFICATION OF RATINGS

.1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards.

PART 2 PRODUCTS

2.1 GENERAL

.1 To meet capacity, pressure drop, terminal velocity, throw, noise level, neck velocity as indicated.

.2 Frames:

.1 Full perimeter gaskets.

.2 Plaster frames where set into plaster or gypsum board and as specified.

.3 Concealed fasteners.

.3 Concealed operators.

.4 Acceptable material: E.H Price Ltd., Nailor, Titus, Krueger, Metal-aire.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install in accordance with manufacturers instructions.

.2 Install with flat head cadmium plated screws in countersunk holes where fastenings are visible.

END OF SECTION

LOUVRES

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

1.2 REFERENCES

.1 American Architectural Manufacturers Association (AAMA)

.1 AAMA 2605:2017, Voluntary Specification, Performance Requirements and Test Procedures for 2017 Superior Performing Organic Coatings on Aluminum Extrusions and Panels.

.2 American Society for Testing and Materials International (ASTM)

.1 ASTM E90-23, Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

.3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

1.3 PRODUCT DATA

.1 Submit product data in accordance with Section 20 05 01 - Mechanical General Requirements.

.2 Indicate the following: schedule of sizes indicating free area, airflow and pressure drops, finish, curb & construction.

1.4 CERTIFICATION OF RATINGS

.1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards.

1.5 TEST REPORTS

.1 Submit certified data from independent laboratory substantiating acoustic and aerodynamic performance to ASTM E90.

PART 2 PRODUCTS

2.1 STATIONARY LOUVRES (L)

.1 Construction: welded with exposed joints ground flush and smooth.

.2 Material: extruded aluminum alloy 6063-T5.

.3 Blade: stormproof pattern with centre watershed in blade, reinforcing bosses and maximum blade length of 1500 mm for all louvres.

.4 Frame, head, sill and jamb: 100 mm (4") deep depth as indicated on drawing schedule. One piece extruded aluminum, minimum 3 mm thick with approved caulking slot, integral to unit.

.5 Mullions: at 1500 mm maximum centres.

.6 Fastenings: stainless steel SAE-194-8F with SAE-194-SFB nuts and resilient neoprene washers between aluminum and head of bolt, or between nut, ss washer and aluminum body.

.7 Screen: 19 mm mesh, 2 mm diam wire aluminum birdscreen on inside face of louvres in formed U-frame.

.8 Finish:

.1 Finish exposed surfaces of exterior aluminum components with factory applied polyvinylidene fluoride (PVF2) coating meeting performance requirements of AAMA 2605, dry film thickness of 0.025 mm.

.1 Colours to match PPG Duranar colour as approved by Architect.

.2 Gloss: Medium.

.3 Appearance: visibly free of flow.

.9 Performance: as per drawing schedule.

.10 Acceptable Materials: Ventex/Alumavent, McGill, PennBarry, Ruskin, E.H. Price, Greenheck.

PART 3 EXECUTION

3.1 INSTALLATION

.1 In accordance with manufacturers and SMACNA recommendations.

.2 Reinforce and brace air vents, intakes and to withstand local wind speeds as indicated.

.3 Anchor securely into opening.

.4 Seal with caulking around to ensure weather tight seal.

END OF SECTION

INDOOR DIRECT FIRED CUSTOM AIR HANDLING UNIT

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

1.2 RELATED SECTIONS

.1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

1.3 REFERENCES

.1 American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)

.1 ASHRAE 52.1-1992, Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter.

.2 ASHRAE 52.2-2017, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.

.2 Canadian Standards Association (CSA).

.1 CSA C22.2 No. 236-15, Heating and Cooling Equipment.

1.4 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 20 05 01 - Mechanical GeneralRequirements.

1.5 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into manual specified in Section 20 05 01 - Mechanical GeneralRequirements.

1.6 MANUFACTURED ITEMS

.1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or thoseordered by him from independent testing agency signifying adherence to codes and standards in force.

PART 2 PRODUCTS

2.1 GENERAL

.1 Air Handling Units shall be built to the level of quality as herein specified and to the description of the Air Handling Unit Schedule.

.2 Substitution of any product other than that specified, must assure no deviation below the stated capacities, air flow rate, heat transfer rate, filtration efficiency and air mixing quality. Power requirements must not be exceeded, and where specifically defined, sound power levels must not be exceeded. Applications for "equal" or "alternate" must address these factors.

.3 Unless stated otherwise, air handling units are to be shipped to the job in two pieces, factory assembled.

.4 Modular units assembled to achieve a close proximation to the intent of this specification will not be considered equal. All equipment shall where specified and applicable, be pre-wired, and factory certified by an approved testing agency such as CETL, ETL, UL, CSA prior to shipment.

.5 Prewired air handling units shall bear an approved label with all the necessary identification marks, electrical data, and any necessary cautions as required by the National Electric Code, Part 2 (Canada).

.6 Provide a system of motor control, including all necessary terminal blocks, motor contactors, motor overload protection, grounding lugs, control transformers, auxiliary contactors and terminals for the connection of external control devices or relays.

.1 Gas fired units shall also include high limit and combustion airflow switch.

.2 Factory installed and wired non-fused disconnect switch in CEMA/NEMA 3 weatherproof configuration.

.7 The air handling units and major components shall be products of manufacturers regularly engaged in the production of such equipment and with a minimum of fifteen continuous years of proven production experience.

2.2 UNIT CONSTRUCTION

.1 Unit Base:

.1 Structure:

.1 Unit bases shall be constructed with structural steel perimeter channels and cross supports of structural steel channel or formed heavy gauge steel. Cross support frequency must be such that floor deflection shall not exceed 1/4” [6.4 mm] per 198” [5 m] span. Manufactures shall comply to CSA Standard W47.1 for welding of steel Air Handling Unit base structures, and be certified to that standard by a qualified independent certification body. All bare metal surfaces, welds, lifting lugs, shall be coated with epoxy paint to prevent corrosion. AHU3001-AHU-1 and AHU3001-AHU-2 must have their own independent equipment base.

.2 Lifting Lugs:

.1 Removable lifting lugs shall provide intermediate lifting points where applicable for balanced lifting (minimum 4 per unit). Removable lifting lugs shall be certified and applicable drawings

with structural engineer's stamp shall be made available to the consultant or owner upon request.

.3 Floors:

.1 Shall be minimum 16-gauge galvanized steel, all seams shall be continuously welded and floor shall be stitch welded to the base frame structure as necessary to prevent 'oil canning'. Provide a 1.5" [38 mm] fully welded perimeter water dam with no penetrations at component attachment points such as isolators or other floor mounted equipment. All pipe and duct openings through the unit floor shall incorporate the same perimeter water dam. Auxiliary floor drains are provided in outside air intake, cooling coil, and humidifier sections, and shall be minimum 1-1/4" [31.8 mm] pipe with NPT threaded connection extended to the unit exterior. "P" trap sizing for drains shall be provided either as part of the manufacturer's submission or included with the Operation and Maintenance Manual. Floors shall be painted with non-slip epoxy paint.

.4 Insulation & Liner:

.1 All base frames must be insulated to prevent condensation with fiberglass, with a minimum density of 3 lb./cu.ft. [48 kg./cu.m.] Fiberglass base insulation shall be covered with minimum 22 gauge [0.84 mm] galvanized metal liner mechanically fastened to the unit base cross supports.

.5 Mounting:

.1 Unit base shall be self-supporting, and be suitable for mounting on a concrete pad as specified herein or on the schedule. AHU3001-AHU-2 must contain additional structural support on the roof of the equipment to support the weight of AHU3001-AHU-1.

.2 Casing:

.1 Wall and Roof Panels:

.1 Panels shall be made with 18-gauge satin coat steel, and be rigid two break construction with widths not to exceed 24" [610 mm]. All wall and roof joints shall be broken inward except outdoor unit roof panels which shall be constructed of a three-break outward roof rib to inhibit water infiltration. All panel assembly joints shall be made with butyl gasket and sheet metal screws, and unit seams shall be sealed with caulking to eliminate air leakage and water infiltration. Any casing penetrations made for electrical, controls, etc. shall be sealed with grommets or other suitable fitting to achieve an air tight seal. Units operating at static pressure greater than 5.0" w.c. [1250 Pa] shall have maximum 18" [457 mm] panel widths and be reinforced with internal bracing designed not to exceed maximum panel deflection of 1/202" [0.126 mm]. All outdoor units wider than 60" [152 mm] shall have roof slope of minimum 1" [25.4 mm] sloped away from the access door side.

.2 Internal Walls:

.1 Internals walls and subfloors shall be galvanized steel with gauge to match exterior wall and roof panels at a minimum. Sealing of internal walls and subfloors shall be ensured by attachment to exterior wall ribs, or to solid metal liner. Air bypass from sealing to perforated liner is unacceptable.

.3 Insulation and Liner:

.1 All walls must be insulated to prevent condensation with fiberglass, with a minimum density of 3 lb./cu.ft. [48 kg./cu.m.] Fiberglass insulation shall be covered with minimum 22 gauge [0.84 mm] galvanized solid metal liner mechanically fastened.

.3 Access Doors:

.1 Provide access doors in each section to allow servicing. Ensure that doors are sufficiently sized to permit removal of filters and motors from their respective access sections. Doors shall be insulated double wall solid steel, with construction to match casing and, given available space, shall open against pressure. Doors that open with pressure shall come with a safety catch device. All doors shall seal against a neoprene foam seal. Doors shall come with a minimum of two handles, and model shall be Allegis PA6. Doors shall have a minimum 2 heavy duty steel hinges. Doors for use on outdoor units shall come with rain gutters installed above them.

.4 Drain Pans:

.1 Provide a 16 gauge [1.59 mm] 304 stainless steel drain pan under all cooling coils. Drain pans must extend a minimum of 6” [152mm] downstream of the coils to ensure any moisture carryover is captured within the pan. Ensure drain pans are double sloped to allow proper drainage, and that they extend under all coil return bends and headers. With stacked coil arrangements, provide a suitably sized standpipe to the bottom most drain pan. Provide a 1-1/4” [31.8 mm] sized drain extended to the exterior of the unit with threaded NPT pipe connection. “P” trap sizing for drains shall be provided either as part of the manufacturer’s submission or included with the Operation and Maintenance Manual.

.5 Unit Finish:

.1 Manufacturer shall finish all Air Handling Units with a corrosion resistant two stage coating process to a dry thickness no less than 3.5 mils. To ensure adequate surface adhesion, unit must be properly prepared and cleaned prior to application of epoxy primer, and top coat of acrylic / polyester urethane. Color shall be RAL9002.

.6 Recovery Coil:

.1 General:

.1 Coil casing shall be minimum 16-gauge galvanized steel and shall be located on a raised track/drain pan stand offs to aid removal. Blank off plates shall be provided to seal coils, and prevent air

bypass. Allowance for coil removal is required and shall be made through a removable, insulated access panel secured with sheet metal screws. Piping, valves, expansion tanks, pump for run around loops are provided by piping contactor.

.2 Construction:

.1 Coils shall be of counter flow design, and be constructed with 5/8" diameter, 0.020" wall thickness copper tubes which are expanded to mechanically bond to fins for maximum heat transfer. Fins shall be aluminum with die-formed collars in a staggered pattern, and be either flat, sine-wave or waffle patterned accordingly to meet performance requirements. Maximum coil face velocity shall not exceed 500 fpm [2.54 m/s]. Coil fins per inch (FPI) shall not exceed 12, and air side pressure drop shall not exceed maximum of 1" w.g. [248. 8 Pa]. Coil header material shall match tube material, and come with integral 1/4" [6.4 mm] vent and drain to withstand test pressure. Coils shall be designed to withstand maximum operating pressure of 300 psig [2.07 mPa] at a maximum temperature of 250°F [121.1°C], and shall be factory leak tested at no less than 550 psig [3.79 mPa] test pressure. Coil connections shall be MPT copper with piping extended through to the exterior of the Air Handling Unit casing, and all penetrations sealed with grommets.

2.3 FANS & MOTORS

.1 Centrifugal (Airfoil – Supply fan only):

.1 Fan shall be twin housed centrifugal fan with backward curved airfoil blades. Inlet cone and housing shall be galvanized. The inlet cone shall contain forefinger device to reduce the effects of recirculation air to improve fan noise and operating efficiency. Fans shall be licensed to bear the AMCA seal per the AMCA Certified Ratings Program, with fan factory testing and procedures in accordance to AMCA bulletins 211, and fan performance certified to AMCA 210. Factory testing to ensure fans are statically and dynamically balanced to grade of G=2.5 shall also be completed by fan manufacturer. Fans shall be equipped with self-aligning, single row, deep groove ball type bearings with pillow block cast housings, and all shall be rated L10 life rating of 200,000 Hrs at peak performance. Fan shafts shall be provided with rust inhibitor coating. Fan assemblies shall be provided with vibration isolation supported in four corner locations with 1" [25.4 mm] static deflection spring isolation. In seismic zones, the isolation spring assembly shall be rated accordingly with seismic housings. Fan isolators shall be factory set (floated), and fan shipping restraints shall be provided to prevent transport damage. Fan discharge shall be attached to wall panels with a heavy neoprene flexible connection for further vibration isolation. Fan shall be capable of 50% turndown of airflow during unoccupied modes.

.2 Motors shall be design shall be NEMA design code A and be rated for continuous duty. Fan motors shall be TEFC and shall be premium

efficiency type with insulation class F. Motor shall be manufactured to NEMA MG1 Part 31.4.4.2 with a minimum IP 44 ingress protection. Stainless steel nameplate with CSA certification shall be included on motor.

.3 Fan drives shall be designed for a minimum of 1.5 service factor and shall be factory mounted with final adjustment to be made by the contractor after installation of the unit. Sheaves and belts assembly shall be complete with protective belt guard including a tachometer port located at the fan shaft. Variable pitch sheaves on motors 5 Hp [3.63 Kw] and smaller and fixed pitch sheaves for 7.5 Hp [5.6 kW] and larger motors shall be provided.

.2 Plenum (Direct Drive -Exhaust fan only):

.1 Fan type shall be unhoused plenum with non-overloading aluminum airfoil blades. Panels and framework shall be constructed of galvanized steel to provide a rigid structure to support the shaft and bearings and reduce low frequency vibration. Wheels shall be statically and dynamically balanced to balance grade G6.3 per ANSI S2.19. D. Wheel hubs shall be cast of 319 aluminum alloy. Fans shall be licensed to bear the AMCA seal per the AMCA Certified Ratings Program, with fan factory testing and procedures in accordance to AMCA bulletins 211, 311, and fan performance certified to AMCA 210. Fan assemblies shall be provided with vibration isolation supported in four corner locations with 1” [25.4 mm] static deflection spring isolation. Fan inlet shall be attached to wall panels with a heavy neoprene flexible connection for further vibration isolation. Plenum fan assemblies shall come complete with protective guards installed around the fan outlet or guards at fan access points. Fan shall be capable of 50% turndown of airflow during unoccupied modes.

.2 Motors shall be design shall be NEMA design code B and be rated for continuous duty. The motor shall be rated in IEEE Std. 841-2021. Non-IEEE841 motors are not acceptable. Fan motors shall be TEFC enclosure with insulation class F. Motor shall be manufactured to NEMA MG1 Part 31.4.4.2 with a minimum IP 56 ingress protection. d stainless steel nameplate with CSA certification shall be included on motor. Motors shall be rated for Class I, Division II, Group A, B, C, D area classification

.3 Airflow Monitoring:

.1 Each fan shall contain a piezo ring for the use of air flow monitoring. The piezo ring measures the differential pressure of the fan and be converted into a 4-20 mA control signal using a pressure transducer. The control signal will be monitored by a remote HVAC control panel.

2.4 DIRECT FIRED HEATING MODULE

.1 General:

.1 Direct gas-fired heat module shall be manufactured as a recognized component to the current edition of ANSI Z83.4 / CSA 3.7 Standard for “Non-Recirculating Direct Gas-Fired Heating and Forced Ventilation Appliances for Commercial and Industrial Application.” The heating modules shall be installed in accordance with the CSA-B149 Heating

module shall provide 100% efficiency of combustion and a minimum thermal efficiency of 92%. All electrical components shall be listed or recognized by a NRTL (ETL, UL, CSA, etc.). Heat modules and burners provided are for use on natural gases as specified. Manifold and gas train built to ANSI, FM, UL, IRI/GAP, or local codes as specified. Heating module shall have a rating label mounted on the front shroud indicating the type of gas for which the heater is equipped, external static design conditions, maximum and minimum Btu input ratings, maximum and minimum gas supply pressures, output at maximum input, supply voltage, and maximum amp rating.

.2 Burner:

.1 Direct gas-fired heating module provided shall have a stainless-steel burner with aluminum burner head casting. Burner assembly shall be mechanically secured to vestibule panels and design shall be suitable to operate as low as 0.68" differential pressure range or air velocity as low as 1500 to 3500 fpm. The gas module shall employ the following:

.1 Gas burners, with integral carryovers, capable of operation at 30:1 turndown with modulating controls.

.2 A profile plate opening sized according to specific application requirements.

.3 Burner circulating air pressure switch to prove air supply for combustion and operation.

.4 Flame Safeguard of the gas burners with integral flame sensing to prove carryover across burner assembly.

.5 Listed Gas Valve(s) incorporating electric safety shut-off valves, and/or manual shut-off, and/or proof of closure, and/or visual indication, and/or gas regulator.

.6 An automatic reset type high limit switch set to 185oF.

.7 Class II step down transformer(s) to provide 24 VAC control voltage at selected supply voltage.

.8 A 1/8" NPT tapped test gauge connection in the gas train for measuring gas manifold pressure.

.9 A 1/8" NPT tapped test gauge connection in the gas train for measuring inlet supply gas pressure.

.10 A union fitting upstream and downstream of gas control to facilitate installation and service.

2.5 FILTERS

.1 General:

.1 Filter shall be mounted in frames to allow proper servicing of the filters. Filters removed through access doors shall be removed from one side of the unit. All filters shall be tested and rated as per ASHRAE Test Standard

52. Filters frames shall be designed to prevent air bypass. Filter velocity must not exceed 500 fpm [2.5 m/s]. Sizes shall be noted on drawings or other supporting materials. A Magnehelic filter gauge shall be provided for each filter bank, range shall be 0-1" w.g. [0-250 Pa] for pre filter banks.

.2 Filters:

.1 Air filters shall be 2" [51 mm] medium efficiency ASHRAE pleated panels consisting of cotton and synthetic media, welded wire media support grid, and beverage board enclosing frame. Filters shall have a Minimum Efficiency Reporting Value of MERV 8 when evaluated under the guidelines of ASHRAE Standard 52.2. The media shall maintain or increase efficiency over the life of the filter. Initial resistance to airflow shall not exceed 0.31" w.g. [77.1 Pa] at an airflow of 500 fpm [2.54 m/s] on 2" [51 mm] depth filters. The filter shall be classified by Underwriters Laboratories as UL Class 2.

2.6 DAMPERS

.1 General:

.1 Dampers shall be AMCA certified, and frames shall be securely screwed to the air-handling unit. Damper blades shall be parallel blade orientation. Electric damper motors shall be supplied and wired by the manufacturer with outside air dampers to include spring return to fail closed. Damper actuator shall be rated for area classification.

.2 Outdoor Air Dampers and Exhaust Air Dampers:

.1 Damper blades shall be thermally insulated, low leakage airfoil shape galvanized steel double skin construction and be symmetrical relative to its axle pivot point, presenting identical performance characteristics with air flowing in either direction through the damper. Blade edge seals shall be TPE suitable for -40°F [-40°C] to 250°F [121°C] and bearings shall be synthetic (acetal) sleeve rotating in polished extruded holes in the 16 ga damper frame. Linkage shall be plated steel. Jamb seal material shall be stainless steel. B. Dampers shall bear the AMCA Certified Ratings Seal for Air Performance Air Leakage in accordance with AMCA 511

.3 Return Air Dampers and Supply Air Dampers:

.1 Damper blades shall be airfoil shape galvanized steel double skin construction and be symmetrical relative to its axle pivot point, presenting identical performance characteristics with air flowing in either direction through the damper. Blade edge seals shall be TPE suitable for -40°F [-40°C] to 250°F [121°C] and bearings shall be synthetic (acetal) sleeve rotating in polished extruded holes in the 16 ga damper frame. Linkage shall be plated steel. Jamb seal material shall be stainless steel. Dampers shall bear the AMCA Certified Ratings Seal for Air Performance Air Leakage in accordance with AMCA 511.

2.7 EQUIPMENT NAMEPLATE / LAMACOID LABELS

.1 Equipment Nameplate:

.1 All equipment shall come with stainless steel laser etched identification nameplate that will withstand outdoor duty and remain legible over time. Nameplate shall be permanently attached to the equipment casing with high bond double sided adhesive tape and screws. Nameplate shall include the following information at a minimum:

.1 Equipment certifications (ETLC, CSA, ULC, etc.)

.2 Equipment tag

.3 Project name

.4 Manufacturers model and serial numbers

.5 Equipment capacities

.6 Electrical circuits information as required by certification body (Volts/Phase/Hertz, MCA, etc.)

.7 Electrical component information as required by certification body (FLA, HP, etc.)

.2 Lamacoid Labels:

.1 Identification of all access sections, sensors, control panels, actuators, and unit tagging shall be done with phenolic plastic labels (lamacoids) with white face and black lettering. Text shall be minimum ¼" [6 mm] high and labels shall be adhered to unit surfaces with high bond double sided adhesive tape. Sticker labels are not acceptable.

2.8 VARIABLE FREQUENCY DRIVES

.1 General:

.1 Each air handling unit shall have VFD shipped loose. The model shall be Danfoss VLT HVAC FC101 with NEMA 1 enclosure. The VFD shall have electronic thermal motor protection against overload and temperature monitoring of the heatsink ensures that the adjustable frequency drive trips in case of overtemperature. VFD shall include DC link reactor to protect against short circuits.

2.9 ELECTRICAL / CONTROLS

.1 Remote HVAC Control Panel:

.1 Both air handling units Supply and Exhaust shall be controlled via a remote HVAC panel. The control panel shall be provided from the same manufacturer as the air handling units. The remote HVAC control panel shall have a NEMA 4 enclosure and HMI LCD screen for equipment

statuses and alarm navigation. The remote HVAC control panel shall have, but not limited to the following interlocks with the air handling units:

.1 Supply AHU:

.1 O/A damper end switch

.2 S/A damper end switch

.3 O/A temperature sensor signal

.4 Recovery coil leaving temperature sensor signal

.5 S/A temperature sensor signal

.6 Supply fan status via airflow switch

.7 Clogged filter switch

.8 Pressure transducer for airflow monitoring

.2 Exhaust AHU:

.1 R/A damper end switch

.2 E/A damper end switch

.3 R/A temperature sensor signal

.4 E/A temperature sensor signal

.5 Supply fan status via airflow switch

.6 Clogged filter switch

.7 Pressure transducer for airflow monitoring

.8 The remote HVAC control panel will monitor these interlocks and operate both air handling units in occupied and unoccupied modes. The remote HVAC control panel shall have, but not limited to the following interlocks with the BAS panel:

.9 Occupied/Unoccupied dry contact

.10 Equipment run statuses

.11 Equipment common alarms

.2 The remote HVAC control panel will also enable the pump (supplied by others) and control valve (supplied by others) for the glycol run around system.

.2 Electrical – Supply AHU:

.1 All power and control wiring shall be run in flexible metal conduit and run internal to the unit casing whenever possible, external conduit runs are to be avoided. Wiring must be clearly labeled at junction points to facilitate reconnection. The electrical installation must comply with CSA 22.1 No. 236 and bear certification mark. All end devices shall be wired to a terminal block. All electrical and control panels shall be recessed inside a vestibule.

A non-fused NEMA 4 disconnect shall be supplied and installed on the exterior of the equipment.

.3 Electrical – Exhaust AHU:

.1 All power and control wiring shall be run in rigid aluminum conduit and run internal to the unit casing whenever possible, external conduit runs are to be avoided. Wiring must be clearly labeled at junction points to facilitate reconnection. The conduit fittings must be rated for Class I, Division II. The electrical installation must comply with CSA 22.1 No. 236. The equipment shall be certified for area classification of Class I, Division II, Group D, T3. All end devices shall be wired to a terminal block. The electrical panel shall have an enclosure rated for NEMA 7. A non-fused NEMA 7 disconnect shall be supplied and installed on the exterior of the equipment.

END OF SECTION

OUTDOOR AIR HANDLING UNITS WITH HEAT RECOVERY

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

1.2 REFERENCES

.1 Air-Conditioning, Heating, and Refrigeration Institute (formerly ARI)

.1 AHRI 260 (I-P 2017), Sound Rating of Ducted Air Moving and Conditioning Equipment.

.2 AHRI 430 (I-P/2014), Central Station Air Handling Units.

.3 AHRI 1060 I-P/2018), Performance Rating of Air-To-Air Heat Exchangers for Energy Recovery Ventilation Heat Equipment

.2 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)

.1 ASHRAE 84-2020, Method of Testing Air-to-Air Heat/Energy Exchangers.

.3 American Society for Testing and Materials International (ASTM)

.1 ASTM B117-19 - Standard Practice for Operation Salt Spray (Fog) Apparatus.

.2 ASTM D1929-20, Standard Test Method for Determining Ignition Temperature of Plastics.

.4 CSA Group (CSA)

.1 CSA C22.2 No. 236-15, Heating and Cooling Equipment.

.2 CSA ANSI Z21.47-2006/CSA 2.3-2006 (R2011), Gas-Fired Central Furnaces.

.3 CSA ANSI Z83.8-2016/2.6-2016 (R2021), Gas Unit Heaters, Gas Packaged Heaters, Gas Utility Heaters and Gas-fired Duct Furnaces.

.5 Underwriters Laboratories (UL)

.1 UL 1995 - Heating and Cooling Equipment.

1.3 QUALITY ASSURANCE

.1 Unit shall be certified in accordance with UL Standard 1995/CSA C22.2 No. 236, Safety Standard for Heating and Cooling Equipment.

.2 Unit shall be certified in accordance with ANSI Z21.47b/CSA 2.3b and ANSI Z83.8/CSA 2.6, Safety Standard Gas-Fired Furnaces.

.3 Unit shall be certified by ETL and ETL Canada listed. Unit nameplate shall include the ETL/ETL Canada label. The nameplate, safety labels and warnings will be in English and French.

1.4 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 20 05 01 - Mechanical General Requirements.

.2 Indicate:

.1 Equipment including connections, piping and fittings, valves, strainers, control assemblies and ancillaries, identifying factory and field assembled.

.2 Wiring as assembled and schematically.

.3 Dimensions, construction details, recommended installation and support, mounting bolt hole sizes and locations and point loads.

.4 Space requirements for operation and maintenance.

.5 Provide fan curves with specified operating point clearly plotted.

1.5 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 201 05 01 - Mechanical General Requirements.

1.6 WARRANTY

.1 Manufacturer shall provide a limited “parts only” warranty for a period of 12 months from the date of equipment startup or 18 months from the date of original equipment shipment from the factory, whichever is less. Warranty shall cover material and workmanship that prove defective, within the specified warranty period, provided manufacturer’s written instructions for Installation, Operation, and maintenance have been followed. Warranty excludes parts associated with routine maintenance, such as belts and filters.

1.7 ACCEPTABLE MATERIALS

.1 Approved manufacturer:

.1 AAON, Trane, Daikin, Valent or approved equal.

PART 2 PRODUCTS

2.1 GENERAL

.1 Unit casing shall be of minimum 1.2 mm (18 gauge) satin coat galvanized sheet metal. Surfaces shall be cleaned with a degreasing solvent to remove oil and metal oxides and primed with a two-part acid based etching primer. Finish coat shall be an electrostatically applied enamel, to all exposed surfaces. All unprotected metal and welds shall be factory coated.

.2 Substitute equipment may be considered for approval that includes at a minimum:

.1 Direct drive supply fans

.2 Double wall cabinet construction

.3 Insulation with a minimum R-value of 13

2.2 DESCRIPTION

.1 General:

.1 Outdoor air handling unit shall include filters, supply fans, dampers, gas heaters, exhaust fans, energy recovery wheels, and unit controls.

.2 Unit shall have decals and tags to indicate lifting and rigging, service areas and caution areas for safety and to assist service personnel.

.3 Unit components shall be labeled, including electrical and controls components.

.4 Estimated sound power levels (dB) shall be shown on the unit ratings sheet.

.5 Installation, Operation, and Maintenance manual shall be supplied within the unit.

.6 Laminated color-coded wiring diagram shall match factory installed wiring and shall be affixed to the interior of the control compartment's hinged access door.

.7 Unit nameplate shall be provided in two locations on the unit, affixed to the exterior of the unit and affixed to the interior of the control compartment's hinged access door.

2.3 CONSTRUCTION:

.1 All cabinet walls, access doors, and roof shall be fabricated of double wall, impact resistant, rigid polyurethane foam panels.

.2 Unit insulation shall have a minimum thermal resistance R-value of 13. Foam insulation shall have a minimum density of 2 pounds/cubic foot and shall be tested in accordance with ASTM D1929 for a minimum flash ignition temperature of 610°F.

.3 Unit construction shall be double wall with G90 galvanized steel on both sides and a thermal break. Double wall construction with a thermal break prevents moisture accumulation on the insulation, provides a cleanable interior, reduces heat transfer through the panel, and prevents exterior condensation on the panel.

.4 Unit shall be designed to reduce air leakage and infiltration through the cabinet. Cabinet leakage shall not exceed 1% of total airflow when tested at 3 times the minimum external static pressure provided in AHRI Standard 340/360. Panel deflection shall not exceed L/240 ratio at 125% of design static pressure, at a maximum 8 inches of positive or negative static pressure, to reduce air leakage. Deflection shall be measured at the midpoint of the panel height and width. Continuous sealing shall be included between panels and between

access doors and openings to reduce air leakage. Piping and electrical conduit through cabinet panels shall include sealing to reduce air leakage.

.5 Unit shall be designed to reduce air leakage and infiltration through the cabinet. Cabinet leakage shall not exceed 1% of total airflow when tested at 3 times the minimum external static pressure provided in AHRI Standard 210/240. Panel deflection shall not exceed L/240 ratio at 125% of design static pressure, at a maximum 8 inches of positive or negative static pressure, to reduce air leakage. Deflection shall be measured at the midpoint of the panel height and width. Continuous sealing shall be included between panels and between access doors and openings to reduce air leakage. Piping and electrical conduit through cabinet panels shall include sealing to reduce air leakage.

.6 Roof of the air tunnel shall be sloped to provide complete drainage. Cabinet shall have rain break overhangs above access doors.

.7 Access to filters, dampers, heaters, energy recovery wheels and electrical and controls components shall be through hinged access doors with quarter turn, zinc cast, lockable handles. Full-length stainless-steel piano hinges shall be included on the doors.

.8 Exterior paint finish shall be capable of withstanding at least 2,500 hours, with no visible corrosive effects, when tested in a salt spray and fog atmosphere in accordance with ASTM B117 test procedure.

.9 Unit shall be provided with base discharge and return air openings. All openings through the base pan of the unit shall have upturned flanges of at least 1/2 inch in height around the opening.

.10 Unit shall include lifting lugs on the top of the unit.

2.4 ELECTRICAL

.1 Unit shall be provided with standard power block for connecting power to the unit.

.2 Unit shall be provided with factory installed and factory wired, non-fused disconnect switch.

.3 Unit shall be provided with a factory installed and field wired 115V, 20-amp GFI outlet in the unit control panel.

.4 Unit shall be provided with phase and brown out protection which shuts down all motors in the unit if the electrical phases are more than 10% out of balance on voltage, the voltage is more than 10% under design voltage or on phase reversal.

FANS

.1 Supply:

.1 Unit shall include direct drive, unhoused, backward curved, plenum supply fan.

.2 Blower and motor shall be dynamically balance and mounted on rubber isolators.

.3 Motor shall be premium efficiency ODP with ball bearings rated for 200,000 hours service with external lubrication points.

.4 Variable frequency drive shall be factory wired and mounted in the unit.

.5 Motor shall include shaft grounding.

.2 Exhaust:

.1 Exhaust damper shall be sized for 100% relief.

.2 Fan and motor shall be dynamically balanced.

.3 Unit shall include barometric relief dampers.

.4 Motor shall be premium efficiency ODP with ball bearings rated for 200,000 hours service with external lubrication points.

.5 Access to exhaust fans shall be through double wall, hinged access doors with quarter turn lockable handles.

.6 Unit shall include belt driven, unhoused, backward curved, plenum exhaust fans.

.7 Variable frequency drives shall be factory wired and mounted in the unit. Fan motors shall be premium efficiency.

.8 Motor shall include shaft grounding.

2.6 GAS HEATING

.1 Stainless steel heat exchanger furnace shall carry a 25-year non-prorated warranty, from the date of original equipment shipment from the factory.

.2 Gas furnace shall consist of stainless-steel heat exchangers with multiple concavities, an induced draft blower and an electronic pressure switch to lockout the gas valve until the combustion chamber is purged and combustion airflow is established.

.3 Furnace shall include a gas ignition system consisting of an electronic igniter to a pilot system, which will be continuous when the heater is operating, but will shut off the pilot when heating is not required.

.4 Unit shall include a single gas connection and have gas supply piping entrances in the unit base for through-the-curb gas piping and in the outside cabinet wall for across the roof gas piping.

.5 High Turndown Modulating Natural Gas Furnace shall be equipped with modulating gas valves, adjustable speed combustion blowers, stainless steel tubular heat exchangers, and electronic controller. Combustion blowers and gas valves shall be capable of modulation. Electronic controller includes a factory wired, field installed supply air temperature sensor. Sensor shall be field installed in the supply air ductwork. Supply air temperature setpoint shall be adjustable on the electronic controller within the controls compartment. Gas heater shall be capable of capacity turndown ratio as shown on the unit rating sheet. Heat trace shall be included on the condensate drain line.

2.7 FILTER BOX

.1 Casing as per Clause 2.2.

.2 Holding frames: galvanized steel or extruded aluminum to suit filter sizes for front servicing.

.3 Seals: to ensure leakproof operation.

.4 Blank-off plates: as required, to fit all openings and of same material as holding frames.

2.8 FILTERS

.1 Unit shall include 2-inch thick, pleated panel filters with an ASHRAE MERV rating of 8.

.2 Unit shall include a clogged filter switch.

2.9 ENERGY WHEEL SECTION

.1 Unit shall contain a factory mounted and tested energy recovery wheel. The energy recovery wheel shall be mounted in a rigid frame containing the wheel drive motor, drive belt, wheel seals and bearings. Frame shall slide out for service and removal from the cabinet.

.2 The energy recovery component shall incorporate a rotary wheel in an insulated cassette frame complete with seals, drive motor and drive belt.

.3 The energy recovery cassette shall be an Underwriters Laboratories Recognized Component for electrical and fire safety. The wheel drive motor shall be an Underwriters Laboratory Recognized Component and shall be mounted in the cassette frame and supplied with a service connector or junction box. Thermal performance shall be certified by the manufacturer in accordance with ASHRAE Standard 84, Method of Testing Air-to-Air Heat Exchangers and AHRI Standard 1060, Rating Air-to-Air Energy Recovery Ventilation Equipment. Cassettes shall be listed in the AHRI Certified Products.

.4 Unit shall include 2-inch thick, pleated panel outside air filters with an ASHRAE MERV rating of 8, upstream of the wheels.

.5 Hinged service access doors shall allow access to the wheel.

.6 Polymer Energy Recovery Wheels:

.1 Shall be provided with removable energy transfer matrix. Wheel frame construction shall be a welded hub, spoke and rim assembly of stainless, plated and/or coated steel and shall be self-supporting without matrix segments in place. Segments shall be removable without the use of tools to facilitate maintenance and cleaning. Wheel bearings shall be selected to provide an L-10 life in excess of 400,000 hours. Rim shall be continuous rolled stainless steel and the wheel shall be connected to the shaft by means of taper locks.

.2 All diameter and perimeter seals shall be provided as part of the cassette assembly and shall be factory set. Drive belts of stretch urethane shall be provided for wheel rim drive.

.3 Polymer Energy recovery wheel cassette shall carry a 5-year non-prorated warranty, from the date of original equipment shipment from the factory. The first 12 months from the date of equipment startup, or 18 months from the date of original equipment shipment from the factory, whichever is less, shall be covered under the standard AAON limited parts warranty. The remaining period of the warranty shall be covered by Airxchange. The 5-year warranty applies to all parts and components of the cassette, with the exception of the motor, which shall carry an 18-month warranty. Warranty shall cover material and workmanship that prove defective, within the specified warranty period, provided the Airxchange written instructions for installation, operation and maintenance have been followed. Warranty excludes parts associated with routine maintenance, such as belts. Refer to the Airxchange Energy Recovery Cassette Limited Warranty Certificate.

.4 Total energy recovery wheels shall be coated with silica gel desiccant permanently bonded by a process without the use of binders or adhesives, which may degrade desiccant performance. The substrate shall be lightweight polymer and shall not degrade nor require additional coatings for application in marine or coastal environments. Coated segments shall be washable with detergent or alkaline coil cleaner and water. Desiccant shall not dissolve nor deliquesce in the presence of water or high humidity.

2.10 CONTROLS

.1 Factory Installed and Factory Provided Controller.

.2 Unit controller shall be capable of controlling all features and options of the unit. Controller shall be factory installed in the unit controls compartment and factory tested. Controller shall be capable of standalone operation with unit configuration, setpoint adjustment, sensor status viewing, unit alarm viewing, and occupancy scheduling available without dependence on a building management system.

.3 Controller shall have an onboard clock and calendar functions that allow for occupancy scheduling.

.4 Controller shall include non-volatile memory to retain all programmed values without the use of a battery, in the event of a power failure.

.5 Unit shall modulate heating with constant airflow to meet ventilation outside air loads. Heating capacity shall modulate based on supply air temperature.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Installation, Operation, and Maintenance manual shall be supplied with the unit.

.2 Installing contractor shall install unit, including field installed components, in accordance with Installation, Operation, and Maintenance manual instructions.

.3 Start up and maintenance requirements shall be complied with to ensure safe and correct operation of the unit.

END OF SECTION

INDOOR AIR HANDLING UNITS WITH HEAT RECOVERY

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 This section shall be read in conjunction with specification Section 21 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

1.2 REFERENCES

.1 Air-Conditioning, Heating, and Refrigeration Institute (formerly ARI)

.2 American Society for Testing and Materials International (ASTM)

.1 .1 ASTM D1929-20, Standard Test Method for Determining Ignition Temperature of Plastics.

.3 CSA Group (CSA)

.1 CSA C22.2 No. 236-15, Heating and Cooling Equipment.

.2 CSA ANSI Z21.47-2006/CSA 2.3-2006 (R2011), Gas-Fired Central Furnaces.

.3 CSA ANSI Z83.8-2016/2.6-2016 (R2021), Gas Unit Heaters, Gas Packaged Heaters, Gas Utility Heaters and Gas-fired Duct Furnaces.

.4 Underwriters Laboratories (UL)

.1 UL 900 - Test Performance of Air Filter Units.

.2 UL 1995 - Heating and Cooling Equipment.

1.3 QUALITY ASSURANCE

.1 Unit shall be certified in accordance with UL Standard 1995/CSA C22.2 No. 236, Safety Standard for Heating and Cooling Equipment.

.2 Unit shall be certified in accordance with ANSI Z21.47b/CSA 2.3b and ANSI Z83.8/CSA 2.6, Safety Standard Gas-Fired Furnaces.

.3 Unit shall be certified by ETL and ETL Canada listed. Unit nameplate shall include the ETL/ETL Canada label. The nameplate, safety labels and warnings will be in English and French.

1.4 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 20 05 01 - Mechanical General Requirements.

.2 Indicate:

.1 Equipment including connections, piping and fittings, valves, strainers, control assemblies and ancillaries, identifying factory and field assembled.

.2 Wiring as assembled and schematically.

.3 Dimensions, construction details, recommended installation and support, mounting bolt hole sizes and locations and point loads.

.4 Space requirements for operation and maintenance.

.5 Provide fan curves with specified operating point clearly plotted.

1.6 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 21 05 01 - Mechanical General Requirements.

1.7 WARRANTY

.1 Manufacturer shall provide a limited “parts only” warranty for a period of 12 months from the date of equipment startup or 18 months from the date of original equipment shipment from the factory, whichever is less. Warranty shall cover material and workmanship that prove defective, within the specified warranty period, provided manufacturer’s written instructions for Installation, Operation, and maintenance have been followed. Warranty excludes parts associated with routine maintenance, such as belts and filters.

1.8 ACCEPTABLE MATERIALS

.1 Approved manufacturer:

.1 AAON, Trane, Daikin, Valent or approved equal.

PART 2 PRODUCTS

2.1 GENERAL

.1 Factory assembled components to form units supplying air at designed conditions, as indicated in plans, schedule & specification.

.2 Substitute equipment may be considered for approval that includes at a minimum:

.1 ECM driven direct drive backward curved plenum supply fan

.2 Double wall cabinet construction

.3 Insulation with a minimum R-value of 6.25

.4 Hinged access doors with lockable handles

.5 LED service lights in the control panel

.6 All other provisions of the specifications must be satisfactorily addressed

2.2 DESCRIPTION

.1 General:

.1 Indoor air handling units shall include filters, supply fans, and the following:

.2 Gas heater

.3 Exhaust fans & energy recovery wheel

.4 Low voltage terminal block for field installed controls by others.

.2 Unit shall have a draw-through supply fan configuration and discharge air vertically.

.3 Unit shall be shipped in three sections and factory tested including leak testing of the coils and run testing of the supply fans and factory wired system. Run test report shall be supplied with the unit in the control compartment's literature packet, and available electronically after the unit ships.

.4 Unit shall have decals and tags to indicate lifting and rigging, service areas and caution areas for safety and to assist service personnel.

.5 Unit components shall be labeled, including pipe stub outs, electrical and controls components.

.6 Installation, Operation and Maintenance manual shall be supplied within the unit.

.7 Laminated color-coded wiring diagram shall match factory installed wiring and shall be affixed to the interior of the control compartment's hinged access door.

.8 Unit nameplate shall be provided in two locations on the unit, affixed to the exterior of the unit and affixed to the interior of the control compartment's hinged access door.

2.3 CONSTRUCTION:

.1 All cabinet walls, access doors, and roof shall be fabricated with double wall, impact resistant, rigid polyurethane foam panels.

.2 Unit insulation shall have a minimum thermal resistance R-value of 6.25. Foam insulation shall have a minimum density of 2 pounds/cubic foot and shall be tested in accordance with ASTM D1929 for a minimum flash ignition temperature of 610°F. Unit construction shall be double wall with G90 galvanized steel on both sides and a thermal break. Double wall construction with a thermal break prevents moisture accumulation on the insulation, provides a cleanable interior, reduces heat transfer through the panel and prevents exterior condensation on the panel.

.3 Unit shall be designed to reduce air leakage and infiltration through the cabinet. Sealing shall be included between panels and between access doors and openings to reduce air leakage. Piping and electrical conduit through cabinet panels shall include sealing to reduce air leakage.

.4 Access doors shall be flush mounted to cabinetry.

.5 Unit shall include a 5-inch forklift base.

.6 Units shall include double-sloped 304 stainless steel drain pan. Drain pan connection shall be on the right-hand side of unit with a 1" MPT fitting.

.7 Unit shall include factory wired control panel compartment LED service lights.

2.4 ELECTRICAL

.1 Unit shall be provided with an internal control panel with separated low and high voltage control wiring. Access to internal control panel shall be through service access door with piano hinges and lockable quarter turn handle.

.2 Unit shall be provided with standard power block for connecting power to the unit.

.3 Unit shall include a factory installed 24V control circuit transformer.

.4 Unit shall have a 5kAIC SCCR.

.5 Unit shall include high and low voltage quick connects for easy wiring at installation.

2.5 FANS

.1 Supply:

.1 Unit shall include direct drive, unhoused, backward curved, plenum supply fans.

.2 Blower and motor assembly shall be dynamically balanced.

.3 Motor shall be a high efficiency electronically commutated motor (ECM).

.4 Blower and motor assembly shall be mounted on rubber isolators.

.5 ECM driven supply fan shall include a factory installed potentiometer within the control compartment for cfm setpoint. The factory provided terminal block shall include a jumper wire that can be removed when wired to field provided 0-10 VDC control signal.

.6 Access to supply fan shall be through an access door with piano pin hinges and lockable quarter turn handles, and then through a bolted removable control panel

.2 Exhaust:

.1 Unit shall include direct drive, unhoused, backward curved, plenum exhaust fans.

.2 Blower and motor assembly shall be dynamically balanced.

.3 Motor shall be a high efficiency electronically commutated motor (ECM).

.4 Blower and motor assembly shall utilize neoprene gasket.

.5 Access to exhaust fan shall be through an access door with removable pin hinges and lockable quarter turn handles.

.6 ECM driven exhaust fan shall include a factory installed potentiometer within the control compartment for cfm setpoint. The factory provided terminal block shall include a jumper wire that can be removed when wired to field provided 0-10 VDC control signal.

2.6 GAS HEATING

.1 Unit shall include a high efficiency indirect fired condensing natural gas fired heater.

.2 Combustion air intake shall be separated combustion through a vent flue on the front of the unit. The vent connection shall be a rubber coupling for connection to PVC.

.3 Unit shall include an exhaust vent connection on the front of the unit. The vent connection shall be a rubber coupling for connection to PVC.

.4 Gas heater access shall be through service access door with piano hinges and lockable quarter turn handle. The removable access door shall include a viewport.

.5 Gas heaters shall include an induced draft fan for positive venting of flue exhaust and an air pressure switch to lockout the gas valve until the combustion chamber is purged and combustion airflow is established.

.6 Gas heater shall be located downstream of the supply fans.

.7 Field installed venting shall be category IV and field installed condensate drain system is required.

.8 Gas heater shall provide a minimum combustion efficiency of 96% with Type 304 stainless steel primary heat exchanger and AL29-4C stainless steel recuperative heat exchanger with aluminum fins.

.9 Gas heater shall be equipped with electronic modulating 3:1 operating controls and all required safety controls including auto reset high limit switch, high flue gas temperature switch, manual reset rollout switch, combustion air proving switch, condensate drain connection and traps and blocked condensate drain shut-off switch.

.10 Gas heater shall include a blocked drain switch and a blocked flue switch.

.11 Gas heater shall include a manual reset rollout switch and two automatic reset high limit switches. One high limit switch shall be mounted in the air stream and the other shall be mounted on the induced draft fan housing.

.12 Gas heater shall include an integrated direct spark ignition control. It shall control the induced draft fan, gas valve, pre-purge timing, ignition, flame sensing and monitoring of the safety circuit at all times, and post purge at the completion of a heating cycle. The board shall include an LED diagnostic light to monitor control status.

.13 Gas heater shall include listed combination gas valve incorporating redundant and main solenoid valves that control gas flow to the main burners, a pressure regulator and a two-position on/off switch for regulation and electrical shut-off of the solenoids.

.14 Unit shall include a single gas connection and have gas supply piping connection on the front of the unit.

.15 Unit shall include a condensate connection opening on the front of the unit. A condensate trap with heat trace shall be installed inside the unit.

.16 Heat exchanger shall carry a 10-year prorated warranty from the date of original equipment shipment from the factory.

2.7 FILTERS

.1 Unit filter access shall be through service access door with piano hinges and quarter turn button fasteners.

.2 Unit shall include 2-inch thick, pleated panel filters with MERV rating of 8, upstream of the cooling coil.

2.8 ENERGY WHEEL SECTION

.1 Unit shall contain an energy recovery cabinet with back outside air opening, back exhaust air opening, top return air opening, and top supply air opening.

.2 Unit shall include 2-inch thick, pleated panel outside air filters with MERV rating of 8, upstream of the wheel.

.3 Unit shall contain a factory mounted and tested energy recovery wheel. The energy recovery wheel shall be mounted in a rigid frame containing the wheel drive motor, drive belt, wheel seals and bearings.

.4 Wheel frame shall slide out for service and removal from the cabinet.

.5 The wheel housing shall be made of galvanized steel and the wheel shall be supported by internal sealed bearings that are permanently lubricated.

.6 The wheel media shall be reinforced with an aluminum structural spoke systems and extruded central hub and shaft.

.7 The drive belt shall be industrial grade adjustable link belt system.

.8 The wheel shall be able to accommodate operating conditions up to 180°F.

.9 The wheel media shall be in compliance with UL 900 requirements with regard to smoke generation and combustibility.

.10 The energy recovery wheel performance shall be listed in the AHRI Certified Products.

.11 Energy recovery wheel shall be covered under the standard AAON limited parts warranty; the first 12 months from the date of equipment startup, or 18 months from the date of original equipment shipment from the factory, whichever is less. Warranty shall cover material and workmanship that prove defective, within the specified warranty period, provided the written instructions for installation, operation and maintenance have been followed. Warranty excludes parts associated with routine maintenance, such as belts.

.12 Total energy recovery wheels shall be made of aluminum which is formed into a fluted, honeycomb matrix and coated with a non-migrating zeolite desiccant composite. Coated segments shall be cleanable with hot water or compressed air without degrading the latent recovery.

.13 Energy recovery wheel access shall be through service access door with piano hinges and quarter turn button fasteners.

2.9 CONTROLS

.1 Unit shall be provided with a proof of airflow switch. When airflow is not detected, the supply fans will shut down.

.2 Unit shall be provided with an internal control panel with separated low and high voltage control wiring.

.3 Access to internal control panel shall be through an access door with piano hinges and lockable quarter turn handles.

.4 Controls shall be field provided and field installed by others. Unit shall be provided with a terminal block and a supply air setpoint potentiometer.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Installation, Operation, and Maintenance manual shall be supplied with the unit.

.2 Installing contractor shall install unit, including field installed components, in accordance with Installation, Operation, and Maintenance manual instructions.

.3 Start up and maintenance requirements shall be complied with to ensure safe and correct operation of the unit.

END OF SECTION

PACKAGED ROOFTOP UNITS AHU3003 & AHU8001

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

1.2 REFERENCES

.1 Air-Conditioning, Heating, and Refrigeration Institute (formerly ARI)

.1 AHRI 210/240 (2017): Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment.

.2 AHRI 340/360 (I-P/2019), Performance Rating of Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment.

.2 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)

.1 ASHRAE 15-2022/ASHRAE 34-2022 package, Safety Standard for Refrigeration Systems and Classification of Refrigerants.

.2 ASHRAE 90.1-2022 (I-P), Energy Standard for Buildings Except Low-Rise Residential Buildings.

.3 American Society for Testing and Materials (ASTM)

.1 ASTM B117-19, Standard Practice for Operating Salt Spray (Fog) Apparatus.

.2 ASTM D1929-20, Standard Test Method for Determining Ignition Temperature of Plastics.

.4 Canadian Standards Association (CSA)

.1 CSA C22.2 No. 236-15, Heating and Cooling Equipment (Bi-National Standard with UL 1995).

.2 CSA ANSI Z21.47-2016/CSA 2.3-2016, Standard for Gas-fired Central Furnaces.

.3 CSA ANSI Z83.8-2016/2.6-2016, Gas Unit Heaters, Gas Packaged Heaters, Gas Utility Heaters and Gas-fired Duct Furnaces.

.5 Electrical Safety Listings (ETL)

.6 Underwriters Laboratories (UL)

.1 UL 1995, Heating and Cooling Equipment.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 20 05 01 - Mechanical General Requirements.

.2 Product Data: Literature shall be provided that indicates dimensions, operating and shipping weights, capacities, ratings, fan performance, filter information, factory supplied accessories, electrical characteristics and connection requirements. Installation, Operation, and Maintenance manual with startup requirements shall be provided.

.3 Shop Drawings: Unit drawings shall be provided that indicate assembly, unit dimensions, construction details, clearances and connection details. Computer generated fan curves for each fan shall be submitted with specific design operation point noted. Wiring diagram shall be provided with details for both power and control systems and differentiate between factory installed and field installed wiring.

1.4 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into manual specified in Section 20 05 01 - Mechanical General Requirements.

1.5 WARRANTY

.1 Manufacturer shall provide a limited “parts only” warranty for a period of 12 months from the date of equipment startup or 18 months from the date of original equipment shipment from the factory, whichever is less. Warranty shall cover material and workmanship that prove defective, within the specified warranty period, provided manufacturer’s written instructions for Installation, Operation, and maintenance have been followed. Warranty excludes parts associated with routine maintenance, such as belts and filters.

1.6 CERTIFICATION RATING

.1 Packaged air-cooled condenser units shall be certified in accordance with AHRI 340/360 performance rating of commercial and industrial unitary air-conditioning and heat pump equipment.

.2 Packaged air-cooled condenser units shall be certified in accordance with AHRI 210/240 performance rating of commercial and industrial unitary air-conditioning and heat pump equipment.

.3 Unit shall be certified in accordance with UL Standard 1995/CSA C22.2 No. 236, Safety Standard for Heating and Cooling Equipment.

.4 Unit and refrigeration system shall comply with ASHRAE 15, Safety Standard for Mechanical Refrigeration.

.5 Unit shall be certified in accordance with CSA ANSI Z21.47/CSA 2.3 and CSA ANSI Z83.8/ 2.6.

.6 Unit Seasonal Energy Efficiency Ratio (SEER) shall be equal to or greater that prescribed by ASHRAE 90.1, Energy Efficient Design of New Buildings except Low-Rise Residential Buildings.

.7 Unit Energy Efficiency Ratio (EER) shall be equal to or greater that prescribed by ASHRAE 90.1, Energy Efficient Design of New Buildings except Low-Rise Residential Buildings.

.8 Unit shall be certified by ETL and ETL Canada listed. Unit nameplate shall include the ETL/ETL Canada label. The nameplate, safety labels and warnings will be in English and French.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Unit shall be shipped with doors screwed shut and outside air hood closed to prevent damage during transport and thereafter while in storage awaiting installation.

.2 Follow Installation, Operation, and Maintenance manual instructions for rigging, moving, and unloading the unit at its final location.

.3 Unit shall be stored in a clean, dry place protected from construction traffic in accordance with the Installation, Operation, and Maintenance manual.

1.8 ACCEPTABLE MATERIAL

.1 Approved manufacturer:

.1 AAON, Trane, Daikin, Valent or approved equal.

PART 2 PRODUCTS

2.1 GENERAL DESCRIPTION

.1 Factory assembled components to form units supplying air at designed conditions, as indicated in plans, schedule & specification.

.2 Substitute equipment may be considered for approval that includes at a minimum:

.1 R-454B Refrigerant

.2 Variable capacity compressor with 10-100% capacity control

.3 Direct drive supply fans

.4 Double wall cabinet construction

.5 Insulation with a minimum R-value of 13

.6 Stainless steel drain pans

.7 Hinged access doors with lockable handles

.8 All other provisions of the specifications must be satisfactorily addressed

2.3 DESCRIPTION

.1 General:

.1 AHU3003: Packaged rooftop unit shall include compressor, evaporator coil, filters, supply fan, dampers, air-cooled condenser coils, condenser fan, electric heater, and unit controls.

.2 AHU8001: Packaged rooftop unit shall include compressors, evaporator coils, filters, supply fans, dampers, air-cooled condenser coils, condenser fans, gas heaters, and unit controls.

.3 Unit shall be factory assembled and tested including leak testing of the DX coils, pressure testing of the refrigeration circuit, and run testing of the completed unit. Run test report shall be supplied with the unit in the service compartment's literature pocket.

.4 Unit shall have decals and tags to indicate lifting and rigging, service areas and caution areas for safety and to assist service personnel.

.5 Unit components shall be labeled, including refrigeration system components and electrical and controls components.

.6 Estimated sound power levels (dB) shall be shown on the unit ratings sheet.

.7 Installation, Operation and Maintenance manual shall be supplied within the unit.

.8 Laminated color-coded wiring diagram shall match factory installed wiring and shall be affixed to the interior of the control compartment's hinged access door.

.9 Unit nameplate shall be provided in two locations on the unit, affixed to the exterior of the unit and affixed to the interior of the control compartment's hinged access door.

2.3 CONSTRUCTION

.1 All cabinet walls, access doors, and roof shall be fabricated of double wall, impact resistant, rigid polyurethane foam panels.

.2 Unit insulation shall have a minimum thermal resistance R-value of 13. Foam insulation shall have a minimum density of 2 pounds/cubic foot and shall be tested in accordance with ASTM D1929 for a minimum flash ignition temperature of 610°F.

.3 Unit construction shall be double wall with G90 galvanized steel on both sides and a thermal break. Double wall construction with a thermal break prevents moisture accumulation on the insulation, provides a cleanable interior, reduces heat transfer through the panel, and prevents exterior condensation on the panel.

.4 Unit shall be designed to reduce air leakage and infiltration through the cabinet. Cabinet leakage shall not exceed 1% of total airflow when tested at 3 times the minimum external static pressure provided in AHRI Standard 210/240. Panel deflection shall not exceed L/240 ratio at 125% of design static pressure, at a maximum 8 inches of positive or negative static pressure, to reduce air leakage. Deflection shall be measured at the midpoint of the panel height and width. Continuous sealing shall be included between panels and between access doors and openings to reduce air leakage. Piping and electrical conduit through cabinet panels shall include sealing to reduce air leakage.

.5 Roof of the air tunnel shall be sloped to provide complete drainage. Cabinet shall have rain break overhangs above access doors.

.6 Access to filters, dampers, cooling coil, heater, compressor, and electrical and controls components shall be through hinged access doors with quarter turn, lockable handles. Full-length stainless-steel piano hinges shall be included on the doors.

.7 Exterior paint finish shall be capable of withstanding at least 2,500 hours, with no visible corrosive effects, when tested in a salt spray and fog atmosphere in accordance with ASTM B117 test procedure.

.8 Units shall include double sloped 304 stainless steel drain pans.

.9 Unit shall be provided with through the base vertical discharge and return air openings. All openings through the unit shall have upturned flanges of at least 1/2 inch around the opening.

.10 Unit shall include lifting lugs on the top of the unit.

2.4 ELECTRICAL

.1 Unit shall be provided with standard power block for connecting power to the unit.

.2 Unit shall have a 5kAIC SCCR.

.3 Unit shall be provided with a factory installed and field wired 115V, 20-amp GFI outlet in the unit control panel.

.4 Unit shall be provided with phase and brown out protection which shuts down all motors in the unit if the electrical phases are more than 10% out of balance on voltage, the voltage is more than 10% under design voltage or on phase reversal.

2.5 SUPPLY FANS

.1 Unit shall include direct drive, unhoused, backward curved, plenum supply fans.

.2 Blowers and motors shall be dynamically balanced.

.3 AHU3003: Motor shall be a high efficiency electrically commutated motor.

.4 AHU8001 Variable frequency drives shall be factory wired and mounted in the unit.

.5 AHU8001 Motors shall include shaft grounding

2.6 EVAPORATOR COILS

.1 Coils shall be designed for use with R-454B refrigerant and constructed of copper tubes with aluminum fins mechanically bonded to the tubes and galvanized steel end casings. Fin design shall be sine wave rippled.

.2 Coils shall be standard capacity

.3 Coils shall be hydrogen or helium leak tested.

.4 Coils shall be furnished with factory installed thermostatic expansion valves.

2.7 REFRIGERATION SYSTEM

.1 Unit shall be factory charged with R-454B refrigerant.

.2 Compressors shall be scroll type with thermal overload protection, independently circuited and carry a 5 year non-prorated warranty, from the date of original equipment shipment from the factory.

.3 Compressors shall be mounted in an isolated service compartment which can be accessed without affecting unit operation. Lockable hinged compressor access doors shall be fabricated of double wall, rigid polyurethane foam injected panels to prevent the transmission of noise outside the cabinet.

.4 Compressors shall be isolated from the base pan with the compressor manufacturer's recommended rubber vibration isolators, to reduce any transmission of noise from the compressors into the building area.

.5 Each refrigeration circuit shall be equipped with thermostatic expansion valve type refrigerant flow control.

.6 Each refrigeration circuit shall be equipped with automatic reset low pressure and manual reset high pressure refrigerant safety controls, Schrader type service fittings on both the high pressure and low pressure sides and a factory installed replaceable core liquid line filter driers.

.7 Unit shall include a variable capacity scroll compressor on the lead refrigeration circuit which shall be capable of modulation from 10-100% of its capacity.

.8 AHU8001: First capacity stage shall be provided with on/off condenser fan cycling and adjustable compressor lockout to allow cooling operation down to 2°C (35°F).

2.8 AIR-COOLED CONDENSER

.1 Condenser fans shall be a vertical discharge, axial flow, direct drive fans.

.2 Coils shall be designed for use with R-454B refrigerant.

.3 Condenser coils shall be multi-pass and fabricated from aluminum microchannel tubes.

.4 Coils shall be designed for a minimum of -12°C (10°F) of refrigerant sub-cooling.

.5 Coils shall be hydrogen or helium leak tested.

.6 AHU3003: Condenser fans shall be high efficiency electrically commutated motor driven with multiple speeds which are controlled with a fan cycle switch based on head pressure and allow matching condenser airflow with cooling capacity steps.

.7 AHU8001: Condenser fans shall be high efficiency electrically commutated motor driven with factory installed head pressure control module. Condenser airflow shall continuously modulate based on head pressure and cooling operation shall be allowed down to 35°F with adjustable compressor lockout.

2.9 HEATING

.1 AHU3003: Electric Heating:

.1 Unit shall include an electric heater consisting of electric heating coils, fuses and a high temperature limit switch, with capacities as shown on the plans.

.2 Electric heating coils shall be in the reheat position downstream of the cooling coil.

.3 Electric heater shall have full modulation capacity controlled by an SCR (Silicon Controlled Rectifier). A 0-10 VDC heating control signal shall be field provided to control the amount of heating.

.2 AHU8001: Gas Heating:

.1 Stainless steel heat exchanger furnace shall carry a 25-year non-prorated warranty, from the date of original equipment shipment from the factory.

.2 Gas furnace shall consist of stainless-steel heat exchangers with multiple concavities, an induced draft blower and an electronic pressure switch to lockout the gas valve until the combustion chamber is purged and combustion airflow is established.

.3 Furnace shall include a gas ignition system consisting of an electronic igniter to a pilot system, which will be continuous when the heater is operating, but will shut off the pilot when heating is not required.

.4 Unit shall include a single gas connection and have gas supply piping entrances in the unit base for through-the-curb gas piping and in the outside cabinet wall for across the roof gas piping.

.5 High Turndown Modulating Natural Gas Furnace shall be equipped with modulating gas valves, adjustable speed combustion blowers, stainless steel tubular heat exchangers, and electronic controller. Combustion blowers and gas valves shall be capable of modulation. Electronic controller includes a factory wired, field installed supply air temperature sensor. Sensor shall be field installed in the supply air ductwork. Supply air temperature setpoint shall be adjustable on the electronic controller within the controls compartment. Gas heater shall be capable of capacity turndown ratio as shown on the unit rating sheet. Heat trace shall be included on the condensate drain line.

2.10 FILTERS

.1 Unit shall include 2-inch thick, pleated panel filters with an ASHRAE MERV rating of 8, upstream of the cooling coil.

.2 Unit shall include a clogged filter switch.

2.11 OUTSIDE AIR/ECONOMIZER

.1 AHU3003: Unit shall include 0-100% economizer consisting of a motor operated outside air damper and return air damper assembly constructed of extruded aluminum, hollow core, airfoil blades with rubber edge seals and aluminum end seals. Damper blades shall be gear driven and designed to have no more than 15 CFM of leakage per sq. ft. of damper area when subjected to 2 inches w.g. air pressure differential across the damper. Unit shall include outside air opening bird screen, outside air hood with rain lip and barometric relief dampers.

.2 AHU8001: Unit shall include 0-100% economizer consisting of a motor operated outside air damper and return air damper assembly constructed of extruded aluminum, hollow core, airfoil blades with rubber edge seals and aluminum end seals. Damper blades shall be gear driven and designed to have no more than 20 cfm of leakage per sq ft. at 4 in. w.g. air pressure differential across the damper. Low leakage dampers shall be Class 2 AMCA certified, in accordance with AMCA Standard 511. Damper assembly shall be controlled by spring return actuator. Unit shall include outside air opening bird screen, outside air hood, and relief dampers.

2.12 CONTROLS

.1 Factory Installed and Factory Provided Controller:

.2 Unit controller shall be capable of controlling all features and options of the unit. Controller shall be factory installed in the unit controls compartment and factory tested. Controller shall be capable of standalone operation with unit configuration, setpoint adjustment, sensor status viewing, unit alarm viewing, and occupancy scheduling available without dependence on a building management system.

.3 Controller shall have an onboard clock and calendar functions that allow for occupancy scheduling.

.4 Controller shall include non-volatile memory to retain all programmed values without the use of a battery, in the event of a power failure.

.5 Unit shall modulate cooling with constant airflow to meet ventilation outside air loads. Cooling capacity shall modulate based on supply air temperature.

.6 Unit shall modulate heating with constant airflow to meet ventilation outside air loads. Heating capacity shall modulate based on supply air temperature Field Installed DDC Controls by Controls Contractor.

2.13 ROOF CURBS

.1 Rooftop equipment seismic curb 600 mm high with continuous plenum base with baffle separating supply and return plenums.

.2 The frame must provide continuous support for the equipment and must resist wind and seismic forces.

.3 All hardware must be plated with a rust resistant finish.

.4 Curb waterproofing shall consist of a continuous galvanized counter flashing nailed over the curbs waterproofing.

.5 Plenum curb shall have 50 mm acoustic insulation on inside surfaces.

.6 The rooftop unit must be solidly fastened to the curb, and the curb anchored to the roof structure.

.7 Roof curb construction to conform to requirements of National Roofing Contractors Association (NRCA).

.8 Provide seismic restraint calculations from P.Eng. For all equipment connections to curb and to the structure.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Installation, Operation, and Maintenance manual shall be supplied with the unit.

.2 Installing contractor shall install unit, including field installed components, in accordance with Installation, Operation, and Maintenance manual instructions.

.3 Start up and maintenance requirements shall be complied with to ensure safe and correct operation of the unit.

END OF SECTION

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

1.2 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 20 05 01 - Mechanical General Requirements.

.2 Indicate:

.1 Equipment, capacity and piping connections.

.2 Dimensions, internal and external construction details, recommended method of installation with proposed structural steel support, sizes and location of mounting bolt holes.

PART 2 PRODUCTS

2.1 FORCE FLOW UNIT HEATERS

.1 Cabinet: horizontal, vertical, recessed or surface type as indicated, 16 ga. thick steel with rounded exposed corners and edges, removable panels, glass fibre insulation and integral air outlet and inlet. Lockset access doors to fan switch.

.2 Finish with factory applied primer coat.

.3 Coils: aluminum fins mechanically bonded to copper tubes. Hydrostatically tested to 1034 (150 psi).

.4 Fans: centrifugal double width wheels, statically and dynamically balanced, direct driven, sleeve bearings, resilient mounted.

.5 Motor: multi-speed, tapped wound permanent split capacitor type with sleeve bearings, built-in thermal overload protection and resilient rubber isolation mounting.

.6 Filters: removable 25 mm thick fibrous glass throwaway type.

.7 Capacity: as indicated on schedule drawing. Base hot water heating capacity on 60°C (140°F) E.W.T., 22°C (40°F) temperature drop & 17°C (65°F) EAT.

.8 Control:

.1 3 speed switches with integral overloads in cabinet.

.2 Control thermostat: Remote Integral electric, line voltage, rating to suit cabinet unit heater. Locking cover, set point locking device, concealed

adjustment, brushed aluminum stainless steel cover and guard. Turn over remote thermostats to Division 26 for installation & wiring.

.9 Acceptable material: Rosemex, Sterling, Rittling, Trane, Engineered Air, Sigma.

2.2 HORIZONTAL UNIT HEATERS

.1 Casing: 16 ga. thick cold rolled steel, gloss enamel finish, with threaded connections for hanger rods.

.2 Coils: seamless copper tubing, silver brazed to steel headers with evenly spaced aluminum fins mechanically bonded to tubing. Hydrostatically test to 150 psi.

.3 Fan: direct drive propeller type, factory balanced, with anti-corrosive finish and fan guard.

.4 Motor: speed as indicated continuous duty, built-in overload protection, and resilient motor supports.

.5 Air outlet: four-way adjustable louvres.

.6 Capacity: as indicated on schedule drawing.

.7 Control room thermostat: Remote Integral electric, line voltage, locking cover, set point locking device, concealed adjustment, c/w guard. Turn over remote thermostats to Division 26 for installation & wiring.

.8 Acceptable material: Rosemex, Sterling, Rittling, Trane, Engineered Air, Sigma.

2.3 HYDRONIC REHEAT COILS

.1 General:

.1 Cleanable tube type: cast brass headers and straight copper tubes.

.2 Plate fin type: tubes mechanically bonded to fins. Spiral wound fin type: mechanically bonded to tubes.

.3 All non-ferrous tubes and headers: brazed assembly.

.4 Maximum tube length: 3.6 m unless specified otherwise.

.5 Factory tested with air under water.

.2 Ratings: AHRI Certified. Submit with shop drawings actual heating fluid entering and leaving conditions for stated air side requirements.

.1 Unless otherwise indicated, preheat coils to be rated for 2.5 m/s (500 fpm).

.2 Pressure drops through heating coils: as indicated.

.3 Water velocity: 1.2 m/s maximum. Under 0.6 m/s, turbulators may be used if manufacturer's standard practice.

.3 Coil casings:

.1 Steel: die formed 1.6 mm thick galvanized zinc coated steel sheet.

.2 Tube supports: allow for expansion and contraction.

.3 Supports: steel channel or double angle frames or other approved support. Provide brass supports for copper coils.

.4 Blank-off plates: of similar material as casing to prevent air bypass. Seal openings where pipes pass through casing using methods recommended by SMACNA.

.4 Heating water coils: cleanable fins.

.1 Tubes: copper.

.2 Fins: aluminum.

.3 Headers: cast brass.

.4 Pressure tests: 1.7 Mpa.

.5 Capacities: as indicated.

.5 Acceptable materials: Aerofin, Heatcraft, Rosemex.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install in accordance with manufacturer's instructions.

.2 Provide double swing pipe joints as indicated.

.3 Hot water units: for each unit, install ball valves on inlet and CB valve outlet of each unit. Install drain valve at low point. Install manual air vent at high point.

.4 Clean finned tubes and comb straight.

.5 Provide supplementary suspension steel as required.

.6 Thermostats on outside walls: mount on insulated backplates.

.7 Before acceptance, set discharge patterns and fan speeds to suit requirements.

.8 Provide duct access doors before and after reheat coils.

END OF SECTION

ELECTRICAL RESISTANCE HEATING

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 This section shall be read in conjunction with specification Section 26 05 00 - Common Work Results for Electrical, all electrical sections, and all other disciplines related to the project.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CSA C22.2 No. 14-18 (R2022), Industrial Control Equipment.

.2 CSA C22.2 No. 46-13 (R2022), Electric Air-Heaters.

1.3 MATERIAL STANDARDS

.1 Canadian Standards Association (CSA)

.1 Electric heaters to CSA C22.2 No. 46.

.2 Controls to CSA C22.2 No. 14.

1.4 GENERAL

.1 Provide heaters c/w relays, transformers, etc. and wiring to make a complete system as indicated.

1.5 PRODUCT DATA

.1 Submit product data in accordance with Section 26 05 00 - Common Work Results for Electrical for all heater types and controls.

PART 2 PRODUCTS

2.1 UNIT HEATERS

.1 Unit heaters equal to Ouellet OHX series, volts, wattage as indicated.

.2 Acceptable alternate manufacturers: Trane or approved equal via addendum.

.3 Complete with wall mounted remote thermostat.

2.2 FORCED AIR CONSOLE HEATERS

.1 Ouellet series OAC, volts, phase, wattage as indicated.

.2 Front-in, Front-out air flow.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install electric heating to manufacturer's instructions.

.2 Test system to ensure all heaters and controls are operating correctly.

.3 Suspend unit heaters from ceiling or wall as indicated, using manufacturer's mounting brackets.

.4 Test fan delay switch to assure dissipation of heat after element shutdown.

END OF SECTION

DIVISION 25 INDEX

CONTROL PANELS

PART 1 GENERAL

1.1 SUMMARY

.1 This Section includes:

.1 Supply of Control Panels by Division 25.

.2 Installation of Control Panels by Division 26, including provision of all hardware, wiring and interconnection as indicated on drawings and described in the specifications.

1.2 RELATED REQUIREMENTS

.1 Section 25 05 02 – SCADA Configuration

.2 Section 25 05 05 – Control Panel Configuration

.3 Section 26 05 00 – Common Work Requirements, Electrical

.4 Section 26 05 21 – Wires and Cables, 0-1000V

.5 Section 26 29 03 – Control Devices

.6 Section 26 29 20 – Variable Frequency Drives

.7 Section 26 90 00 – Wiring of Equipment Supplied by Others

1.3 REFERENCE STANDARDS

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No. 38-14, Thermoset-insulated Wires and Cables

.2 CSA C22.2 No. 127-15, Equipment and Lead Wires

.3 CSA C22.2 No. 214-17, Communications Cables

.4 CSA C22.2 No. 239-17, Control and Instrumentation Cables

1.4 SUBMITTALS

.1 Make submittals in accordance with Section 01 33 00 – Submittals and 01 78 00 – Closeout Submittals.

.2 Submit for review:

.1 Equipment list and systems manufacturers within ten (10) working days after award of contract.

.3 Quality Control:

.1 All new equipment and assemblies of equipment shall be fabricated in a CSA approved panel shop. Permanent CSA labels shall be attached to each assembly and all equipment supplied.

.2 All field modifications to existing equipment shall be completed by a CSA approved panel shop. Field Permanent CSA labels shall be attached to each assembly and all equipment supplied.

.3 Provide equipment and material from manufacturer's regular production, CSA certified, manufactured to standard quoted plus additional specified requirements.

.4 Where CSA certified equipment is not available, submit such equipment to inspection authorities for special inspection and approval before delivery to site.

.5 Submit proof of compliance to specified standards with shop drawings and product data in accordance. Label or listing of specified organization is acceptable evidence.

.6 In lieu of such evidence, submit certificate from testing organization, approved by third party Engineer registered in Canada, certifying that item was tested in accordance with their test methods and that item conforms to their standard/code.

.7 For materials, whose compliance with organizational standards/codes/ specifications is not regulated by an organization using its own listing or label as proof of compliance, furnish certificate stating that material complies with applicable referenced standard or specification.

.8 Permits and fees: in accordance with general conditions of contract.

1.5 MAINTENANCE DATA

.1 Provide CAD as-built panel drawings and wiring schematics for each panel.

1.6 SCOPE OF WORK

.1 Provision of shop assembled control panels in accordance with Contract Drawings. Panels shall be complete with all devices for a complete and operational system, including but not limited to the devices and features described in Part 2 – Products.

.2 Provision of PLC programming – see Specification 25 05 05 – Control Panel Configuration.

.3 Provision of SCADA configuration - see Specification 25 05 02 – SCADA Configuration.

.4 Provision of network administration services for WPCP “SCADA” and “INTERNET” networks until plant is fully commissioned.

PART 2 PRODUCTS

2.1 ENCLOSURES

.1 Enclosures shall be NEMA 12 with the following features:

.1 Grey finish with white removable backplane.

.2 Suitable for floor mounting c/w feet and wall fasteners at top.

.3 Provide 120% of panel space required for all devices.

2.2 PROGRAMMABLE LOGIC CONTROLLERS

.1 ControlLogix 5580, 1756-L82E 5MB Ethernet processor in accordance with Contract Drawings, for CP-81. I/O and components consisting of:

.1 Provide 5GB SD compact flash card for backup memory for each 5580 processors.

.2 Provide 20% spare I/O for each I/O type.

.3 Digital I/O to be 120VAC unless indicated otherwise.

.4 Prosoft Modbus COMM Module – MV156E-MCM required in CP-81 for interfacing to ION 7650 Power meter & Generator controller.

.5 Provide an extended depth terminal block housing (1756-TBE) for each ControlLogix I/O card with 36-pin terminal blocks.

.6 PLC power protection shall include CSA approved surge suppression and a UPS sufficient for panel load requirements for 20 minutes. UPS shall be located inside the PLC panel enclosure.

.7 All analog instrumentation connected to PLC shall be powered from a 24VDC power supply mounted in the PLC panel.

.1 Power supply to be connected to positive and negative terminal blocks for instrumentation power.

.2 The power supply shall have a minimum of 50% spare capacity.

.2 Allen Bradley CompactLogix 5370, 1769-L33ER 2MB dual Ethernet processor in accordance with Contract Drawings, for CP-31, CP-61 and CP-71 (provisional item). I/O and components consisting of:

.1 Provide 2GB SD compact flash card for backup memory for each 5370 processor.

.2 Provide 20% spare I/O for each I/O type.

.3 Digital I/O to be 120VAC unless indicated otherwise.

.4 PLC power protection shall include CSA approved surge suppression and a UPS sufficient for panel load requirements for 20 minutes. UPS shall be located inside the PLC panel enclosure.

.5 All analog instrumentation connected to PLC shall be powered from a 24VDC power supply mounted in the PLC panel.

.1 Power supply to be connected to positive and negative terminal blocks for instrumentation power.

.2 The power supply shall have a minimum of 50% spare capacity.

2.3 TOUCHSCREEN OPERATOR INTERFACE TERMINAL (OIT)

.1 Door-mounted, 15”, color, touch-screen, Ethernet-connected, 24VDC-powered HMI.

.2 HMI to be programmed for all I/O and control functions directly controlled by each panel PLC.

.3 Center height of HMI shall be 1525mm above finished grade when panel is installed.

.4 Standard of acceptance: Allen-Bradley Panel View Plus 7 Performance, model number 2711P-T15C22D9P, or approved equivalent.

2.4 ETHERNET SWITCHES

.1 Industrial-type Managed Ethernet Switches for physically separate “SCADA” and “INTERNET” networks:

.1 EtherNet/IP, DIN-rail mounted, 24 VDC power supply, operating temperature between 0- and 45-degrees C.

.2 Ethernet switches shall have 20% spare RJ45 ports, minimum 2.

.3 If required, fiber ports shall be SC type. Number of fiber ports as shown in Network Topology Drawing plus minimum 1 spare pair.

.4 Acceptable manufacturers: Phoenix Contact, Hirschmann, Cisco Stratix or approved equivalent.

2.5 WIRELESS ACCESS POINTS

.1 Industrial-type WLAN access point / client for USA & Canada, with two internal antennas for single-hole mounting, IP54 rating, WLAN 802.11 a/b/g/n, frequency: 2.4 GHz & 5 GHz.

.2 Connections:

.1 Power supply: 18-32 VDC

.2 RJ45: for LAN, web, http/https, Command Line Interface

.3 Operating modes: access point, client adapter, repeater

.4 Configuration: Web-based management, command line interface

.5 Security: 802.11i, WPA PSK (preshared key), WPA2, AES, TKIP, MAC filter, supports 802.1X/RADIUS

.6 Standard of acceptance: Phoenix Contact FL WLAN 1101, or approved equivalent.

2.6 FIBER-OPTIC PATCH PANEL

.1 Modular Industrial Patch Panel:

.1 DIN-rail mounted.

.2 6 x SC duplex adapter modules. One module for each incoming 6-pair fiber cable into the control panel.

.3 Strain relief cable glands on all incoming fiber bundle cables.

.2 Standard of acceptance: Hirschmann MIPP Fiber Splice Box, or approved equivalent.

2.7 TERMINAL BLOCKS

.1 Terminal blocks shall be DIN-rail mounted Phoenix Contact UK Series or approved equivalent.

.2 3-level terminal blocks with fuses for all analog I/O channels.

.3 2-level terminal blocks for all digital input channels.

.4 All terminal blocks shall be labelled.

.5 All wires terminated to terminal blocks shall have crimped ferrule lugs.

2.8 INTERPOSING RELAYS

.1 Provide interposing relays for all digital outputs, DIN mounted, with the following features:

.1 Indicating light.

.2 24VDC or 120VAC coil, as required by the PLC digital output voltage.

.3 2A, 120VAC contact, minimum.

2.9 WIRING

.1 All wiring to have tin-plated stranded copper conductors, minimum 19 strands.

.2 All wiring shall have 600V, thermosetting type insulation of one of the following CSA types:

.1 REW

.2 CL1251

.3 CL1503

.4 Or approved equivalent.

.3 Type TEW wire is not acceptable.

.4 Provide shielded-twisted-pair instrument cable from all analog channels to terminal blocks, including spare channels. Analog channels shall be fused at terminal block with fuse status indication.

.5 All common supply digital output channels shall be fused at the channel output block.

.6 All wires terminated to terminal blocks shall have crimped ferrule lugs.

.7 Ethernet cables patch cables shall be pre-manufactured CAT5e.

.8 Fiber optic cable patch cables shall be pre-manufactured OM2 50/125um duplex multimode cable, with SC type connectors.

2.10 WIRING LABELS

.1 Label all wires with the corresponding I/O designation (e.g. “I:2/07”). Label commons with corresponding uniquely named labels.

.2 Analog cables shall be labelled with their channel designation (e.g. I:1/02) on their jacket with the “+” or “-” wires individually labelled.

.3 All wiring labels shall be mechanically printed and shall be permanent wiring adhesive strips.

2.11 WIRING DUCT

.1 Wiring duct shall be:

.1 Manufactured of high impact self-extinguishing warp resistant PVC, grey in colour.

.2 Minimum size 50mm width X 75mm height.

.3 Provided with continuous covers and finger slots every 20mm on both sides along the entire length of the duct.

2.12 TRANSIENT VOLTAGE SURGE SUPPRESSOR

.1 Provide a CSA approved, DIN mounted, transient voltage surge suppressor. Surge suppressor shall include an auxiliary contact for fault indication connection to PLC input.

.2 Standard of acceptance: Phoenix Contact Type 2 Surge Arrester or approved equivalent.

2.13 UPS FAIL CONTACTOR

.1 Provide contactor with 4 power poles – 2 N.O., 2 N.C. screw terminals, and 1 N.C. aux. contact for alarm to PLC.

.2 Standard of acceptance: Allen Bradley Bulletin 100-C, or approved equivalent.

2.14 UNINTERRUPTIBLE POWER SUPPLY

.1 Provide one (1) Uninterruptible Power Supply for each of the shop manufactured PLC panel, with sufficient capacity to maintain operation of each panel for twenty (20) minutes minimum.

.2 UPS to be modular type with separate power pass module, transfer utility, lightning and surge protection, overload indicators, replace battery indicator, and user-replaceable hot-swap sealed batteries. UPS shall also have two (2) dry contact status contacts to be wired to each PLC in panel (Fault Status and On Battery Status).

.3 Standard of acceptance: Eaton 9PX series, or approved equivalent.

.4 CP-81 UPS load to include the following devices:

.1 Power metering unit in Main Switchboard

2.15 GROUND BUS

.1 Provide two (2) 10mm X 50mm X 150mm stand-off mounted ground bus with 32 drilled and tapped holes. One isolated ground busbar for 24VDC analog instrumentation and one power ground busbar for 120VAC devices.

.2 Separate #6 AWG insulated bond wire from instrumentation ground bus to electrical room ground bus to be provided by Div. 26.

2.16 UTILITY ITEMS

.1 LED working light wired to door switch.

.2 Door mounted (outside) laptop shelf. Shelf height shall be 1050mm above finished floor when panel is installed.

.3 Duplex convenience receptacle on enclosure backplane.

.4 Door mounted (outside) network port and laptop receptacle.

.5 Door mounted (inside) drawing pocket.

2.17 INTRINSIC SAFETY BARRIERS

.1 Provide isolated, DIN rail mounted, Intrinsically Safe Barriers for devices to be wired from each PLC panel to classified areas.

2.18 CIRCUIT BREAKERS

.1 Provide circuit breakers for each device being powered from control panel, sized as recommended by device manufacturer. Provide 20% spare circuit breakers.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install shop manufactured Control Panels as indicated by Division 26 and Contract Drawings.

.2 Terminate field wiring on terminal blocks as indicated and provide wiring labels to correspond with wire label to which the field wire is to be connected. All ends of the field wiring shall be labelled (i.e. at the field device, junction box and control panel). Typically, the wire label would consist of the input or output designation, e.g. I:12/07.

.3 Field wiring terminated to panel terminal blocks shall have crimped ferrule lugs.

.4 No wiring shall enter the control panel from the top of the enclosure.

.5 Electrical inspection of panel shall be carried out and completed prior to installation. Proof of all necessary certification will be provided by the Contractor to the Engineer at time of installation.

.6 Configuration of PLC application software by Section 25 05 05 Integrator.

3.2 IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results – Electrical.

.2 Install size 5 nameplate indicating tag name, and circuit fed from.

3.3 COMMISSIONING

.1 Ensure noiseless ground-bus is mounted in PLC Panels and connected to building ground bus using separate #6AWG wire.

.2 Ensure cable shields and network grounds are connected to noiseless ground.

.3 Verify proper function of devices which receive power from control panels.

.4 Check motor rotations and configure variable frequency drive parameters.

.5 Stroke valves and verify limit switches if applicable.

.6 Calibrate analog inputs and outputs.

.7 Document and confirm digital input and output designations. i.e. open/close, on/off, up/down, in/out using PLC program.

.8 Tune process control loops

.9 Verify that all alarms are correctly delayed, set, acknowledged, and reset and that both the General Process Alarm to the Alarm Notification responds correctly.

END OF SECTION

PART 1 GENERAL

1.1 CONFIGURATION OF SCADA

.1 Supply of SCADA by Division 25. Division 26 to supply, install and provide all wiring and interconnection as indicated on drawings.

.2 The Contractor shall solicit the services of the prequalified System Integrator listed below to provide the SCADA work as defined in this Section.

Capital Controls and Instrumentation Inc.
1333 Michael St. Unit 03
Ottawa, ON, K1B 3M9
C/O: Brad Lavallée, brad.lavallee@capitalcontrols.ca
Tel: 613-248-1999

1.2 RELATED SECTIONS

.1 Section 25 05 01 – Control Panels

Section 25 05 05 – Control Panel Configuration

1.3 SUBMITTALS

.1 Make submittals in accordance with Section 01 33 00 – Submittals and 01 78 00 – Closeout Submittals.

1.4 MAINTENANCE DATA

.1 Provide operation and maintenance data for SCADA system for incorporation into manual.

1.5 SCOPE OF WORK

.1 Provision of SCADA programming, configuration, development, and connectivity to support the installation, commissioning, and acceptance of the Wastewater Treatment Plant.

.2 The SCADA system will act as the Human Machine Interface (HMI) for all devices interfaced to the PLC's and controls.

.3 SCADA will provide the monitoring, controlling, alarming, logging, and reporting features required for effective operations.

.4 Configuration and programming of the door mounted displays in each cabinet. These touch screen displays will act as the Operator Interface Terminal (OIT) for all devices interfaced to each PLC. These displays are to mimic the main SCADA screens.

.1 Provision sample screens to be approved by the Contract Administrator before implementation. The screens shall include, but not be limited to:

.2 Process Overview

.3 Device Control pop-ups

.4 Reports

.5 Alarm display and Summary

.6 Historical Trends

.7 Setup

.8 Detailed Process illustrations

.9 Hardware check-out/maintenance screens

.5 SCADA Integrator to be available for support 24/7 for the 1-year warranty period. Maximum of 4-hour response time to be on site if required during warranty period.

.6 Provide Operation and Maintenance Data for SCADA system for incorporation into O&M manuals.

1.6 CODES & STANDARDS

.1 IEC 61000-4-2, 61000-4-3 & 61000-4-4: Electromagnetic Compatibility (EMC)

.2 IEC 61499-1 & 61499-2: Function Blocks for Industrial Process Measurement and Control Systems

.3 IEC 61158-2: Fieldbus Standard for Use in Industrial Control Systems – Physical Layer Specifications and Service Definition

.4 IEC 61131-3: Sequential Function Chart, Function Block, Ladder Diagram, Structured Test, and Instruction List editors

PART 2 PRODUCTS

2.1 USER PROGRAM

.1 Executable software, database or timed interval/event report written or assembled for the purpose of control, monitored, and reporting with respect to the operation of equipment provided under this contract. This includes but is not limited to PLC/RTU programs, spreadsheets and macros, scripts, databases, queries and searches, VB add-ons, transmitter configurations and microprocessor-based instrument calibrations.

.2 User programs shall not be proprietary.

.3 Programming, data table structure, and memory usage shall be documented. Most efficient methods and memory usage shall be employed.

.4 User programs shall be submitted in hardcopy and softcopy for archive at the completion of the project and/or at the request of the Engineer.

.5 Subsequent edits to user programs shall be submitted in hardcopy and softcopy for archive.

2.2 SCADA OPERATOR STATION PC (2 REQUIRED)

.1 Workstation (ThinkStation P3 Tower or equivalent)

.1 Intel i7 vPro Processor

.2 32 Gb RAM

.3 1 TB boot drive

.4 2x 4TB RAID 1 spinner drives

.5 Windows 11 Pro 64 OS

.6 Dual display port outputs

.7 1Gb ethernet port

.8 4 USB-A ports, 1 USB-C port

.2 Two Monitors – 27",1920 x 1080 resolution (HP E27 G5 or equivalent)

.1 Adjustable height, tilt & swivel

2.3 SCADA RACK WITH COMPONENTS

.1 21U Server rack c/w two vertical 6 outlet strips.

.2 Rackmount UPS

.3 One Synology DS423+ Network Attached Storage (NAS) c/w four Western Digital RED 6TB hard drives with RAID 5 redundancy and required software.

.4 Level 3 Switches / components

.1 One - HP Aruba CX6300 24-port SFP+ and 4-port SFP56

.1 Dual power supplies

.2 SFP56 to SFP56 0.65m DAC cables (2)

.3 SFP+ to SFP+ 10Gbe 3M DAC cables (6)

.4 HPE Aruba Networking CX 6200M 24G 4SFP+ Switch (1)

.5 HPE Aruba Networking X371 12VDC 250W 100-240VAC PS (1)

.6 HPE Aruba Networking 10G SFP+ to SFP+ 1m DAC cable (1)

2.4 SOFTWARE LICENSES

.1 The Township's existing SCADA programming software shall be upgraded to the latest version of ROCKWELL FactoryTalk View SE with Unlimited Screen limits, for the Work described in this Section - to run on the two 'new' operator workstations.

.2 Existing alarm dialer software to be upgraded to latest version.

.3 If required, Contractor shall provide any additional software required for the Work described in this section.

PART 3 EXECUTION

3.1 GENERAL SCADA SOFTWARE REQUIREMENTS

.1 The SCADA software shall consist of a Human-Machine Interface (HMI) system with support for supervisory and process control, real-time data acquisition, alarm and event management, historical data collection, report generation, remote communications to PLC's.

.2 The SCADA system will act as the Human-Machine Interface (HMI) for all devices Interfaced to the plant PLC's and remote PLC's. It will provide the monitoring, controlling, alarming, logging, and reporting features required for effective operations.

.3 Navigation through the overview screens will allow the user of the system the ability to move forward or reverse on all systems by pressing on tabs as illustrated on the Process and Instrumentation Diagram. Process flow will be from left to right.

.4 The SCADA system operator shall be able to execute all monitoring and supervisory control functions from this HMI. Typical operator commands include modifying setpoints for control loops, alarm acknowledgment and setpoint adjustment, auto/manual switching and on/off control of field devices and taking points or devices on/off scan. The operator shall be able to access all SCADA tag name/hierarchical names or graphic displays from any workstation on the network without having to know which data historian or server the point or display resides on. The system software shall include an object-oriented colour graphics display generator with full animation capabilities to provide users with a realistic visualization of the system process. All graphical editing operations shall be point-and-click; selecting icons from a floating and docking tool bar, pull down menus or keyboard commands. It shall be possible to perform a functional test of any graphic display by switching to the runtime mode with a single mouse click. The graphics editor shall include a broad library of complex objects and process symbols such as meters, pushbuttons, sliders, gauges, pumps, motors, tanks, valves, trends, alarms, and controller faceplates. All complex objects shall be

scalable to any size and may include animation links to provide dynamic response based on real-time data or user action.

.5 Display Navigation

.1 Operators shall interface to all process and SCADA activities through easily recognized icons, pull down or full screen menus.

.2 The operator shall be able to access displays via a pointing device and/or soft key menus with a choice of function keys, cursor control keys, or any single key on the keyboard. Display navigation shall not normally require the use of typing text commands into an alphanumeric keyboard. Supported pointing devices shall include a mouse or touch screen.

.3 The operator shall be able to easily identify which objects are selectable from any display by simply dragging the pointing device over the object. Displaying a halo around the object shall provide confirmation that an object can be selected. Typical objects include process device symbols (pumps, motors, etc.) controller faceplates, buttons or switches or sliders.

.6 Programming Conventions

.1 The status of a device shall be illustrated graphically (e.g. colour change), and in text form in the SCADA display. States include but are not limited to ON / OFF, UP / DOWN, OPEN / CLOSED, AUTO / MANUAL, REMOTE / LOCAL, NORMAL / ALARM. Status colours shall be as follows: GREEN for ON, RUN and OPEN. RED for OFF, STOP and CLOSED. BAR GRAPHS: Levels shown shall be shown in BLUE when in normal operating conditions and flashing RED when in alarm condition, (once alarm acknowledged – RED, not flashing).

.2 Trends shall be located on separate full-size screens or pop-up displays. Trend displays shall be historical available for all analog values. There shall be no greater than 4 pens per trend. X & Y axis magnitude and starting value shall be adjustable by sliders.

.3 Control loop displays shall contain Setpoint, Process Variable, Actuator Position, Ready/Suspend status, Auto/Manual status and switching, Remote/Local status and loop alarm information. Displays shall reflect field status at all times. Displays will include pop ups for any interlock status information. Display will include help windows with complete text descriptions explaining controls. Targets to access hardware check-out / maintenance screens shall on the help screens or windows.

.4 Device tags and their descriptions shall be identical to the field processor they originate from, as indicated on the plant P&ID. Tag name naming conventions shall be consistent throughout the plant.

.5 The following shall be provided for all devices on the network of PLC’s at a minimum:

.1 Pumps (and Blowers): SCADA will provide the following information on each of the Pumps in the system, VFDs included if applicable. This includes the historical logging and trending of the following data:

.1 Pump Run status
.2 Pump Ready status
.3 Pump Fail status (Overload, Overtemp, Seal Fail, VFD Fail, etc)
.4 Selector switch position (Local, Off, Remote)
.5 Maintenance Count in hours
.6 Elapsed Runtime Hours
.7 Hours since last maintenance (Operator Configurable via SCADA)
.8 Hours until next maintenance (Operator Configurable via SCADA)
.9 VFD Command Speed
.10 VFD Actual Speed
.11 Motor Voltage
.12 Motor Amps

.2 Valves: The SCADA will provide the following information on each of the Valves in the system. This includes the historical logging and trending of the following data:

.1 Valve Open
.2 Valve Closed
.3 Selector switch position. (Local, Off, Remote)
.4 Valve Fail status (Fail to Open/Close, etc)
.5 Valve Actuated Position
.6 Valve Actuated Command Position

.3 Transmitters (Flow, Pressure, Level, Analytical, etc): The SCADA will provide Historical logging and Trending of each of these devices as well as High and Low alarm setpoints that are operator adjustable.

.1 Discrete Instruments (Pressure Switches, Level Switches, Motion Switches, etc):
.2 The SCADA will provide historical logging and trending of each of these devices.

.4 Fixed Speed Motors: The SCADA will provide the following information on each of the Motors in the system. This includes the Historical logging and Trending of the following data:

.1 Motor Run status
.2 Motor Ready status
.3 Motor Command state
.4 Motor Fail status (Overload, Overtemp, Seal Fail, VFD Fail, etc)
.5 Selector switch position. (Local, Off, Remote)
.6 Maintenance Count in hours.

.7 Elapsed Runtime Hours.

.8 Hours since last maintenance (Operator Configurable via SCADA)

.9 Hours until next maintenance (Operator Configurable via SCADA)

.10 Motor Amps

.6 Configure PLC application software to perform process functions as described in approved Sequence of Operation and as illustrated in Contract Drawings.

.7 Configure communication settings to establish required communications with other devices on the network.

.8 Configure PLC so that all PLC alarms are configurable for dial-out as determined with operations staff and contract administrator.

3.2 INSTALLATION

.1 Configure communication with plant and remote PLC's.

.2 Co-ordinate with Sections 25 05 01, and 25 05 05 to establish connectivity of SCADA computer.

.3 Install and configure all applications on the SCADA PC and ensure correct operation.

.4 Demonstrate that the SCADA project starts & runs without operator intervention on power-up and restarts normally on a power-fail recovery.

.5 Demonstrate the proper operation of SCADA project and supporting applications.

.6 Provide a written report to Engineer upon completion of SCADA system installation.

.7 Address any deficiencies listed by the Engineer at no extra expense to the Owner.

3.3 FIELD QUALITY CONTROL

.1 Provide 20 hours of training for operators and maintenance personnel, to consist of five, four-hour sessions. Dates are to be approved by the Owner. Training shall include:

.1 Automatic Startup (Normal) and shutdown of system and application.

.2 Manual Startup and shutdown of the application.

.3 Overview of site networks.

.4 Alarm management.

.5 Printer maintenance.

.6 Reports.

.7 Detailed operator's manual.

.8 Detailed maintenance/design manual.

END OF SECTION

CONTROL PANEL CONFIGURATION

PART 1 GENERAL

1.1 CONFIGURATION OF CP'S

.1 Programming and configuration of the Control Panels and Modification to existing Panels supplied by this Division.

.1 The Contractor shall solicit the services of the prequalified System Integrator listed below to provide the Control Panel Configuration as defined in this Section.

Capital Controls and Instrumentation Inc.
1333 Michael St. Unit 03
Ottawa, ON, K1B 3M9
C/O: Brad Lavallée, brad.lavallee@capitalcontrols.ca
Tel: 613-248-1999

1.2 RELATED SECTIONS

.1 Section 25 05 01 – Control Panels

.2 Section 25 05 02 – SCADA

1.3 SUBMITTALS

.1 Make submittals in accordance with Section 01 33 00 – Submittals and 01 78 00 – Closeout Submittals.

.2 Submit a PLC Sequence of Operation Control Narrative for each PLC for review and approval.

.1 Prepare narratives in Microsoft Word file format. When indicated, provide documents in editable file format for incorporation into plant manual. Otherwise provide Adobe Reader files (PDF type with commenting allowed).

.3 Provide Operation and Maintenance Data for SCADA system for incorporation into O&M manuals.

1.4 MAINTENANCE DATA

.1 Provide as-built updated control narrative in SCADA/PLC manual. Include detail comments and complete PLC/operator interface configuration and programming printouts in manuals.

1.5 SCOPE OF WORK

.1 Provide programming and configuration to meet requirements of processes including but not limited to:

.1 All coding for each PLC.

.2 Configuration and programming of touchscreen Operator Interface Terminal (OIT) displays in each panel.

.2 Provision of PLC programming as approved in the PLC Sequence of Operation, to support the installation, commissioning, and acceptance of the systems.

.1 After the programs have been fully written documented, commented, and tested, a formal presentation/review shall be made with the engineer. The SCADA integrator shall review and describe the entire program, rung by rung.

.3 Provision of configuration of all networking devices to ensure full participation of each device on the Ethernet network.

.4 Co-ordination with Section 25 05 02 - SCADA to:

.1 Make all process data available for the SCADA integration.

.2 Provide PLC software to minimize calculations and logic performed by the SCADA system.

.3 Provide HMI display screens that are similar as possible to the SCADA displays.

.4 Refer to Section 25 05 02 for HMI display conventions.

.5 Co-ordination with Section 25 05 02 so that all PLC alarms are configurable for dial-out and remote inquiry as described in approved Sequence of Operation.

.6 Watchdog hand shaking logic shall be implemented to monitor healthy run status of PLC and healthy communication between SCADA and each PLC. Failure of SCADA-to-PLC watchdog pulse will cause the PLC to activate the General Alarm which will result major alarm via the dial-out modem. If the PLC program stops running, its normally closed general alarm relay will be de-energized. Failure of the PLC will cause an alarm to be displayed by the SCADA application.

1.6 USER PROGRAM

.1 User program shall not be proprietary.

.2 PLC programming shall be written in a clear organized fashion in ladder logic.

.3 Programming, data table structure and memory usage shall fully be documented. Both short and long comments initialized. Ladder rung descriptors shall be written for each rung. Each register used in the program shall have a descriptor. Most efficient methods and memory usage shall be employed.

.4 User programs shall be submitted in hardcopy and softcopy for archive at the completion of the project.

.5 Subsequent edits to user programs shall be submitted in hardcopy and soft copy for archive to the Engineer at the completion of the project, or at the Engineer’s request.

.6 Documentation to support the understanding of program content shall include tag-names, descriptions and comments and shall reflect Contract Drawings, P&ID, and approved Sequence of Operation.

.7 User program shall support the safe and correct operation of all devices physically connected to each PLC in which the user program resides.

.8 User program functionality shall reflect Contract Drawings, P&ID, and approved Sequence of Operation, and shall be subject to approval by the Engineer.

.9 Electronic copy of control narrative to be kept current and up to date as program is edited/changed. This document to be readily available to the operator via the SCADA displays – coordinate with 25 05 02.

PART 2 PRODUCTS

2.1 SOFTWARE

.1 The Township's existing PLC and HMI programming software shall be used for the Work described in this section.

.2 If required, Contractor to provide any additional software required for the Work described in this section.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Configure PLC application software to perform process functions as described in approved Sequence of Operation, Control Narrative, and as illustrated in Contract Drawings.

.2 Configure communication settings and co-ordinate with Section 25 05 02 (SCADA configuration) to establish required communications with other devices on the network.

.3 Co-ordinate with Section 25 05 02 (SCADA) to:

.1 Make all process data available to the SCADA integrator.

.2 Provide PLC software to minimize calculations and logic performed by the SCADA system.

.3 Provide HMI display screens that mimic the corresponding main SCADA iFIX screens.

.4 Configure PLC so that all PLC alarms are configurable for dial-out as described in approved Sequence of Operation.

3.2 COMMISSIONING

.1 Verify proper function of devices which receive power from control panel.

.2 Check motor rotations and configure variable frequency drive parameters.

.3 Stroke valves and verify limit switches if applicable.

.4 Calibrate analog inputs and outputs.

.5 Document and confirm digital input and output designations (Open/Close, On/Off, Up/Down, In/Out, etc.) using PLC program.

.6 Tune process control loops.

.7 Verify that all alarms are correctly delayed, set, acknowledged, and reset, and that both the General Process Alarm to the Alarm Notification responds correctly.

END OF SECTION

LEVEL ELEMENTS

PART 1 GENERAL

1.1 SHOP DRAWINGS AND PRODUCT DATA

.1 This section specifies the supply, installation, field testing, and placing into operation of various level elements and transmitters as specified below, and as identified in, but not limited to, the attached Instrumentation Data Sheets and the Contract Drawings.

.2 The attached data sheets only indicate instruments to be supplied by Div. 25. Refer to contract drawings and shop drawings for instruments supplied by preselected equipment suppliers.

.3 Responsibility shall include supply and installation of all component and Vendor subsystems as to provide a fully functioning system, including supervision, calibration, checkout, start-up operating adjustment and documentation, tagging and compliance with data sheets.

.4 Submit shop drawings and product data in accordance with Section 01 33 00 – Submittals.

.5 The measuring elements of instrumentation designated for hazardous locations must be in full compliance with the OESC.

1.2 DELIVERY, STORAGE AND HANDLING

.1 Ship assembled to the degree which is possible. Inform installer of site assembly requirements.

1.3 RELATED SECTIONS

.1 Section 01 33 00 - Submittals

.2 Section 01 91 13 - Commissioning Requirements

.3 Section 01 91 33 - Commissioning Forms

.4 Section 01 91 41 - Commissioning Training

.5 Section 44 00 10 - Process General Requirements

.6 Section 26 00 10 - Electrical General Requirements

1.4 REFERENCES

.1 ISA RP12.06.01-2003, Recommended Practice for Wiring Methods for Hazardous (Classified) Locations Instrumentation, Part 1: Intrinsic Safety.

.2 CSA C22.2 No. 0.3-01 (R2005), Test Methods for Electrical Wires and Cables

1.5 COMMISSIONING AND TRAINING

.1 Commissioning, training, and closeout documents are to be carried out in accordance with Section 01 91 13, Section 01 91 33, and Section 01 91 41.

.2 Also submit the following:

.1 Manufacturer's calibration certificates.

.2 Instrument field calibration sheets.

.3 Instrument field loop check sheets.

PART 2 PRODUCTS

2.1 MATERIAL

.1 All instrumentation, control, and electrical devices provided under this Section shall be CSA approved and shall bear the CSA approvals seal as detailed in these specifications.

.2 Each device shall be a pre-assembled packaged unit. Upon delivery to the Work Site, each level measuring system shall be ready for installation with only minor piping and electrical connections required by the Contractor.

.3 Power supply to the transmitters shall be 120V AC, 60 Hz, single phase unless otherwise indicated. Primary elements shall derive any required power from the transmitter.

.4 The systems shall be installed to measure the specified process at the ranges and conditions indicated in these specifications and on the Contract Drawings. The devices will be installed at the locations indicated on the Drawings.

.5 Environmental, temperature and pressure requirements for the instruments shall be as specified.

.6 Each instrument shall be complete with mounting flanges and/or brackets as supplied by the instrument manufacturer.

.7 Sensing units shall be mounted so that interference to the sensing function is not caused by surrounding structures. The sensor shall be mounted on its own support, purposely built by the instrument manufacturer based on the manufacturer's recommendations, to facilitate maintenance and/or adjustment.

.8 Where amplifier/transmitter electronics are installed in a classified environment the housings shall be suitable for the application. i.e. Class 1, Div. 1 and suited to a wet and corrosive environment.

.9 The system design shall be based on the process ranges and service requirements listed in these specifications and on the Contract Drawings.

2.2 ULTRASONIC LEVEL TRANSMITTER

.1 Equipment will include the level element (transducer), a remote mounted transmitter enclosure, and interconnecting cable between the transducer and transmitter enclosure. The Contractor shall install the transducers and transmitter enclosures at the approximate locations indicated on the Drawings.

.2 Mounting and installation hardware shall be 316L stainless steel. If necessary, the Contractor shall provide and install a pipe section for installation of the transducer. A junction box shall be provided for each transducer for termination of the manufacturer supplied cable. Multiple transducers in a common area can be provided with a single junction box. A multi-pole receptacle shall be provided and installed for connection of each transducer as detailed in Installation Standards.

.3 The Contractor shall install and terminate the interconnecting cable between the element and transmitter. Power and control cable connections between the transmitter and remote devices shall be provided as specified elsewhere in the Contract Documents.

.4 The transmitters may or may not be factory calibrated by the supplier and shall need to be field verified by the Contractor. The Contractor shall make adjustments to setup, zero and span settings or other adjustments as required to calibrate the instruments.

.5 The Contractor shall be responsible for start-up and testing of the devices and shall perform loop or continuity testing to verify that all electrical connections are correct. Testing shall be in accordance with the testing standards, specified elsewhere in the Contract Documents.

.6 Typical transducer range 1-10 m with 6° beam angle, minimum of 20 m cable, 1” NPT mounting thread.

.7 Tools and spare parts shall be furnished and packaged as recommended by the manufacturer. As a minimum, the following spare parts shall be furnished:

.1 One spare transducer assembly.

.2 Handheld calibration tool as required.

.8 Additional equipment: Provide vendor supplied mounting equipment to permit easy installation and removal.

.9 Acceptable manufacturers:

.1 Siemens

.2 Rosemount

.3 ABB

2.3 RADAR LEVEL MEASUREMENT

.1 Equipment will include the level element (transducer), a remote mounted transmitter enclosure, and interconnecting cable between the transducer and

transmitter enclosure. The Contractor shall install the transducers and transmitter enclosures at the approximate locations indicated on the Drawings.

.2 Mounting and installation hardware shall be 316L stainless steel. If necessary, the Contractor shall provide and install a pipe section for installation of the transducer. A junction box shall be provided for each transducer for termination of the manufacturer supplied cable. Multiple transducers in a common area can be provided with a single junction box. A multi-pole receptacle shall be provided and installed for connection of each transducer as detailed in Installation Standards.

.3 The Contractor shall install and terminate the interconnecting cable between the element and transmitter. Power and control cable connections between the transmitter and remote devices shall be provided as specified elsewhere in the Contract Documents.

.4 The transmitters may or may not be factory calibrated by the supplier and shall need to be field verified by the Contractor. The Contractor shall make adjustments to setup, zero and span settings or other adjustments as required to calibrate the instruments.

.5 The Contractor shall be responsible for start-up and testing of the devices and shall perform loop or continuity testing to verify that all electrical connections are correct. Testing shall be in accordance with the testing standards, specified elsewhere in the Contract Documents.

.6 Typical transducer range 1-10 m with 20° beam angle, minimum of 20 m cable, Flange mounting.

.7 Tools and spare parts shall be furnished and packaged as recommended by the manufacturer. As a minimum, the following spare parts shall be furnished:

.1 One spare transducer assembly.
.2 Handheld calibration tool as required.

.8 Additional equipment: Provide vendor supplied mounting equipment to permit easy installation and removal.

.9 Acceptable manufacturers:

.1 Siemens
.2 Rosemount
.3 ABB

2.4 HYDROSTATIC PRESSURE LEVEL PROBE

.1 Equipment will include the level probe (transducer), a remote mounted indicator enclosure, and interconnecting cable between the transducer and indicator enclosure. The Contractor shall install the transducers and indicator enclosures at the approximate locations indicated on the Drawings.

.2 Mounting and installation hardware shall be 316L stainless steel. The Contractor shall provide and install a pipe section for installation of the transducer. The

Contract shall coordinate the pipe diameter with the transducer diameter dimensions.

.3 A junction box shall be provided for each transducer for termination of the manufacturer supplied cable. Multiple transducers in a common area can be provided with a single junction box. A multi-pole receptacle shall be provided and installed for connection of each transducer as detailed in Installation Standards.

.4 The Contractor shall install and terminate the interconnecting cable between the element and transmitter. Power and control cable connections between the transmitter and remote devices shall be provided as specified elsewhere in the Contract Documents.

.5 The transmitters may or may not be factory calibrated by the supplier and shall need to be field verified by the Contractor. The Contractor shall make adjustments to setup, zero and span settings or other adjustments as required to calibrate the instruments.

.6 The Contractor shall be responsible for start-up and testing of the devices and shall perform loop or continuity testing to verify that all electrical connections are correct. Testing shall be in accordance with the testing standards, specified elsewhere in the Contract Documents.

.7 Tools and spare parts shall be furnished and packaged as recommended by the manufacturer. As a minimum, the following spare parts shall be furnished:

.1 One spare transducer assembly.
.2 Handheld calibration tool as required.

.8 Additional equipment: Provide vendor supplied mounting equipment to permit easy installation and removal.

.9 Acceptable manufacturers:

.1 Endress+Hauser
.2 Siemens
.3 Rosemount

2.5 HYDROSTATIC PRESSURE LEVEL TRANSMITTER – ALUM TANKS

.1 Equipment will include the level indicating transmitter with integral sensing element (transducer) and interconnecting cable between the transmitter and PLC control panel. The Contractor shall install the transmitters at the approximate locations indicated on the Drawings.

.2 Mounting and installation hardware shall be 316L stainless steel. If necessary, the Contractor shall provide and install a pipe section for installation of the transducer. A junction box shall be provided for each transducer for termination of the manufacturer supplied cable. Multiple transducers in a common area can be provided with a single junction box. A multi-pole receptacle shall be provided and installed for connection of each transducer as detailed in Installation Standards.

.3 The Contractor shall install and terminate the interconnecting cable between the transducer and the control panel. Power and control cable connections between the control panel and transducer shall be provided as specified elsewhere in the Contract Documents.

.4 The transmitters may or may not be factory calibrated by the supplier and shall need to be field verified by the Contractor. The Contractor shall make adjustments to setup, zero and span settings or other adjustments as required to calibrate the instruments.

.5 The Contractor shall be responsible for start-up and testing of the devices and shall perform loop or continuity testing to verify that all electrical connections are correct. Testing shall be in accordance with the testing standards, specified elsewhere in the Contract Documents.

.6 Tools and spare parts shall be furnished and packaged as recommended by the manufacturer. As a minimum, the following spare parts shall be furnished:

.1 One spare transducer assembly.
.2 Handheld calibration tool as required.

.7 Additional equipment: Provide vendor supplied mounting equipment to permit easy installation and removal.

.8 Acceptable manufacturers:

.1 Siemens
.2 Rosemount
.3 Endress+Hauser

2.6 CONDUCTIVITY LEVEL PROBE (MULTITRODE)

.1 Equipment will include the multi-sensor probe element, a remote mounted transmitter and intrinsically safe barrier enclosure, and interconnecting cable between the transducer and transmitter enclosure. The Contractor shall install the transducers and transmitter enclosures at the approximate locations indicated on the Drawings.

.2 Mounting and installation hardware shall be 316L stainless steel. If necessary, the Contractor shall provide and install a pipe section for installation of the transducer. A junction box shall be provided for each transducer for termination of the manufacturer supplied cable. Multiple transducers in a common area can be provided with a single junction box. A multi-pole receptacle shall be provided and installed for connection of each transducer as detailed in Installation Standards.

.3 The Contractor shall install and terminate the interconnecting cable between the element and transmitter. Power and control cable connections between the transmitter and remote devices shall be provided as specified elsewhere in the Contract Documents.

.4 The transmitters may or may not be factory calibrated by the supplier and shall need to be field verified by the Contractor. The Contractor shall make adjustments

to setup, zero and span settings or other adjustments as required to calibrate the instruments.

.5 The Contractor shall be responsible for start-up and testing of the devices and shall perform loop or continuity testing to verify that all electrical connections are correct. Testing shall be in accordance with the testing standards, specified elsewhere in the Contract Documents.

.6 Additional equipment: Provide vendor supplied mounting equipment to permit easy installation and removal.

.7 Probe:

.1 Probe Length: as shown on Instrument Data Sheet
.2 Sensors: 10 sensors
.3 Sensor Material: Avesta 254 SMO High Grade Stainless Steel Alloy
.4 Probe Material: uPVC Premium Quality Extruded Tube
.5 Cable length: specified by contractor
.6 CSA approval - Class 1, Division 1, Group D.
.7 Temperature range of 0°C to 65°C

.8 Controller:

.1 To accept ten (10) sensor inputs.
.2 10 digital outputs.
.3 LED display complete with bar-graph for level indication and power on indication.
.4 120VAC power.
.5 CSA general purpose.
.6 Accepts a ten (10) sensor probe.

.9 Acceptable products:

.1 Xylem MultiTrode Probe complete with MTIC Indicator Controller and MTISB Intrinsically Safe Barrier.

2.7 FLOAT TYPE LEVEL SWITCHES

.1 Level switches shall consist of a non-mercury type switch element encapsulated in a nominal 125 mm diameter PVC float housing. The switch contact shall be single-pole, double throw, rated 10 amperes at 120 volts AC. The float shall be supported from a flexible three-conductor 18 AWG cable which also acts as the float hinge. The cable shall be suitable for fixed mount or weighted suspension type installation as indicated on the drawings or in the Instrument Data Sheets. All necessary mounting hardware shall be provided. The hinge-cable length shall be field adjustable in a manner which allows the deadband to be adjusted between 3 mm and 900 mm.

.2 Mounting and installation hardware shall be 316L stainless steel. If necessary, the Contractor shall provide and install a pipe section for installation of the float switches. A junction box shall be provided for each float switch for termination of

the manufacturer supplied cable. Multiple float switches in a common area can be provided with a single junction box. A multi-pole receptacle shall be provided and installed for connection of switches as detailed in Installation Standards.

.3 Interconnecting cable from the float switch to the switch junction box shall be provided and installed. Cable shall be of the type approved by the float switch manufacturer. Length of cable shall be a minimum of six (6) meters.

.4 Provide each probe with the appropriate/necessary level signal interface relays to connect into remote rack mounted I/O modules. Intrinsically safe relays shall be provided to interface with switches in classified areas.

.5 Securely mount the float switches to prevent damage or entanglement with other equipment or devices. Provide all cabling for a fully functional system.

.6 Tools and spare parts shall be furnished as recommended by the manufacturer. As a minimum, the following spare parts shall be furnished:

.7 One spare float assembly.

.8 Acceptable manufacturers: Flygt or approved equivalent.

.9 All level switches with designation LSL, LSH, LLSL or LLSH shall be supplied in accordance with the Float Type Level Switches specification unless noted otherwise in the level element data sheet.

2.8 VIBRATING FORK LEVEL SWITCHES

.1 Vibrating fork level switches shall consist of a 316L stainless steel piezoelectric driven tuning fork housed in a single compartment powder coated aluminum. The switch shall be double-pole double throw, rated for 8 amperes at 250 volts AC. The unit shall be suitable for integral mounting, consisting of a single enclosure that includes the electronic module and the sensor probe. The unit shall have an extended probe length of 300 mm below the finished floor.

.2 Mounting and installation hardware shall be 316L stainless steel. The unit shall be mounted in the vertical configuration. All necessary mounting hardware shall be provided including all wall mounting hardware to secure the unit.

.3 Unit shall have a ¾” NPT mounting thread.

.4 Tools and spare parts shall be furnished and packaged as recommended by the manufacturer.

.5 Acceptable manufacturers: ABB, Rosemount, or equivalent.

PART 3 INSTALLATION

3.1 INSTRUMENTS

.1 All mounting plates, pedestals, bolts, shims, angle iron and other miscellaneous steel or hardware items required for the securing of equipment shall be supplied unless specifically noted otherwise.

.2 All instruments to be installed in accordance with the Manufacturer's installation instructions.

.3 Each instrument sensing line shall be complete with an isolation valve. The isolation valves shall conform to Divisions 44 equipment requirements.

.4 Instruments or raceway will be installed so as not to obstruct access routes, equipment maintenance space or space for future equipment.

.5 Where the removal of filter cartridges and heater elements is necessary, attention will be paid to instrument locations and tubing runs.

.6 Instrument supports shall be located and installed to provide a fully supported, secure system with minimum vibration.

3.2 INDICATORS

.1 Select instruments so that normal operating point is just above midpoint of instrument range. (60 – 70%)

.2 All indications shall be displayed on a linear scale unless otherwise specified. Local indicators shall be in engineering units.

3.3 TESTING

.1 These devices will be field calibrated by the Contractor. The Contractor shall be responsible for start-up and testing of the devices and shall perform loop or continuity testing to verify that all electrical connections are correct. Testing shall be in accordance with the testing standards, specified elsewhere in the Contract Documents.

.2 During testing demonstrate proper calibration and correct operation to the Owners Representative.

.3 Upon completion of testing of each device, affix a tag to the instrument certifying that calibration and testing have been completed and specifying the calibration points. Include loop check sheet and instrument calibration sheets in instruction books.

END OF SECTION

INSTRUMENT DATA SHEET

LEVEL TRANSMITTERS

Project	Client	Township of South Stormont	Project No.	19070
	Location	Ingleside WWTP	Instrument Spec.	25 10 01
			Revision	1

General	Tag Number	LE/LIT-4010	LIT-4031	LE/LIT-2010
	Description of Instrument	Ultrasonic Level Transmitter	Radar Level Transmitter	Ultrasonic Level Transmitter
	Service	Splitter Box Level	Tank Level	Splitter Box Level
	Location	Primary Clarifier Splitter Box	Primary Scum Tank	Aeration Splitter Box
	P&ID No.	P0005	P0005	P0007
Process	Fluid	Raw Sewage	Primary Scum / Sewage	Primary Effluent
	Ambient Temperature	-40 ... +40 deg. C	-40 ... +40 deg. C	-40 ... +40 deg. C
	Measurement Function	Level	Level	Level
Transmitter	Tag No.	LIT-4010	LIT-4031	LIT-2010
	Transmitter Type	Remote	Integral	Remote
	Power Requirement	120 VAC	24VDC, loop powered	120 VAC
	Electrical Connection	1/2" NPT	1/2" NPT	1/2" NPT
	Contact Type	2 SPST Form A / 1 SPDT Form C	n/a	2 SPST Form A / 1 SPDT Form C
	Display Type	Digital LCD Integral Display	Digital LCD Integral Display	Digital LCD Integral Display
	Instrument Range	0.3 ... 15 m	0.3 ... 20 m	0.3 ... 15 m
	Operating Range	TBC	TBC	TBC
	Output Signal	4 - 20 mA (level measurement) dry contact (loss of echo)	4 - 20 mA	4 - 20 mA (level measurement) dry contact (loss of echo)
	Accuracy / Repeatability	±0.25% of Range or 6mm	±0.1% of Range or 10mm	±0.25% of Range or 6mm
	Enclosure Rating	IP65 / NEMA 4X	IP67 / NEMA 4X	IP65 / NEMA 4X
	Enclosure Material	Polycarbonate	Aluminum, polyester powder coat	Polycarbonate
	Mounting	Railing / Stand	Flange Mount	Wall Mount
Element	Tag No.	LE-4010	n/a	LE-2010
	Sensor Type	Ultrasonic Transducer	Radar, 150mm (6") Horn	Ultrasonic Transducer
	Beam Angle	6 deg.	20 deg.	6 deg.
	Frequency	44 kHz	6 GHz	44 kHz
	Measurement Range	TBC	n/a	TBC
	Facing Material	CSM Rubber	316L SS antenna, PTFE cone	CSM Rubber
	Mounting Thread	1" NPT	n/a	1" NPT
	Mounting Flange	n/a	316L SS, 200mm (8") ASME 150 lb, flat faced	n/a
	Submergence Shield Kit	No	No	No
	Enclosure Rating	IP 66/68	n/a	IP 66/68
	Enclosure Material	PVDF	n/a	PVDF
	Cable Length	As required	n/a	As required
Access	Name Plate	Yes	Yes	Yes
	Connection Plug	TBC	TBC	TBC
	Mounting Bracket	Yes, 316L-SS	No	Yes, 316L-SS
Approval / Enclosure		CSA / NEMA 4X/6	CSA / NEMA 4X/6	CSA / NEMA 4X
Class / Division / Group		Class I / Div. 1 / Group A-D	Class I / Div. 1 / Group A-D	Unclassified
Comments				c/w Stilling Well
Manufacturer		Siemens	Siemens	Siemens
Model Number		Echomax XPS-15 c/w LUT400	Sitrans LR200	Echomax XPS-15 c/w LUT400
Alternates				

Notes:
1. Vendor to supply Stainless Steel Tag with Instrument Tag Number clearly stamped on it.
2. Vendor is to fill in missing data in this specification sheet relevant to the device (i.e. model #)
3. Contractor is to supply mounting hardwate appropriate for the application.

No.	Date	By	Chkd	Appd	Revision
1	2022-12-23	T.S.	J.B.	J.B.	Issued for Permit

INSTRUMENT DATA SHEET

LEVEL TRANSMITTERS

Project	Client	Township of South Stormont	Project No.	19070
	Location	Ingleside WWTP	Instrument Spec.	25 10 01
			Revision	1

General	Tag Number	LE/LIT-2102	LE/LIT-2202	LE/LIT-5010
	Description of Instrument	Ultrasonic Level Transmitter	Ultrasonic Level Transmitter	Ultrasonic Level Transmitter
	Service	Tank Level	Tank Level	Splitter Box Level
	Location	Aeration Tank 1	Aeration Tank 2	Secondary Clarifier Splitter Box
	P&ID No.	P0007	P0007	P0008
Process	Fluid	Aerated Sewage	Aerated Sewage	Aerated Sewage
	Ambient Temperature	-40 ... +40 deg. C	-40 ... +40 deg. C	-40 ... +40 deg. C
	Measurement Function	Level	Level	Level
Transmitter	Tag No.	LIT-2102	LIT-2202	LIT-5010
	Transmitter Type	Remote	Remote	Remote
	Power Requirement	120 VAC	120 VAC	120 VAC
	Electrical Connection	1/2" NPT	1/2" NPT	1/2" NPT
	Contact Type	2 SPST Form A / 1 SPDT Form C	2 SPST Form A / 1 SPDT Form C	2 SPST Form A / 1 SPDT Form C
	Display Type	Digital LCD Integral Display	Digital LCD Integral Display	Digital LCD Integral Display
	Instrument Range	0.3 ... 15 m	0.3 ... 15 m	0.3 ... 15 m
	Operating Range	TBC	TBC	TBC
	Output Signal	4 - 20 mA (level measurement) dry contact (loss of echo)	4 - 20 mA (level measurement) dry contact (loss of echo)	4 - 20 mA (level measurement) dry contact (loss of echo)
	Accuracy / Repeatability	±0.25% of Range or 6mm	±0.25% of Range or 6mm	±0.25% of Range or 6mm
	Enclosure Rating	IP65 / NEMA 4X	IP65 / NEMA 4X	IP65 / NEMA 4X
	Enclosure Material	Polycarbonate	Polycarbonate	Polycarbonate
	Mounting	Wall Mount	Wall Mount	Wall Mount
Element	Tag No.	LE-2102	LE-2202	LE-5010
	Sensor Type	Ultrasonic Transducer	Ultrasonic Transducer	Ultrasonic Transducer
	Beam Angle	6 deg.	6 deg.	6 deg.
	Frequency	44 kHz	44 kHz	44 kHz
	Measurement Range	TBC	TBC	TBC
	Facing Material	CSM Rubber	CSM Rubber	CSM Rubber
	Mounting Thread	1" NPT	1" NPT	1" NPT
	Mounting Flange		n/a	n/a
	Submergence Shield Kit	No	No	No
	Enclosure Rating	IP 66/68	IP 66/68	IP 66/68
	Enclosure Material	PVDF	PVDF	PVDF
	Cable Length	As required	As required	As required
Access	Name Plate	Yes	Yes	Yes
	Connection Plug	TBC	TBC	TBC
	Mounting Bracket	Yes, 316L-SS	Yes, 316L-SS	Yes, 316L-SS
Approval / Enclosure		CSA / NEMA 4X	CSA / NEMA 4X	CSA / NEMA 4X
Class / Division / Group		Unclassified	Unclassified	Unclassified
Comments				
Manufacturer		Siemens	Siemens	Siemens
Model Number		Echomax XPS-15 c/w LUT400	Echomax XPS-15 c/w LUT400	Echomax XPS-15 c/w LUT400
Alternates				

Notes:
1. Vendor to supply Stainless Steel Tag with Instrument Tag Number clearly stamped on it.
2. Vendor is to fill in missing data in this specification sheet relevant to the device (i.e. model #)
3. Contractor is to supply mounting hardwate appropriate for the application.

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INSTRUMENT DATA SHEET

LEVEL TRANSMITTERS

Project	Client	Township of South Stormont	Project No.	19070
	Location	Ingleside WWTP	Instrument Spec.	25 10 01
			Revision	1

General	Tag Number	LIT-5031	LE/LIT-6051	
	Description of Instrument	Radar Level Transmitter	Ultrasonic Level Transmitter	
	Service	Tank Level	Effluent Reservoir Level	
	Location	Secondary Scum Tank	Final Effluent Reservoir	
	P&ID No.	P0008	P0011	
Process	Fluid	Secondary Scum	Disinfected Sewage Effluent	
	Ambient Temperature	-40 ... +40 deg. C	15 deg. C	
	Measurement Function	Level	Level	
Transmitter	Tag No.	LIT-5031	LIT-6051	
	Transmitter Type	Integral	Remote	
	Power Requirement	24VDC, loop powered	120 VAC	
	Electrical Connection	1/2" NPT	1/2" NPT	
	Contact Type	n/a	2 SPST Form A / 1 SPDT Form C	
	Display Type	Digital LCD Integral Display	Digital LCD Integral Display	
	Instrument Range	0.3 ... 20 m	0.3 ... 15 m	
	Operating Range	TBC	TBC	
	Output Signal	4 - 20 mA	4 - 20 mA (level measurement) dry contact (loss of echo)	
	Accuracy / Repeatability	±0.1% of Range or 10mm	±0.25% of Range or 6mm	
	Enclosure Rating	IP67 / NEMA 4X	IP65 / NEMA 4X	
	Enclosure Material	Aluminum, polyester powder coat	Polycarbonate	
	Mounting	Flange Mount	Wall Mount	
Element	Tag No.	n/a	LE-6051	
	Sensor Type	Radar, 150mm (6") Horn	Ultrasonic Transducer	
	Beam Angle	20 deg.	6 deg.	
	Frequency	6 GHz	44 kHz	
	Measurement Range	n/a	TBC	
	Facing Material	316L SS antenna, PTFE cone	CSM Rubber	
	Mounting Thread	n/a	1" NPT	
	Mounting Flange	316L SS, 200mm (8") ASME 150 lb, flat faced	n/a	
	Submergence Shield Kit	No	No	
	Enclosure Rating	n/a	IP 66/68	
	Enclosure Material	n/a	PVDF	
	Cable Length	n/a	As required	
Access	Name Plate	Yes	Yes	
	Connection Plug	TBC	TBC	
	Mounting Bracket	No	Yes, 316L-SS	
Approval / Enclosure		CSA / NEMA 4X	CSA / NEMA 4X	
Class / Division / Group		Unclassified	Unclassified	
Comments				
Manufacturer		Siemens	Siemens	
Model Number		Sitrans LR200	Echomax XPS-15 c/w LUT400	
Alternates				

Notes:
1. Vendor to supply Stainless Steel Tag with Instrument Tag Number clearly stamped on it.
2. Vendor is to fill in missing data in this specification sheet relevant to the device (i.e. model #)
3. Contractor is to supply mounting hardwate appropriate for the application.

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INSTRUMENT DATA SHEET

LEVEL TRANSMITTERS

Project	Client	Township of South Stormont	Project No.	19070
	Location	Ingleside WWTP	Instrument Spec.	25 10 01
			Revision	1

General	Tag Number	LIT-2251	LIT-2171	LIT-7101
	Description of Instrument	Radar Level Transmitter	Radar Level Transmitter	Radar Level Transmitter
	Service	Tank Level	Tank Level	Tank Level
	Location	Secondary Digester	Biosolids Tank 1	Biosolids Tank 2
	P&ID No.	P0013	P0013	P0014
Process	Fluid	Primary Sludge	Digested Sludge	Digested Sludge
	Ambient Temperature	-40 ... +40 deg. C	-40 ... +40 deg. C	-40 ... +40 deg. C
	Measurement Function	Level	Level	Level
Transmitter	Tag No.	LIT-2251	LIT-2171	LIT-7101
	Transmitter Type	Integral	Integral	Integral
	Power Requirement	24VDC, loop powered	24VDC, loop powered	24VDC, loop powered
	Electrical Connection	1/2" NPT	1/2" NPT	1/2" NPT
	Contact Type	n/a	n/a	n/a
	Display Type	Digital LCD Integral Display	Digital LCD Integral Display	Digital LCD Integral Display
	Instrument Range	0.3 ... 20 m	0.3 ... 20 m	0.3 ... 20 m
	Operating Range	TBC	TBC	TBC
	Output Signal	4 - 20 mA	4 - 20 mA	4 - 20 mA
	Accuracy / Repeatability	±0.1% of Range or 10mm	±0.1% of Range or 10mm	±0.1% of Range or 10mm
	Enclosure Rating	IP67 / NEMA 4X	IP67 / NEMA 4X	IP67 / NEMA 4X
	Enclosure Material	Aluminum, polyester powder coat	Aluminum, polyester powder coat	Aluminum, polyester powder coat
	Mounting	Flange Mount	Flange Mount	Flange Mount
Element	Tag No.	n/a	n/a	n/a
	Sensor Type	Radar, 150mm (6") Horn	Radar, 150mm (6") Horn	Radar, 150mm (6") Horn
	Beam Angle	20 deg.	20 deg.	20 deg.
	Frequency	6 GHz	6 GHz	6 GHz
	Measurement Range	n/a	n/a	n/a
	Facing Material	316L SS antenna, PTFE cone	316L SS antenna, PTFE cone	316L SS antenna, PTFE cone
	Mounting Thread	n/a	n/a	n/a
	Mounting Flange	316L SS, 200mm (8") ASME 150 lb, flat faced	316L SS, 200mm (8") ASME 150 lb, flat faced	316L SS, 200mm (8") ASME 150 lb, flat faced
	Submergence Shield Kit	No	No	No
	Enclosure Rating	n/a	n/a	n/a
	Enclosure Material	n/a	n/a	n/a
	Cable Length	n/a	n/a	n/a
Access	Name Plate	Yes	Yes	Yes
	Connection Plug	TBC	TBC	TBC
	Mounting Bracket	No	No	No
Approval / Enclosure		CSA / NEMA 4X	CSA / NEMA 4X	CSA / NEMA 4X
Class / Division / Group		Unclassified	Unclassified	Unclassified
Comments				
Manufacturer		Siemens	Siemens	Siemens
Model Number		Sitrans LR200	Sitrans LR200	Sitrans LR200
Alternates				

Notes:
1. Vendor to supply Stainless Steel Tag with Instrument Tag Number clearly stamped on it.
2. Vendor is to fill in missing data in this specification sheet relevant to the device (i.e. model #)
3. Contractor is to supply mounting hardwate appropriate for the application.

No.	Date	By	Chkd	Appd	Revision
1	2022-12-23	T.S.	J.B.	J.B.	Issued for Permit

INSTRUMENT DATA SHEET

LEVEL TRANSMITTERS

Project	Client	Township of South Stormont	Project No.	19070
	Location	Ingleside WWTP	Instrument Spec.	25 10 01
			Revision	1

General	Tag Number	LIT-7201	LE/LIT-1051	LE/LIT-1052
	Description of Instrument	Radar Level Transmitter	Hydrostatic Pressure Probe	Multi-Sensor Level Probe
	Service	Tank Level	Wet Well Level	Wet Well Level
	Location	Biosolids Tank 3	Site Sewage Pump Station	Site Sewage Pump Station
	P&ID No.	P0014	P0015	P0015
Process	Fluid	Digested Sludge	Raw Sewage	Raw Sewage
	Ambient Temperature	-40 ... +40 deg. C	-40 ... +40 deg. C	-40 ... +40 deg. C
	Measurement Function	Level	Level	Level
Transmitter	Tag No.	LIT-7201	LIT-1051	LIT-1052
	Transmitter Type	Integral	Remote	Remote
	Power Requirement	24VDC, loop powered	120VAC	120VAC
	Electrical Connection	1/2" NPT	Twist-lock receptacle	Twist-lock Receptacle
	Contact Type	n/a	n/a	n/a
	Display Type	Digital LCD Integral Display	Digital LCD Integral Display	LED Integral Display
	Instrument Range	0.3 ... 20 m	TBC	TBC
	Operating Range	TBC	TBC	TBC
	Output Signal	4 - 20 mA	4-20mA	10 X Dry Contacts, Selectable N/O or N/C
	Accuracy / Repeatability	±0.1% of Range or 10mm	±0.2% of set span	n/a
	Enclosure Rating	IP67 / NEMA 4X		IP67 / NEMA 4X
	Enclosure Material	Aluminum, polyester powder coat		316 SS
	Mounting	Flange Mount		
Element	Tag No.	n/a		LE-1052
	Sensor Type	Radar, 150mm (6") Horn		Conductivity, Multi-sensor
	Beam Angle	20 deg.		n/a
	Frequency	6 GHz		n/a
	Measurement Range	n/a		TBC
	Facing Material	316L SS antenna, PTFE cone	316L SS	PVC
	Mounting Thread	n/a	n/a	n/a
	Mounting Flange	316L SS, 200mm (8") ASME 150 lb, flat faced	n/a	n/a
	Submergence Shield Kit	No	n/a	n/a
	Enclosure Rating	n/a	Class 1. Div. 1, Group D	Class 1. Div. 1, Group D
	Enclosure Material	n/a		n/a
	Cable Length	n/a	As Req'd	
Access	Name Plate	Yes	Yes	Yes
	Connection Plug	TBC	TBC	TBC
	Mounting Bracket	No	Yes	Yes
Approval / Enclosure		CSA / NEMA 4X	CSA / NEMA 4X	CSA / NEMA 4X
Class / Division / Group		Unclassified	Unclassified	Unclassified
Comments			Common transmitter enclosure with LIT-1052	Common transmitter enclosure with LIT-1051
Manufacturer		Siemens	Endress & Hauser	Flygt
Model Number		Sitrans LR200	FMX21, 42mm c/w	Multitrode c/w MTIC Indicating Controller & MTISB Intrinsically Safe Relay
Alternates				

Notes:
1. Vendor to supply Stainless Steel Tag with Instrument Tag Number clearly stamped on it.
2. Vendor is to fill in missing data in this specification sheet relevant to the device (i.e. model #)
3. Contractor is to supply mounting hardwate appropriate for the application.

No.	Date	By	Chkd	Appd	Revision
1	2022-12-23	T.S.	J.B.	J.B.	Issued for Permit

INSTRUMENT DATA SHEET

LEVEL TRANSMITTERS

Project	Client	Township of South Stormont	Project No.	19070
	Location	Ingleside WWTP	Instrument Spec.	25 10 01
			Revision	1

General	Tag Number	LIT-2081	LIT-2082	
	Description of Instrument	Pressure Transmitter	Pressure Transmitter	
	Service	Tank Level	Tank Level	
	Location	Alum Tank 1	Alum Tank 2	
	P&ID No.	P0017	P0017	
Process	Fluid	Alum	Alum	
	Ambient Temperature	5 ... +40 deg. C	5 ... +40 deg. C	
	Measurement Function	Level	Level	
Transmitter	Tag No.	LIT-2081	LIT-2082	
	Transmitter Type	Integral	Integral	
	Power Requirement	24VDC, loop powered	24VDC, loop powered	
	Electrical Connection	1/2" NPT	1/2" NPT	
	Contact Type	n/a	n/a	
	Display Type	Digital LCD Integral Display	Digital LCD Integral Display	
	Instrument Range	TBC	TBC	
	Operating Range	TBC	TBC	
	Output Signal	4 - 20 mA	4 - 20 mA	
	Accuracy / Repeatability	±0.1% of Range or 10mm	±0.1% of Range or 10mm	
	Enclosure Rating	IP67 / NEMA 4X	IP67 / NEMA 4X	
	Enclosure Material	Aluminum, polyester powder coat	Aluminum, polyester powder coat	
	Mounting	TBC	TBC	
Element	Tag No.	n/a	n/a	
	Sensor Type	Radar, 150mm (6") Horn	Radar, 150mm (6") Horn	
	Beam Angle	n/a	n/a	
	Frequency	n/a	n/a	
	Measurement Range	n/a	n/a	
	Facing Material	TBC	TBC	
	Mounting Thread	TBC	TBC	
	Mounting Flange	TBC	TBC	
	Submergence Shield Kit	n/a	n/a	
	Enclosure Rating	n/a	n/a	
	Enclosure Material	n/a	n/a	
	Cable Length	n/a	n/a	
Access	Name Plate	Yes	Yes	
	Connection Plug	TBC	TBC	
	Mounting Bracket	No	No	
Approval / Enclosure		CSA / NEMA 4X	CSA / NEMA 4X	
Class / Division / Group		Unclassified	Unclassified	
Comments				
Manufacturer		Siemens	Siemens	
Model Number		Sitrans P320	Sitrans P320	
Alternates				

Notes:
1. Vendor to supply Stainless Steel Tag with Instrument Tag Number clearly stamped on it.
2. Vendor is to fill in missing data in this specification sheet relevant to the device (i.e. model #)
3. Contractor is to supply mounting hardwate appropriate for the application.

No.	Date	By	Chkd	Appd	Revision
1	2022-12-23	T.S.	J.B.	J.B.	Issued for Permit

PRESSURE ELEMENTS

PART 1 GENERAL

1.1 SHOP DRAWINGS AND PRODUCT DATA

.1 This section specifies the supply, installation, field testing, and placing into operation of all flow meters, flow transducers and transmitters as identified in but not limited to the attached Instrumentation Data Sheets (PE/PIT/PI Pressure Transmitter and Pressure Indicators).

.2 The attached data sheets only indicate instruments to be supplied by Div. 25. Refer to contract drawings and shop drawings for instruments supplied by preselected equipment suppliers.

.3 Responsibility shall include supply and installation of all component and Vendor subsystems as to provide a fully functioning system, including supervision, calibration, checkout, start-up operating adjustment and documentation, tagging and compliance with data sheets.

.4 Submit shop drawings and product data in accordance with Section 01 33 00 – Submittals.

.5 The measuring elements of instrumentation designated for hazardous locations must be in full compliance with the OESC.

1.2 DELIVERY, STORAGE AND HANDLING

.1 Ship assembled to the degree which is possible. Inform installer of site assembly requirements.

1.3 RELATED SECTIONS

.1 Section 01 33 00 - Submittals

.2 Section 01 91 13 - Commissioning Requirements

.3 Section 01 91 33 - Commissioning Forms

.4 Section 01 91 41 - Commissioning Training

.5 Section 44 00 10 - Process General Requirements

.6 Section 26 00 10 - Electrical General Requirements

1.4 REFERENCES

.1 ISA RP12.06.01-2003, Recommended Practice for Wiring Methods for Hazardous (Classified) Locations Instrumentation, Part 1: Intrinsic Safety.

.2 CSA C22.2 No. 0.3-01 (R2005), Test Methods for Electrical Wires and Cables

1.5 COMMISSIONING AND TRAINING

.1 Commissioning, training, and closeout documents are to be carried out in accordance with Section 01 91 13, Section 01 91 33, and Section 01 91 41.

.2 Also submit the following:

.1 Manufacturer's calibration certificates.

.2 Instrument field calibration sheets.

.3 Instrument field loop check sheets.

PART 2 PRODUCTS

2.1 GENERAL

.1 All instrumentation, control, and electrical devices provided under this Section shall be CSA approved and shall bear the CSA approvals seal as detailed in Section 44 00 10 - Process General Requirements.

.2 Provide each instrument with mechanisms and enclosures that are corrosion resistant.

.3 Provide each instrument with mechanisms enclosed in a dust-proof and a moisture-proof case.

.4 Provide all indicator and gauge dials finished in permanent white with black graduations and figures.

.5 Each instrument sensing line shall be complete with an isolation valve. The isolation valves shall conform to Division 44 Specification 44 10 71.

.6 Sensing units shall be mounted so that interference to the sensing function is not caused by surrounding structures. The sensor shall preferably be mounted on its own support, purpose built to manufactures recommendations, to facilitate maintenance and/or adjustment.

.7 Where amplifier/transmitter electronics is installed in a classified environment the housings shall be suitable for the application. i.e. Class 1, Division 1 and suited to a wet and corrosive environment. Each of the Pressure Elements and Transmitters supplied for this project must meet this requirement.

2.2 DIAPHRAGM SEALS

.1 Where indicated on the Instrument Data Sheet, a diaphragm seal shall be provided for the respective instrument, switch or pressure indicator. Diaphragm seals shall be thread-attached type with removable Viton diaphragm, SS16 L plated upper housing, and stainless-steel lower housing. The upper housing shall be contoured to fit and provide a seat and seal for the diaphragm and shall be designed to permit removal of the pressure sensing element with the system under pressure. The lower housing shall be provided with a tapped and plugged 6mm NPT flushing connection. Each diaphragm seal and the pressure sensing element served shall

be factory assembled, filled with a suitable fluid, and calibrated as a unit. The diaphragm seal and seal diameter shall be selected to suit the design pressure ranges indicated in the attached data sheets.

2.3 WAFER TYPE ANNULAR SEAL PRESSURE SENSOR

.1 Pressure Sensors are to be of the wafer type, designed to fit between standard ANSI B16.1 Class 125/ANSI B16.5 Class 150 pipeline flanges. Face-to-face of the entire sensor shall be no longer than specifications MSS-SP67. Sensor shall be flow through design with flexible elastomer sensing ring around the full circumference. The elastomer sensing ring shall be rigidly clamped between metal end cover flanges, and no part of the elastomeric sensing ring shall be exposed to the external face of the sensor. There shall be no dead ends or crevices, and flow passage shall make the sensor self-cleaning.

.2 The pressure-sensing ring shall measure pressure for 360° around the full inside circumference of the pipeline. Flexible sensing ring shall have a cavity behind the ring filled with fluid to transfer pressure to the gauge.

.3 Line pressure pushes against an elastomer ring inside the sensor. The deflection of the ring displaces a fluid fill inside the body of the sensor, forcing the fluid into a pressure-measuring device.

.4 Tools and spare parts shall be furnished and packaged in accordance with Section 44 00 10.

.5 Acceptable manufacturers: Red Valve Series 48, Winters D81 or approved equal.

2.4 PRESSURE GAUGES

.1 Service

- .1 Tag Number: See instrument list.
- .2 Service: See instrument list.
- .3 Fluid: See instrument list.
- .4 Operating Pressure: As noted, application requirement.
- .5 Installation Drawing: See instrument list.

.2 Performance:

- .1 Accuracy: ±0.5% of span.

.3 Gauge:

- .1 Type: Bourdon tube, ANSI Grade 2A.
- .2 Range: See instrument list.
- .3 Wetted Parts: 316 stainless steel.
- .4 Gear Mechanism: 316 stainless steel.
- .5 Case Material: Black polypropylene.
- .6 Blowout: Back blowout.
- .7 Window: Shatter-proof.

.8 Filling: Liquid filled, liquid shall be selected based on the instrument location. Outdoor gauges shall operate within a temperature range of +40°C to -50°C.

.9 Dial: 115 mm white plastic laminated metal dial with black markings. Indicator rests approximately in the 50% range, under normal operating conditions.

.10 Calibration: Slotted calibration screw.

.11 Mounting: Stem mounting.

.12 Process Connection: 13 mm (0.5”) Threaded-male NPT, bottom connection.

2.5 PRESSURE ELEMENTS/TRANSMITTERS

.1 Transmitters shall be capable of providing a 4-20mA signal and shall be of the two-wire type. Process fluid shall be isolated from the sensing elements by AISI Type 316 stainless steel, Hastelloy-C, or cobalt-chromium-nickel alloy diaphragms, and a silicon oil fluid fill. Diaphragm material shall be selected based on the indicated measured process medium for proper operation in the process.

.2 Where a two channel transmitter is indicated, PIT 305, receiving signals from two pressure elements PE-305A and PE-305B, should the transmitter not be capable to transmitting two input channels then the supplier shall provide to transmitters, one for each pressure element.

.3 Transmitters shall have self-diagnostics and electronically adjustable span, zero, and damping. Transmitters shall have over-range protection greater than the maximum line pressure. Transmitters shall not be damaged by reverse polarity. Transmitters shall be capable of having an elevated or suppressed zero, as required by the application. Transmitters shall be provided with a 3-1/2 digit LCD display, calibrated in engineering units.

.4 Mounting and installation hardware shall be 316L stainless steel. Mounting hardware shall be provided to allow pipe-stand for the pressure element and wall mounting of the transmitter. Include NPT process connection, diaphragm seal and flushing connections for all units, coordinate with Div. 44 to provide pipe reducers and bushings to connect to the specified process connection.

.5 Each pressure transmitter system shall be provided with a shut-off valve and mounting hardware. The shut-off valve shall be mounted to the transmitter prior to shipment. The manifold shall have test ports on the instrument side of the valve. The valve shall be as specified in Section 44 10 71.

.6 Transmitters shall be configurable as either square root or linear. The effect of static pressure changes on accuracy shall be negligible. The transmitter shall have minimum 15:1 field rangeability.

.7 For systems which require a dedicated programming device for calibration, maintenance, or troubleshooting, one such programming device shall be provided for each location. The programming device shall include appropriate operation

manuals and shall be included in the training requirements. For systems which allow the programming device functions to be implemented in software, running on a laptop computer, the software shall be provided instead of the programming device.

.8 Tools and spare parts shall be furnished and packaged in accordance with Section 40 00 10 – Instrumentation; Spare Parts. As a minimum, the following spare parts shall be furnished for each level system:

.9 .1 Two spare fuses of each type required.

.10 Acceptable manufacturers:

.1 Siemens
.2 Rosemount
.3 Endress+Hauser

2.6 PRESSURE SWITCHES

.1 Pressure switches shall be diaphragm actuated type switches. Switches shall be field adjustable type, with trip point repeatability better than 1% of actual pressure. Switches shall be housed in EEMAC Type 4 enclosures. Switches shall be differential type where indicated on the Instrument Data Sheet. Switch wetted parts shall be in accordance with the Material Class Sheets. Where not covered by the Material Class Sheets, the switch shall be provided with a teflon coated diaphragm, viton seals, and a stainless steel connection port.

.2 Panel mounted and surface mounted switches shall be provided with 6 mm NPT connections. All stem mounted switches shall be provided with 12 mm NPT connections.

.3 All pressure switches shall ranged as indicated in the data sheets. Unless otherwise indicated, switches shall have a fixed deadband and shall be auto-reset type. As a minimum switches shall be SPDT, rated 10 amperes at 120 volts AC.

.4 Each switch shall be provided with a threaded end, ball-type shutoff valve, as per Shutoff valve materials shall be in accordance with the Specification 44 10 71, bushings required to . Where not covered by the Material Class Sheets, valves shall have 316SS wetted parts and teflon seals. Multi-port valves shall have all unused ports plugged.

.5 Each switch shall be powered with a multi-pole receptacle on the switch enclosure for connection of external wiring. The receptacle shall be a male connector with integral leads for each pole. Number of poles shall be equal to the number of switch terminal connections for external wiring (to a maximum of 10 poles per connector). The connector shall be installed in a knockout or hub, with leads connected to the switch terminals. Receptacles shall be as indicated in Installation Standards.

.6 Each switch shall be provided with all required mounting hardware to securely mount the unit according to the mounting requirements indicated in the Instrument Data Sheet. Mounting and installation hardware shall be 316L stainless steel.

.7 Tools and spare parts shall be furnished and packaged in accordance with Section 14 00 10.

2.7 MISCELLANEOUS

.1 All indications shall be displayed on a linear scale unless otherwise specified. Local indicators shall be in Engineering units.

.2 Instruments shall be suitable for the environmental conditions in which they are to be installed. The Supplier shall determine where injurious conditions may be expected to occur and make proper provision to protect the instruments to ensure their proper and reliable operation. Provide power surge protectors, heating cables and devices to protect instruments, equipment and lines from being functionally impaired or damaged by power surges or environmental conditions.

.3 Those parts of the gauge or switch which are in contact with the process fluid shall be made of materials which are inert to the effects of the process fluid. It shall be incumbent on the Supplier to review the application to ensure that the specified device is suitable for the service conditions.

.4 All clean service pressure gauges, transmitters and switches shall be installed with a gauge/root valve equal to Whitey SS-6NDGM12-F8 complete with bleed valve SS-BVM8 and SS-$^1/_2$-inch plugs as required.

.5 All dirty service pressure gauges, transmitters and switches shall be installed with an appropriate seal as indicated in the drawings and specified elsewhere.

PART 3 EXECUTION

3.1 MANUFACTURER'S QUALITY CONTROL & FACTORY TESTING

.1 Provide manufacturer's quality control program and factory testing in accordance with Division 01.

.2 Provide calibration of all instruments. The Calibration Certificates shall be shipped with the instruments; the original documents shall be submitted to the Contract Administrator and copies shall be included in the Operations and Maintenance Manual.

3.2 PLANNING AND COORDINATION OF SERVICES OR INSTALLATIONS

.1 Plan and coordinate services and installation in accordance with Division 26.

.2 Install anchors, bolts, pipe sleeves, hanger inserts, etc. required in ample time to prevent delays to other division's installation work.

3.3 DELIVERY, STORAGE AND HANDLING

.1 Provide and securely attach the tag number and instructions for proper field handling and installation to each instrument prior to packaging.

.2 Package instrumentation to provide protection against shipping damage, dust, moisture and atmospheric contaminants.

.3 Transport, unload, store and handle instrumentation at the site. Inspect instrumentation for damage in shipment and return damaged instrumentation to the manufacturer. Store instruments indoors, in dry, clean and temperature controlled storage facilities.

3.4 FIELD INSTALLATION

.1 Provide field instruments as indicated in accordance with this section.

.2 Do not install primary elements or other sensitive equipment until construction is sufficiently completed to provide an "operating condition" environment. Notify the Contract Administrator prior to installing any equipment of this type.

.3 The instrument locations are to be coordinated with the installation of adjacent equipment under other Divisions, but locations must be approved by the Contract Administrator prior to installation.

.4 Equipment, supplied under other Divisions/Sections, but interconnected with the work of this Section will be either mounted by these other Divisions/Sections or, handed over for installation by this Section as indicated.

.5 Provide process connections, mounting hardware, floor stands, wall brackets and/or instrument racks as required for complete and operational system to the satisfaction of the Contract Administrator.

.6 Ensure that covers where required are properly installed on all equipment. Provide all covers, padding, guards, etc. as required to guard any equipment against damage to finish, proper operation or life expectancy.

.7 Obtain and use instrument mounting details from the manufacturer or supplier for installation purposes. Where the instrument installation details furnished with the Specification and Drawings conflict with the manufacturer’s installation detail, mount the instrument in accordance with manufacturer’s specifications and instructions. Prior to installation, obtain the ruling and approval from the Contract Administrator.

.8 Unless shown otherwise, do not mount direct reading or electrical transmitters on process piping; mount on instrument racks or stands or in enclosures near the sensor at a level that permits viewing from floor elevation.

.9 Install the instrumentation and auxiliary devices such that they are accessible for operation and maintenance. Provide space between instruments and other equipment and piping for ease of removal and servicing. Generally, install instrumentation to be accessible from floor level or grade.

.1 Locate indicators such that indicator display is readily readable at eye level (1.5–1.6m) from floor elevation.

.2 Locate transmitter with adequate clearance and accessibility for service. For pipe/rack mounted instruments at least 1m distance/ clearance to the wall.

.3 Allow sufficient clearance for cover removal and adjustment of switches.

.4 Provide adequate clearance (100mm minimum) from piping and other obstructions for operation of valve handles.

.5 Provide safe access to the sensor.

.10 Provide field wiring c/w cables, raceway (wireways, conduit, wiring-duct, cable tray, etc.), terminations, etc.

.1 Where the instruments are installed in the hazardous areas, provide wiring, sensors/instruments enclosures and intrinsically safety circuitry to meet the CSA Code Class, Group or Division as specified.

.2 For remote transmitter units, installed manufacture supplied primary signal cables from primary element / transducer to the transmitter per manufacturer's instructions. Where cables are not supplied by the manufacturer, the Contractor is responsible to provide the required cable. The cables are to be installed without any splices. Where maximum standard cable length is inadequate for the field conditions, provide manufacturer's approved termination box, suitable for the environment.

.3 Instrumentation cables shall be as described by Division 25 and 26 of this specification. Single pair twisted shielded cable to be run in conduit. Multipairs shall be Teck run in cable tray.

.4 Control wiring shall be either multi-conductor Teck run in cable tray or single conductor wire run in conduit.

.5 Provide junction/terminal boxes as required and/or indicated on the drawings; terminate cables and conduits as required.

.6 Provide liquid-tight flexible metal or non-metallic conduit for up to a meter from the primary sensor or transmitter, or as appropriate to allow removal of it, for the following installations:

.1 Where primary sensor signal cables are required to be installed in the conduit.

.2 Where cables are required to be installed in the conduit for integral transmitter units.

.3 Where vibration of the process piping is excessive, beyond manufacturer's recommendations.

.7 Terminate primary sensor cables and conductors at the primary element / transducer (for non-sealed cables) and transmitter in accordance with manufacturer's recommendations, and Division 26 requirements.

.8 Provide and terminate control power, discrete indication and control, analog indication and control, and communication cables and conductors at transmitters and control panels as indicated on the drawings as directed by the Contract Administrator, in accordance with manufacturer's recommendations, and Division 26 requirements.

.11 Select instruments so that normal operating point is just above midpoint of instrument range (60 – 70%).

.12 All indications shall be displayed on a linear scale unless otherwise specified. Local indicators shall be in engineering units.

.13 Verify all identification legends on equipment and cross-check wiring identification numbers with drawings and schedules.

.14 Return all damaged equipment to the factory for total corrective repairs. Replace damaged equipment with new product if deemed necessary by the Engineer. The Contractor to bear any costs due to construction delays resulting from the delay in delivery of acceptable equipment.

3.5 FIELD QUALITY CONTROL, START-UP AND COMMISSIONING

.1 Provide field quality control, start-up and commissioning in accordance with Division 01 requirements.

.2 After the instrument is fully installed, (including mounting, process connections, signal connections and power connections) and after the process is put into test mode or actual operation, perform preventative maintenance tasks, calibrate the instrument, and perform commissioning and start-up.

.3 Provide services of a competent Manufacturer's/Supplier's trained and certified technical representative to verify the installation, and provide calibration, adjustment, testing, and troubleshooting of all the instrumentation and control devices and systems until the operation of the systems are satisfactory to the Contract Administrator.

.1 The Contractor is responsible for coordination and scheduling of such a work. Notify the Engineer in writing 5 working days prior to scheduling the visits.

.2 Tests shall be carried out either separately or in conjunction with other equipment tests as determined by the Contract Administrator.

.3 Prepare instrumentation installation and calibration certification sheet for each primary element sensor and electronic indicator/analyzer/transmitter for each instrument uniquely specified. Utilize this sheet to calibrate, test and record each instrument.

.4 Calibrate measurements over the full instrument range, including zero, full range and 3 intermediate points. Repeat 2 times and document all results.

.5 Demonstrate alarms by varying process conditions. Repeat 3 times and document all results.

.6 Where equipped, calibrate instruments communication to insure that the device communicates all information to the communication network.

.7 Provide record of the calibration and testing to the Contact Administrator after the work is completed; a copy of the field notes before leaving the site if practical, or faxed copy within 12h, and a copy of the final typed-written record report within 48h.

.8 In the Instrument Data Sheet document the results of calibration and note any setting or adjustment made.

3.6 MANUFACTURER'S CERTIFICATION AND TRAINING

.1 Provide manufacturer's certification and training in accordance with Division 01 and as modified herein.

.1 The Manufacturer's Qualified Technical Representative shall provide a training session for up to six (6) Owner's representatives for minimum of half (1/2) normal workday per each type of instrument at the job site location determined by the Contract Administrator.

.2 Include training on calibration, testing, maintenance and operation.

.3 The Contractor is responsible for coordination and scheduling of such a work.

END OF SECTION

INSTRUMENT DATA SHEET

PRESSURE TRANSMITTERS

Project	Client	Township of South Stormont	Project No.	19070
	Location	Ingleside WWTP	Instrument Spec.	25 10 02
			Revision	1

General	Tag Number	PIT-3130	PIT-3230	PIT-3330
	Service	PS Pump 1 Discharge Pressure	PS Pump 2 Discharge Pressure	PS Pump 3 Discharge Pressure
	Location	Headworks Bldg, Thickener Room	Headworks Bldg, Thickener Room	Headworks Bldg, Thickener Room
	P&ID No.	P0006	P0006	P0006
	Line Tag	100-PS-SS1	100-PS-SS1	100-PS-SS1
	Line Size (mm)	100	100	100
Process / Fluid Data	Fluid	Primary Sludge	Primary Sludge	Primary Sludge
	Oper. Press Norm / Max (kPa)			
	Oper. Temp Norm / Max (°C)			
	Ambient Temperature (°C)			
	S.G. @ Oper. Temp			
	Viscosity @ Oper. Temp			
	Percent Solids / Type			
	Measurement Function	Pressure	Pressure	Pressure
Transmitter	Tag No.	PIT-3130	PIT-3230	PIT-3330
	Transmitter Type	Loop Powered	Loop Powered	Loop Powered
	Power Requirement	24VDC	24VDC	24VDC
	Electrical Connection	1/2" NPT	1/2" NPT	1/2" NPT
	Contact Type			
	Display Type	Digital LCD Integral Display	Digital LCD Integral Display	Digital LCD Integral Display
	Instrument Range	0 - 400 kPa	0 - 400 kPa	0 - 400 kPa
	Operating Range	0 - 250 kPa	0 - 250 kPa	0 - 250 kPa
	Output Signal	4 - 20 mA	4 - 20 mA	4 - 20 mA
	Accuracy / Repeatability	±0.065%	±0.065%	±0.065%
	Enclosure Rating	NEMA 4X	NEMA 4X	NEMA 4X
	Enclosure Material	Polyamid	Polyamid	Polyamid
	Mounting			
Element	Tag No.	n/a	n/a	n/a
	Sensor Type	Integral	Integral	Integral
	Measurement Range	0 - 400 kPa	0 - 400 kPa	0 - 400 kPa
	Element Material	Stainless Steel	Stainless Steel	Stainless Steel
	Line Size (mm)	100	100	100
	Enclosure Rating	NEMA 4X	NEMA 4X	NEMA 4X
	Enclosure Material	316L SS	316L SS	316L SS
	Process Connection	Red Valve Series 48	Red Valve Series 48	Red Valve Series 48
	Cable Length	n/a	n/a	n/a
Access	Name Plate	Yes	Yes	Yes
	Connection Plug	Yes	Yes	Yes
	Mounting Bracket	Yes	Yes	Yes
	Isolation Valve and/or Manifold	Quick Disconnect	Quick Disconnect	Quick Disconnect
Approval / Enclosure		CSA, NEMA 4X	CSA, NEMA 4X	CSA, NEMA 4X
Class / Division / Group		Unclassified	Unclassified	Unclassified
Comment				
Manufacturer		Siemens	Siemens	Siemens
Model Number		Sitrans P320	Sitrans P320	Sitrans P320
Alternates				

Notes:

1. Vendor to supply Stainless Steel Tag with Instrument Tag Number clearly stamped on it.
2. Vendor is to fill in missing data in this specification sheet relevant to the device (i.e. model #)
3. Contractor is to supply mounting hardwate appropriate for the application.
4. Dirty service transmitter to be factory installed and calibrated with Red Valve Series 48 Pressure Sensor.

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INSTRUMENT DATA SHEET

PRESSURE TRANSMITTERS

Project	Client	Township of South Stormont	Project No.	19070
	Location	Ingleside WWTP	Instrument Spec.	25 10 02
			Revision	1

General	Tag Number	PIT-2140	PIT-2240	PIT-2340
	Service	WAS Pump 1 Discharge Pressure	WAS Pump 2 Discharge Pressure	WAS Pump 3 Discharge Pressure
	Location	Pump Gallery	Pump Gallery	Pump Gallery
	P&ID No.	P0009	P0009	P0009
	Line Tag	150-WAS-SS1	150-WAS-SS1	150-WAS-SS1
	Line Size (mm)	150	150	150
Process / Fluid Data	Fluid	Activated Sludge	Activated Sludge	Activated Sludge
	Oper. Press Norm / Max (kPa)			
	Oper. Temp Norm / Max (°C)			
	Ambient Temperature (°C)			
	S.G. @ Oper. Temp			
	Viscosity @ Oper. Temp			
	Percent Solids / Type			
	Measurement Function	Pressure	Pressure	Pressure
Transmitter	Tag No.	PIT-2140	PIT-2240	PIT-2340
	Transmitter Type	Loop Powered	Loop Powered	Loop Powered
	Power Requirement	24VDC	24VDC	24VDC
	Electrical Connection	1/2" NPT	1/2" NPT	1/2" NPT
	Contact Type			
	Display Type	Digital LCD Integral Display	Digital LCD Integral Display	Digital LCD Integral Display
	Instrument Range	0 - 400 kPa	0 - 400 kPa	0 - 400 kPa
	Operating Range	0 - 250 kPa	0 - 250 kPa	0 - 250 kPa
	Output Signal	4 - 20 mA	4 - 20 mA	4 - 20 mA
	Accuracy / Repeatability	±0.065%	±0.065%	±0.065%
	Enclosure Rating	NEMA 4X	NEMA 4X	NEMA 4X
	Enclosure Material	Polyamid	Polyamid	Polyamid
	Mounting			
Element	Tag No.	n/a	n/a	n/a
	Sensor Type	Integral	Integral	Integral
	Measurement Range	0 - 400 kPa	0 - 400 kPa	0 - 400 kPa
	Element Material	Stainless Steel	Stainless Steel	Stainless Steel
	Line Size (mm)	150	100	100
	Enclosure Rating	NEMA 4X	NEMA 4X	NEMA 4X
	Enclosure Material	316L SS	316L SS	316L SS
	Process Connection	Red Valve Series 48	Red Valve Series 48	Red Valve Series 48
	Cable Length	n/a	n/a	n/a
Access	Name Plate	Yes	Yes	Yes
	Connection Plug	Yes	Yes	Yes
	Mounting Bracket	Yes	Yes	Yes
	Isolation Valve and/or Manifold	Quick Disconnect	Quick Disconnect	Quick Disconnect
Approval / Enclosure		CSA, NEMA 4X	CSA, NEMA 4X	CSA, NEMA 4X
Class / Division / Group		Unclassified	Unclassified	Unclassified
Comment				
Manufacturer		Siemens	Siemens	Siemens
Model Number		Sitrans P320	Sitrans P320	Sitrans P320
Alternates				

Notes:

1. Vendor to supply Stainless Steel Tag with Instrument Tag Number clearly stamped on it.
2. Vendor is to fill in missing data in this specification sheet relevant to the device (i.e. model #)
3. Contractor is to supply mounting hardwate appropriate for the application.
4. Dirty service transmitter to be factory installed and calibrated with Red Valve Series 48 Pressure Sensor.

No.	Date	By	Chkd	Appd	Revision	
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INSTRUMENT DATA SHEET

PRESSURE TRANSMITTERS

Project	Client	Township of South Stormont	Project No.	19070
	Location	Ingleside WWTP	Instrument Spec.	25 10 02
			Revision	1

General	Tag Number	PIT-3152	PIT-3252	PIT-3083
	Service	TWAS Pump 1 Discharge Pressure	TWAS Pump 2 Discharge Pressure	Service Water Pressure
	Location	Headworks Bldg, Thickener Room	Headworks Bldg, Thickener Room	Headworks Basement
	P&ID No.	P0010	P0010	P0011
	Line Tag	100-TWAS-SS1	100-TWAS-SS1	150-SW-SA1-25A
	Line Size (mm)	100	100	150
Process / Fluid Data	Fluid	Thickened Activated Sludge	Thickened Activated Sludge	Final Effluent
	Oper. Press Norm / Max (kPa)			
	Oper. Temp Norm / Max (°C)			
	Ambient Temperature (°C)			
	S.G. @ Oper. Temp			
	Viscosity @ Oper. Temp			
	Percent Solids / Type			
	Measurement Function	Pressure	Pressure	Pressure
Transmitter	Tag No.	PIT-3152	PIT-3252	PIT-3083
	Transmitter Type	Loop Powered	Loop Powered	Loop Powered
	Power Requirement	24VDC	24VDC	24VDC
	Electrical Connection	1/2" NPT	1/2" NPT	1/2" NPT
	Contact Type			
	Display Type	Digital LCD Integral Display	Digital LCD Integral Display	Digital LCD Integral Display
	Instrument Range	0 - 400 kPa	0 - 400 kPa	0 - 400 kPa
	Operating Range	0 - 250 kPa	0 - 250 kPa	0 - 250 kPa
	Output Signal	4 - 20 mA	4 - 20 mA	4 - 20 mA
	Accuracy / Repeatability	±0.065%	±0.065%	±0.065%
	Enclosure Rating	NEMA 4X	NEMA 4X	NEMA 4X
	Enclosure Material	Polyamid	Polyamid	Polyamid
	Mounting			
Element	Tag No.	n/a	n/a	n/a
	Sensor Type	Integral	Integral	Integral
	Measurement Range	0 - 400 kPa	0 - 400 kPa	0 - 400 kPa
	Element Material	Stainless Steel	Stainless Steel	Stainless Steel
	Line Size (mm)	100	100	100
	Enclosure Rating	NEMA 4X	NEMA 4X	NEMA 4X
	Enclosure Material	316L SS	316L SS	316L SS
	Process Connection	Red Valve Series 48	Red Valve Series 48	Red Valve Series 48
	Cable Length	n/a	n/a	n/a
Access	Name Plate	Yes	Yes	Yes
	Connection Plug	Yes	Yes	Yes
	Mounting Bracket	Yes	Yes	Yes
	Isolation Valve and/or Manifold	Quick Disconnect	Quick Disconnect	Quick Disconnect
Approval / Enclosure		CSA, NEMA 4X	CSA, NEMA 4X	CSA, NEMA 4X
Class / Division / Group		Unclassified	Unclassified	Unclassified
Comment				
Manufacturer		Siemens	Siemens	Siemens
Model Number		Sitrans P320	Sitrans P320	Sitrans P320
Alternates				

Notes:

1. Vendor to supply Stainless Steel Tag with Instrument Tag Number clearly stamped on it.
2. Vendor is to fill in missing data in this specification sheet relevant to the device (i.e. model #)
3. Contractor is to supply mounting hardwate appropriate for the application.
4. Dirty service transmitter to be factory installed and calibrated with Red Valve Series 48 Pressure Sensor.

No.	Date	By	Chkd	Appd	Revision	
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INSTRUMENT DATA SHEET

PRESSURE TRANSMITTERS

Project	Client	Township of South Stormont	Project No.	19070	
	Location	Ingleside WWTP	Instrument Spec.	25 10 02	
			Revision	1	
General	Tag Number	PIT-2142	PIT-2242	PDIT-3005-1	
	Service	Biosolids Pump 1 Discharge Pressure	Biosolids Pump 2 Discharge Pressure	Airlock Operation Compliance	
	Location	Pump Gallery	Pump Gallery	Headworks Airlock Vestibule	
	P&ID No.	P0013	P0013	n/a	
	Line Tag	200-DS-SS1	200-DS-SS1	n/a	
	Line Size (mm)	200	200	n/a	
Process / Fluid Data	Fluid	Digested Sludge	Digested Sludge		
	Oper. Press Norm / Max (kPa)				
	Oper. Temp Norm / Max (°C)				
	Ambient Temperature (°C)				
	S.G. @ Oper. Temp				
	Viscosity @ Oper. Temp				
	Percent Solids / Type				
	Measurement Function	Pressure	Pressure	Differential Pressure	
Transmitter	Tag No.	PIT-2142	PIT-2242	PDIT-3005-1	
	Transmitter Type	Loop Powered	Loop Powered	Loop Powered	
	Power Requirement	24VDC	24VDC	24VDC	
	Electrical Connection	1/2" NPT	1/2" NPT	1/2" NPT	
	Contact Type				
	Display Type	Digital LCD Integral Display	Digital LCD Integral Display	Digital LCD Integral Display	
	Instrument Range	0 - 400 kPa	0 - 400 kPa		
	Operating Range	0 - 250 kPa	0 - 250 kPa	0	
	Output Signal	4 - 20 mA	4 - 20 mA	4 - 20 mA	
	Accuracy / Repeatability	±0.065%	±0.065%	±0.065%	
	Enclosure Rating	NEMA 4X	NEMA 4X	NEMA 4X	
	Enclosure Material	Polyamid	Polyamid	Polyamid	
	Mounting			Wall Mount	
Element	Tag No.	n/a	n/a	n/a	
	Sensor Type	Integral	Integral		
	Measurement Range	0 - 400 kPa	0 - 400 kPa		
	Element Material	Stainless Steel	Stainless Steel		
	Line Size (mm)	200	200		
	Enclosure Rating	NEMA 4X	NEMA 4X		
	Enclosure Material	316L SS	316L SS		
	Process Connection	Red Valve Series 48	Red Valve Series 48		
	Cable Length	n/a	n/a	n/a	
Access	Name Plate	Yes	Yes	Yes	
	Connection Plug	Yes	Yes		
	Mounting Bracket	Yes	Yes	Yes	
	Isolation Valve and/or Manifold	Quick Disconnect	Quick Disconnect	Manifold	
Approval / Enclosure		CSA, NEMA 4X	CSA, NEMA 4X	CSA / NEMA 4X	
Class / Division / Group		Unclassified	Unclassified	Class 1. Div. 1, Group D	
Comment					
Manufacturer		Siemens	Siemens	Siemens	
Model Number		Sitrans P320	Sitrans P320	Sitrans P320	
Alternates					

Notes:

1. Vendor to supply Stainless Steel Tag with Instrument Tag Number clearly stamped on it.
2. Vendor is to fill in missing data in this specification sheet relevant to the device (i.e. model #)
3. Contractor is to supply mounting hardwate appropriate for the application.
4. Dirty service transmitter to be factory installed and calibrated with Red Valve Series 48 Pressure Sensor.

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ANALYTICAL ELEMENTS

PART 1 GENERAL

1.1 SHOP DRAWINGS AND PRODUCT DATA

.1 This section specifies the supply installation, field testing, and placing into operation of various analytical instruments as described below, and as provided in but not limited to the attached Instrumentation Data Sheets (AE/AIT).

.2 The attached data sheets only indicate instruments to be supplied by Div. 25. Refer to contract drawings and shop drawings for instruments supplied by preselected equipment suppliers.

.3 Responsibility shall include supply and installation of all component and Vendor subsystems as to provide a fully functioning system, including supervision, calibration, checkout, start-up operating adjustment and documentation, tagging and compliance with data sheets.

.4 Submit shop drawings and product data in accordance with Section 01 33 00 – Submittals.

.5 The measuring elements of instrumentation designated for hazardous locations must be in full compliance with the OESC.

1.2 DELIVERY, STORAGE AND HANDLING

.1 Ship assembled to the degree which is possible. Inform installer of site assembly requirements.

1.3 RELATED SECTIONS

.1 Section 01 33 00 - Submittals

.2 Section 01 91 13 - Commissioning Requirements

.3 Section 01 91 33 - Commissioning Forms

.4 Section 01 91 41 - Commissioning Training

.5 Section 44 00 10 - Process General Requirements

.6 Section 26 00 10 - Electrical General Requirements

1.4 REFERENCES

.1 ISA RP12.06.01-2003, Recommended Practice for Wiring Methods for Hazardous (Classified) Locations Instrumentation, Part 1: Intrinsic Safety.

.2 CSA C22.2 No. 0.3-01 (R2005), Test Methods for Electrical Wires and Cables

PART 2 PRODUCTS

2.1 MATERIAL

.1 All instrumentation, control, and electrical devices provided under this Section shall be CSA approved and shall bear the CSA approvals seal.

.2 Provide each instrument with mechanisms that are corrosion resistant.

.3 Provide each instrument with mechanisms enclosed in a dust-proof and a moisture-proof case (unless stated otherwise).

.4 Provide all indicator and gauge dials finished in permanent white with black graduations and figures.

.5 Each component and composite instrument shall be suitable for the location and installation position at the attitude designated on the drawings. (eg. horizontal, vertical or sloped position.)

.1 If sensing systems utilize probes then the probes shall be braced to the structure with a minimum of two 316 SS clamps to prevent sensor movement for any reason.

.2 Sensing units shall be mounted so that interference to the sensing function is not caused by surrounding structures. The sensor shall preferably be mounted on its own support, purpose built to manufactures recommendations, to facilitate maintenance and/or adjustment.

.6 Each instrument shall be complete with supplier manufactured mounting flanges and/or brackets. The flanges shall conform to Division 44.

.7 Where amplifier/transmitter electronics is installed in an explosive environment, the housings shall be suitable for the application. (i.e. Class 1, Div 2 and suited to a wet and corrosive environment.)

.8 Provide each instrument powered with 120 VAC with a circuit protector fuse / breaker.

.9 All control panel mounted instruments shall be suitable for flush mounting and shall be furnished with bezel.

2.2 COMBINATION PH/TEMP METERS

.1 PH Systems shall be suitable for the measurement of pH in the fluids of wastewater treatment plant and also suitable for measurement of pH of final treated and filtered water.

.2 Equipment will include the pH electrode assembly, a remote mounted transmitter enclosure, and interconnecting cable between the electrode assembly and transmitter enclosure. The Contractor shall install the electrode assembly and transmitter enclosures at the approximate locations indicated on the Drawings.

.3 Mounting and installation hardware shall be 316L stainless steel. If necessary, the Contractor shall provide and install a pipe section for installation of the transducer. A multi-pole receptacle shall be provided and installed for connection of each electrode assembly as detailed in Installation Standards.

.4 The Contractor shall install and terminate the interconnecting cable between the element and transmitter. Power and control cable connections between the transmitter and remote devices shall be provided as specified elsewhere in the Contract Documents.

.5 The transmitters shall need to be field calibrated by the Contractor. The Contractor shall make adjustments to setup, zero and span settings or other adjustments as required to calibrate the instruments.

.6 The Contractor shall be responsible for start-up and testing of the devices and shall perform loop or continuity testing to verify that all electrical connections are correct. Testing shall be in accordance with the testing standards, specified elsewhere in the Contract Documents.

.7 Electrode for combined pH and temperature measurement c/w measuring cables and immersion assembly. (Probe shall include guard against mechanical damage). Typical pH range of 2 - 12 pH with integral PT-100 temperature compensation. Temperature range: -15 - 80°C.

.8 Tools and spare parts shall be furnished and packaged in accordance with Section 44 00 10 – General Process Requirements; Spare Parts. As a minimum, the following spare parts shall be furnished:

.1 One (1) complete spare pH/temperature electrode assembly.

.9 If not already allowed for elsewhere, provide handheld calibration tool as may be required.

2.3 COMBINATION ORP/TEMP METERS

.1 Jamie to add specs.

2.4 SUSPENDED SOLIDS METERS

.1 Jamie to add specs.

2.5 UV ABSORBANCE TRANSMITTANCE

.1 UV Transmittance system shall be capable of continually measuring UV absorbance and transmittance in water.

.2 The method of measuring UV absorbance and percent transmittance will be by determining the Spectral Absorption Coefficient (SAC) at a wavelength of 254 mm using a 2-beam ultra-violet absorption technology with a 1, 2, 5 or 50 mm path length.

.3 Equipment will include an immersion style probe assembly, a remote mounted transmitter enclosure, and interconnecting cable between the probe assembly and transmitter enclosure. The Contractor shall install the probe assembly and transmitter enclosures at the approximate locations indicated on the Drawings.

.4 Mounting and installation hardware shall be 316L stainless steel. A multi-pole receptacle shall be provided and installed for connection of each probe assembly as detailed in Installation Standards.

.5 The Contractor shall install and terminate the interconnecting cable between the element and transmitter. Power and control cable connections between the transmitter and remote devices shall be provided as specified elsewhere in the Contract Documents.

.6 The transmitters shall need to be field calibrated by the Contractor. The Contractor shall make adjustments to setup, zero and span settings or other adjustments as required to calibrate the instruments.

.7 The Contractor shall be responsible for start-up and testing of the devices and shall perform loop or continuity testing to verify that all electrical connections are correct. Testing shall be in accordance with the testing standards, specified elsewhere in the Contract Documents.

.8 Insertion/Immersion Probe assemblies c/w measuring cables. Transmitter Output/Display value (%).

.9 Typical range of 0 – 60 m^{-1} at 50 mm.

.10 Tools and spare parts shall be furnished and packaged in accordance with Section 44 00 10 – General Process Requirements. As a minimum, the following spare parts shall be furnished:

.1 One calibration kit and one-year of spare swiper blades.

.11 If not already allowed for elsewhere, provide handheld calibration tool as may be required.

.12 Acceptable Manufacturers: HACH Solitax Units shall be suitable for both suspended immersion application and retractable insertion into pipe as indicated in the design drawings.

2.6 DISSOLVED OXYGEN METERS

.1 Jamie to add specs.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Carry out installation, calibration and adjustment in accordance with manufacturer's installations instructions, recommended practices and as indicated on drawings and elsewhere in these specifications.

.2 All mounting plates, pedestals, bolts, shims, angle iron and other miscellaneous steel or hardware items required for the securing of equipment shall be supplied unless specifically noted otherwise.

.3 All instruments to be installed in accordance with the Manufacturer's installation instructions.

.4 Instruments or raceway will be installed so as not to obstruct access routes, equipment maintenance space or space for future equipment.

.5 Instrument supports shall be located and installed to provide a fully supported, secure system with minimum vibration.

3.2 INDICATORS

.1 Select instruments so that normal operating point is just above midpoint of instrument range. (60 – 70%)

.2 All indications shall be displayed on a linear scale unless otherwise specified. Local indicators shall be in engineering units.

3.3 START-UP

.1 The contractor shall have manufacturer's representative check and verify that instrumentation installation is in accordance with drawings and manufacturer's installation instructions.

.2 The contractor shall have manufacturer's representative instruct plant personnel on operation and maintenance of filters.

.3 The manufacturer shall include two (2) trips to the site, each 2 days: one (1) trip to start-up and calibration and one (1) trip to train the operators.

.4 Upon completion of testing of each device, affix a tag to the instrument certifying that calibration and testing have been completed and specifying the calibration points. Include loop check sheet and instrument calibration sheets in instruction books.

END OF SECTION

INSTRUMENT DATA SHEET

ANALYZING TRANSMITTERS

Project	Client	Township of South Stormont	Project No.	19070
	Location	Ingleside WWTP	Instrument Spec.	25 10 04
			Revision	1

General	Tag Number	AE/AIT-3003	AE/AIT-2101
	Service	pH and Temperature	ORP, pH and Temperature
	Location	Headworks Inlet Channel	Aeration Tank 1 Mixer
	P&ID No.	P0004	P0007
	Line Tag		
	Line Size (mm)		
Process / Fluid Data	Fluid	Primary Influent	Aerated Sewage
	Oper. Press Norm / Max (kPa)		
	Oper. Temp Norm / Max (°C)		
	Ambient Temperature (°C)		
	S.G. @ Oper. Temp		
	Viscosity @ Oper. Temp		
	Percent Solids / Type		
	Measurement Function	pH, Temperature	ORP, pH, Temperature
Transmitter	Tag No.	AIT-3003	AIT-2101
	Transmitter Type	Single Channel Remote	Dual Channel Remote
	Power Requirement	120V	120V
	Electrical Connection	1/2" NPT	1/2" NPT
	Contact Type		
	Display Type	Digital LCD Integral Display	Digital LCD Integral Display
	Instrument Range		
	Operating Range		
	Output Signal	Dual 4 - 20 mA (pH, Temp)	Triple 4 - 20 mA (ORP, pH, Temp)
	Accuracy / Repeatability	<1%	<1%
	Enclosure Rating	NEMA 4X	NEMA 4X
	Enclosure Material	Metal w/ Corrosion Resistant Finish	Metal w/ Corrosion Resistant Finish
	Mounting	Wall Mount	Panel Mount

Element	Tag No.	AE/TE-3003	AE/TE-2101B	AE-2102A
	Sensor Type	pH, Temp	pH, Temp	ORP
	Measurement Range	-2 to 14 pH / 0 to 50 deg C	-2 to 14 pH / 0 to 50 deg C	-1500 to 1500 mV
	Element Material	Glass, General Purpose	Glass, General Purpose	Platinum
	Enclosure Rating	NEMA 4X	NEMA 4X	NEMA 4X
	Enclosure Material	Stainless Steel	Stainless Steel	Stainless Steel
	Process Connection	Immersion Probe	Immersion Probe	Immersion Probe
	Cable Length			
Access	Name Plate	Yes	Yes	Yes
	Connection Plug	Quick Disconnect	Quick Disconnect	Quick Disconnect
	Sensor Mounting Assembly	Immersion Type	Immersion Type	Immersion Type
	Mounting Straps	Standard Hardware	Standard Hardware	Standard Hardware
Approval / Enclosure		CSA, NEMA 4X	CSA, NEMA 4X	CSA, NEMA 4X
Class / Division / Group		Class 1, Div. 1, Group D	Unclassified	Unclassified
Comment				
Manufacturer		HACH	HACH	HACH
Model Number		DPS1 c/w SC200 Controller	DPS1 c/w SC200 Controller	DRS5 c/w SC200 Controller
Alternates				

Notes:

1. Vendor to supply Stainless Steel Tag with Instrument Tag Number clearly stamped on it.
2. Vendor is to fill in missing data in this specification sheet relevant to the device (i.e. model #)
3. Contractor is to supply mounting hardwate appropriate for the application.

No.	Date	By	Chkd	Appd	Revision	
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INSTRUMENT DATA SHEET

ANALYZING TRANSMITTERS

Project	Client	Township of South Stormont	Project No.	19070
	Location	Ingleside WWTP	Instrument Spec.	25 10 04
			Revision	1

General	Tag Number	AE/AIT-2201	AE/AIT-2103
	Service	ORP, pH and Temperature	DO and Temp
	Location	Aeration Tank 2 Mixer	Aeration Tank 1
	P&ID No.	P0007	P0007
	Line Tag		
	Line Size (mm)		
Process / Fluid Data	Fluid	Aerated Sewage	Aerated Sewage
	Oper. Press Norm / Max (kPa)		
	Oper. Temp Norm / Max (°C)		
	Ambient Temperature (°C)		
	S.G. @ Oper. Temp		
	Viscosity @ Oper. Temp		
	Percent Solids / Type		
	Measurement Function	ORP, pH, Temperature	DO, Temperature
Transmitter	Tag No.	AIT-2201	AIT-2103
	Transmitter Type	Dual Channel Remote	Single Channel Remote
	Power Requirement	120V	120V
	Electrical Connection	1/2" NPT	1/2" NPT
	Contact Type		
	Display Type	Digital LCD Integral Display	Digital LCD Integral Display
	Instrument Range		
	Operating Range		
	Output Signal	Triple 4 - 20 mA (ORP, pH, Temp)	Dual 4 - 20 mA (DO, Temp)
	Accuracy / Repeatability	<1%	<1%
	Enclosure Rating	NEMA 4X	NEMA 4X
	Enclosure Material	Metal w/ Corrosion Resistant Finish	Metal w/ Corrosion Resistant Finish
	Mounting	Panel Mount	Panel Mount

Element	Tag No.	AE/TE-2201B	AE-2201A	AE/TE-2103
	Sensor Type	pH, Temp	ORP	DO, Temp
	Measurement Range	-2 to 14 pH / 0 to 50 deg C	-1500 to 1500 mV	0 to 20 mg/L / 0 to 50 deg C
	Element Material	Glass, General Purpose	Platinum	
	Enclosure Rating	NEMA 4X	NEMA 4X	NEMA 4X
	Enclosure Material	Stainless Steel	Stainless Steel	Stainless Steel
	Process Connection	Immersion Probe	Immersion Probe	Immersion Probe
	Cable Length			
Access	Name Plate	Yes	Yes	Yes
	Connection Plug	Quick Disconnect	Quick Disconnect	Quick Disconnect
	Sensor Mounting Assembly	Immersion Type	Immersion Type	Immersion Type
	Mounting Straps	Standard Hardware	Standard Hardware	Standard Hardware
Approval / Enclosure		CSA, NEMA 4X	CSA, NEMA 4X	CSA, NEMA 4X
Class / Division / Group		Unclassified	Unclassified	Unclassified
Comment				
Manufacturer		HACH	HACH	HACH
Model Number		DPS1 c/w SC200 Controller	DRS5 c/w SC200 Controller	LDO c/w SC200 Controller
Alternates				

Notes:

1. Vendor to supply Stainless Steel Tag with Instrument Tag Number clearly stamped on it.
2. Vendor is to fill in missing data in this specification sheet relevant to the device (i.e. model #)
3. Contractor is to supply mounting hardwate appropriate for the application.

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INSTRUMENT DATA SHEET

ANALYZING TRANSMITTERS

Project	Client	Township of South Stormont	Project No.	19070
	Location	Ingleside WWTP	Instrument Spec.	25 10 04
			Revision	1

General	Tag Number	AE/AIT-2203	AE/AIT-2151	AE/AIT-2251
	Service	DO and Temp	pH and Temp	ORP and Temp
	Location	Aeration Tank 2	Primary Digester Tank	Secondary Digester Tank
	P&ID No.	P0007	P0013	P0013
	Line Tag			
	Line Size (mm)			
Process / Fluid Data	Fluid	Aerated Sewage	Aerated Sewage	Aerated Sewage
	Oper. Press Norm / Max (kPa)			
	Oper. Temp Norm / Max (°C)			
	Ambient Temperature (°C)			
	S.G. @ Oper. Temp			
	Viscosity @ Oper. Temp			
	Percent Solids / Type			
	Measurement Function	DO, Temperature	pH, Temperature	DO, Temperature
Transmitter	Tag No.	AIT-2203	AIT-2151	AIT-2251
	Transmitter Type	Single Channel Remote	Single Channel Remote	Single Channel Remote
	Power Requirement	120V	120V	120V
	Electrical Connection	1/2" NPT	1/2" NPT	1/2" NPT
	Contact Type			
	Display Type	Digital LCD Integral Display	Digital LCD Integral Display	Digital LCD Integral Display
	Instrument Range			
	Operating Range			
	Output Signal	Dual 4 - 20 mA (DO, Temp)	Dual 4 - 20 mA (pH, Temp)	Dual 4 - 20 mA (ORP, Temp)
	Accuracy / Repeatability	<1%	<1%	<1%
	Enclosure Rating	NEMA 4X	NEMA 4X	NEMA 4X
	Enclosure Material	Metal w/ Corrosion Resistant Finish	Metal w/ Corrosion Resistant Finish	Metal w/ Corrosion Resistant Finish
	Mounting	Panel Mount	Panel Mount	Panel Mount
Element	Tag No.	AE/TE-2203	AE/TE-2151	AE/TE-2251
	Sensor Type	DO, Temp	pH, Temp	ORP, Temp
	Measurement Range	0 to 20 mg/L / 0 to 50 deg C	-2 to 14 pH / 0 to 50 deg C	-1500 to 1500 mV / 0 to 50 deg C
	Element Material		Glass, General Purpose	Platinum
	Enclosure Rating	NEMA 4X	NEMA 4X	NEMA 4X
	Enclosure Material	Stainless Steel	Stainless Steel	Stainless Steel
	Process Connection	Immersion Probe	Immersion Probe	Immersion Probe
	Cable Length			
Access	Name Plate	Yes	Yes	Yes
	Connection Plug	Quick Disconnect	Quick Disconnect	Quick Disconnect
	Sensor Mounting Assembly	Immersion Type	Immersion Type	Immersion Type
	Mounting Straps	Standard Hardware	Standard Hardware	Standard Hardware
Approval / Enclosure		CSA, NEMA 4X	CSA, NEMA 4X	CSA, NEMA 4X
Class / Division / Group		Unclassified	Unclassified	Unclassified
Comment				
Manufacturer		HACH	HACH	HACH
Model Number		LDO c/w SC200 Controller	DPS1 c/w SC200 Controller	DRS5 c/w SC200 Controller
Alternates				

Notes:

1. Vendor to supply Stainless Steel Tag with Instrument Tag Number clearly stamped on it.
2. Vendor is to fill in missing data in this specification sheet relevant to the device (i.e. model #)
3. Contractor is to supply mounting hardwate appropriate for the application.

No.	Date	By	Chkd	Appd	Revision	
1	2022-12-23	T.S.	J.B.	J.B.	Issued for Permit	

INSTRUMENT DATA SHEET

ANALYZING TRANSMITTERS

Project	Client	Township of South Stormont	Project No.	19070
	Location	Ingleside WWTP	Instrument Spec.	25 10 04
			Revision	1

General	Tag Number	AE/AIT-6010	
	Service	ORP, pH and Temperature	
	Location	UV Influent Channel	
	P&ID No.	P0010	
	Line Tag		
	Line Size (mm)		
Process / Fluid Data	Fluid	Effluent	
	Oper. Press Norm / Max (kPa)	101.3 (1 atm)	
	Oper. Temp Norm / Max (°C)	15	20
	Ambient Temperature (°C)	15	
	S.G. @ Oper. Temp		
	Viscosity @ Oper. Temp		
	Percent Solids / Type		
	Measurement Function	ORP, pH, Temperature, UV Transmittance	
Transmitter	Tag No.	AIT-6010	
	Transmitter Type	Dual Channel Remote	
	Power Requirement	120V	
	Electrical Connection	1/2" NPT	
	Contact Type		
	Display Type	Digital LCD Integral Display	
	Instrument Range		
	Operating Range		
	Output Signal	Quadruple 4 - 20 mA (ORP, pH, Temp, UVT)	
	Accuracy / Repeatability	<1%	
	Enclosure Rating	NEMA 4X	
	Enclosure Material	Metal w/ Corrosion Resistant Finish	
	Mounting	Wall Mount	

Element	Tag No.	AE/TE-6010A	AE-6010B	AE-6010C
	Sensor Type	pH, Temp	ORP	UV Absorption (2-beam, reagent free)
	Measurement Range	-2 to 14 pH / 0 to 50 deg C	-1500 to 1500 mV	0.01 to 60 m-1 at 50mm
	Element Material	Glass, General Purpose	Platinum	
	Enclosure Rating	NEMA 4X	NEMA 4X	NEMA 4X
	Enclosure Material	Stainless Steel	Stainless Steel	Stainless Steel
	Process Connection	Immersion Probe	Immersion Probe	Immersion Probe
	Cable Length			
Access	Name Plate	Yes	Yes	Yes
	Connection Plug	Quick Disconnect	Quick Disconnect	Quick Disconnect
	Sensor Mounting Assembly	Immersion Type	Immersion Type	Immersion Type
	Mounting Straps	Standard Hardware	Standard Hardware	Standard Hardware
Approval / Enclosure		CSA, NEMA 4X	CSA, NEMA 4X	CSA, NEMA 4X
Class / Division / Group		Unclassified	Unclassified	Unclassified
Comment		3 sensors connected to single SC1000 controller		
Manufacturer		HACH	HACH	HACH
Model Number		DPS1 c/w SC1000 Controller	DRS5 c/w SC1000 Controller	UVAS PLUS sc c/w SC1000 Controller
Alternates				

Notes:

1. Vendor to supply Stainless Steel Tag with Instrument Tag Number clearly stamped on it.
2. Vendor is to fill in missing data in this specification sheet relevant to the device (i.e. model #)
3. Contractor is to supply mounting hardwate appropriate for the application.

No.	Date	By	Chkd	Appd	Revision	
1	2022-12-23	T.S.	J.B.	J.B.	Issued for Permit	

INSTRUMENT DATA SHEET

ANALYZING TRANSMITTERS

Project	Client	Township of South Stormont	Project No.	19070
	Location	Ingleside WWTP	Instrument Spec.	25 10 04
			Revision	1

General	Tag Number	AE/AIT-2040	AE/AIT-2041	AE/AIT-3052
	Service	WAS Density	RAS Density	TWAS Density
	Location	Pump Gallery Basement	Pump Gallery Basement	Headworks Basement, Thickener Room
	P&ID No.	P0009	P0009	P0010
	Line Tag	150-WAS-SS1	300-RAS-SS1	100-TWAS-SS1
	Line Size (mm)	150	300	100
Process / Fluid Data	Fluid	Waste Activated Sludge	Return Activated Sludge	Thickened Waste Activated Sludge
	Oper. Press Norm / Max (kPa)			
	Oper. Temp Norm / Max (°C)			
	Ambient Temperature (°C)			
	S.G. @ Oper. Temp			
	Viscosity @ Oper. Temp			
	Percent Solids / Type			
	Measurement Function	Turbidity, Suspended Solids	Turbidity, Suspended Solids	Turbidity, Suspended Solids
Transmitter	Tag No.	AIT-2040	AIT-2041	AIT-3052
	Transmitter Type	Single Channel Remote	Single Channel Remote	Single Channel Remote
	Power Requirement	120V	120V	120V
	Electrical Connection	1/2" NPT	1/2" NPT	1/2" NPT
	Contact Type			
	Display Type	Digital LCD Integral Display	Digital LCD Integral Display	Digital LCD Integral Display
	Output Signal	Dual 4 - 20 mA (Turbidity, Sus. Solids)	Dual 4 - 20 mA (Turbidity, Sus. Solids)	Dual 4 - 20 mA (Turbidity, Sus. Solids)
	Instrument Range			
	Operating Range			
	Accuracy / Repeatability	Turb.: <1% Sus. Solids: <3%	Turb.: <1% Sus. Solids: <3%	Turb.: <1% Sus. Solids: <3%
	Enclosure Rating	NEMA 4X	NEMA 4X	NEMA 4X
	Enclosure Material	Metal w/ Corrosion Resistant Finish	Metal w/ Corrosion Resistant Finish	Metal w/ Corrosion Resistant Finish
	Mounting	Wall Mount	Wall Mount	Wall Mount
Element	Tag No.	AE/TE-2040	AE/TE-2041	AE/TE-3052
	Sensor Type	Turbidity, Suspended Solids	Turbidity, Suspended Solids	Turbidity, Suspended Solids
	Measurement Range	Turb.: 0.001 to 4000 NTU Sus. Solids: 0.001 mg/L to 500 g/L	Turb.: 0.001 to 4000 NTU Sus. Solids: 0.001 mg/L to 500 g/L	Turb.: 0.001 to 4000 NTU Sus. Solids: 0.001 mg/L to 500 g/L
	Element Material			
	Enclosure Rating	NEMA 4X	NEMA 4X	NEMA 4X
	Enclosure Material	Stainless Steel	Stainless Steel	Stainless Steel
	Process Connection	Insertion Probe	Insertion Probe	Insertion Probe
	Cable Length			
Access	Name Plate	Yes	Yes	Yes
	Connection Plug	Quick Disconnect	Quick Disconnect	Quick Disconnect
	Sensor Mounting Assembly	Highline Insertion	Highline Insertion	Highline Insertion
	Mounting Straps	Ball Valve Assembly Kit	Ball Valve Assembly Kit	Ball Valve Assembly Kit
Approval / Enclosure		CSA, NEMA 4X	CSA, NEMA 4X	CSA, NEMA 4X
Class / Division / Group		Unclassified	Unclassified	Unclassified
Comment				
Manufacturer		HACH	HACH	HACH
Model Number		Solitax sc c/w SC200 Controller	Solitax sc c/w SC200 Controller	Solitax sc c/w SC200 Controller
Alternates				

Notes:

1. Vendor to supply Stainless Steel Tag with Instrument Tag Number clearly stamped on it.
2. Vendor is to fill in missing data in this specification sheet relevant to the device (i.e. model #)
3. Contractor is to supply mounting hardwate appropriate for the application.
4. Dirty service transmitter to be factory installed and calibrated with Red Valve Series 48 Pressure Sensor.

No.	Date	By	Chkd	Appd	Revision	
1	2022-12-23	T.S.	J.B.	J.B.	Issued for Permit	

INSTRUMENT DATA SHEET

ANALYZING TRANSMITTERS

Project	Client	Township of South Stormont	Project No.	19070
	Location	Ingleside WWTP	Instrument Spec.	25 10 04
			Revision	1

General	Tag Number							
	Service							
	Location							
	P&ID No.							
	Line Tag							
	Line Size (mm)							
Process / Fluid Data	Fluid							
	Oper. Press Norm / Max (kPa)							
	Oper. Temp Norm / Max (°C)							
	Ambient Temperature (°C)							
	S.G. @ Oper. Temp							
	Viscosity @ Oper. Temp							
	Percent Solids / Type							
	Measurement Function							
Transmitter	Tag No.							
	Transmitter Type							
	Power Requirement							
	Electrical Connection							
	Contact Type							
	Display Type							
	Output Signal							
	Instrument Range							
	Operating Range							
	Accuracy / Repeatability							
	Enclosure Rating							
	Enclosure Material							
	Mounting							
Element	Tag No.							
	Sensor Type							
	Measurement Range							
	Element Material							
	Enclosure Rating							
	Enclosure Material							
	Process Connection							
	Cable Length							
Access	Name Plate							
	Connection Plug							
	Sensor Mounting Assembly							
	Mounting Straps							
Approval / Enclosure								
Class / Division / Group								
Comment								
Manufacturer								
Model Number								
Alternates								

Notes:

1. Vendor to supply Stainless Steel Tag with Instrument Tag Number clearly stamped on it.
2. Vendor is to fill in missing data in this specification sheet relevant to the device (i.e. model #)
3. Contractor is to supply mounting hardwate appropriate for the application.
4. Dirty service transmitter to be factory installed and calibrated with Red Valve Series 48 Pressure Sensor.

No.	Date	By	Chkd	Appd	Revision	

FLOW METERS

PART 1 GENERAL

1.1 SHOP DRAWINGS AND PRODUCT DATA

.1 This section specifies the supply (for those instruments not included within the supply of a pre-selected equipment package), installation, field testing, and placing into operation of all flow meters (including those supplied as part of a pre-selected equipment package), various level elements and flow transducers/transmitters as specified below, and as identified in but not limited to the attached Instrumentation Data Sheets and on the Contract Drawings.

.2 Responsibility shall include supply and installation of all component and Vendor subsystems as to provide a fully functioning system, including supervision, calibration, checkout, start-up operating adjustment and documentation, tagging and compliance with data sheets.

.3 Submit shop drawings and product data in accordance with Section 01 33 00 – Submittals.

.4 The measuring elements of instrumentation designated for hazardous locations must be in full compliance with the OESC.

1.2 DELIVERY, STORAGE AND HANDLING

.1 Ship assembled to the degree which is possible. Inform installer of site assembly requirements.

1.3 RELATED SECTIONS

.1 Section 01 33 00 - Submittals

.2 Section 01 91 13 - Commissioning Requirements

.3 Section 01 91 33 - Commissioning Forms

.4 Section 01 91 41 - Commissioning Training

.5 Section 44 00 10 - Process General Requirements

.6 Section 26 00 10 - Electrical General Requirements

1.4 REFERENCES

.1 ISA RP12.06.01-2003, Recommended Practice for Wiring Methods for Hazardous (Classified) Locations Instrumentation, Part 1: Intrinsic Safety.

.2 CSA C22.2 No. 0.3-01 (R2005), Test Methods for Electrical Wires and Cables

1.5 COMMISSIONING AND TRAINING

.1 Commissioning, training, and closeout documents are to be carried out in accordance with Section 01 91 13, Section 01 91 33, and Section 01 91 41.

.2 Also submit the following:

.1 Manufacturer's calibration certificates.

.2 Instrument field calibration sheets.

.3 Instrument field loop check sheets.

PART 2 PRODUCTS

2.1 GENERAL

.1 All instrumentation, control, and electrical devices provided under this Section shall be CSA approved and shall bear the CSA approvals seal as detailed in Section 44 00 10 - Process General Requirements.

.2 Provide each instrument with mechanisms and enclosures that are corrosion resistant.

.3 Provide each instrument with mechanisms enclosed in a dust-proof and a moisture-proof case.

.4 Provide all indicator and gauge dials finished in permanent white with black graduations and figures.

.5 Each component shall be carefully selected and designed for a long lifetime with ample margin to withstand transient and other surge voltages which may occur in the circuits from any source in the power supply.

.6 Each component and composite instrument shall be suitable for the location and installation position at the attitude designated on the drawings, eg., horizontal, vertical or sloped position.

.1 If sensing systems utilize probes then the probes shall be braced to the structure with a minimum of two 316 SS clamps to prevent sensor movement for any reason.

.2 Where probes are suspended into vessels or chambers, stilling tubes shall be used to prevent excessive movement.

.3 Sensing units shall be mounted so that interference to the sensing function is not caused by surrounding structures. The sensor shall preferably be mounted on its own support, purpose built to manufactures recommendations, to facilitate maintenance and/or adjustment.

.7 Where amplifier/transmitter electronics is installed in an explosive environment, the housings shall be suitable for the application. i.e. Class 1, Div 1 and suited to a wet and corrosive environment. Each of the Flow meter instruments supplied for this project must meet this requirement.

2.2 MAGNETIC FLOWMETERS

.1 Magnetic flowmeters shall be completely obstruction less, in-line meters with no constrictions in the flow of fluid through the meter. The meter shall consist of a metallic tube with flanged ends and with grounding rings. Flange diameter and bolt drilling pattern shall comply with ANSI/ASME B16.5, Class 150. Flangeless wafer insert style meters may be used for pipe sizes up to 150 mm, where compatible with adjacent piping flanges. Meters shall be suitable for the maximum range of working pressures of the adjacent piping. Electrode and liner material shall be fully compatible with the process fluid. Each meter shall be factory calibrated, at a facility which is traceable to NIST or other standard acceptable to the Engineer. A copy of the calibration report shall be submitted.

.2 The meter shall be capable of standing empty for extended periods of time without damage to any components. The meter housing shall withstand submergence in 10 m of water for 48 hours without damage.

.3 Magnetic flowmeter systems shall provide zero flow stability by means of automatic zero adjustment of a DC excited metering circuit. Converters shall be capable of bi-directional flow measurement. Signal converters shall be of the same manufacturer as the flow element.

.4 Signal cable from the meter to signal converter shall be provided by the meter manufacturer. A minimum of three meters of interconnecting cable shall be provided. The signal converter shall be housed in a corrosion-resistant, weatherproof, EEMAC 4 enclosure, suitable for wall or pipe strut mounting. The signal converter shall be suitable for operation over an ambient temperature range of -34 to 60°C, and a relative humidity of 10-100%.

.5 Each magnetic flowmeter shall be provided with an optional remote mounted or integral, microprocessor-based signal converter (transmitter). The signal converter shall include output damping, self-testing, built-in calibration capability, and an “empty pipe zero” contact input. The overall accuracy of the magnetic flowmeter signal converter shall be ±0.5% of actual flowrate for full-scale flow settings of 1-10 m per second. Converter output shall be linear with flowrate. The signal converter shall be provided with an integral four digit LCD indicator, scaled in engineering units.

.6 The signal converter shall be housed in a corrosion-resistant, weatherproof, EEMAC 4 enclosure, suitable for wall or pipe strut mounting. The signal converter shall be suitable for operation over an ambient temperature range of -34 to 60°C, and a relative humidity of 10-100%.

.7 Each transmitter shall be powered from 120 volts AC, 60 Hz, single phase. A multi-pole receptacle shall be provided on the transmitter enclosure for connection of AC power via a cordset in accordance with Installation Standards.

.8 Magnetic flowmeters shall be factory calibrated by the Contractor to the flow ranges indicated in the Instrument Data Sheets. Copies of the factory calibration

data sheets shall be submitted in accordance with the applicable sections of the Contract Documents.

.9 Each magnetic flowmeter system shall be provided with all required mounting hardware to mount both the element and transmitter according to the mounting requirements indicated in the Instrument Data Sheet. Mounting and installation hardware shall be 316L stainless steel or other material approved by the flowmeter manufacturer for use in the specified conditions.

.10 For systems where the primary element and transmitter are physically separated, interconnecting cable from the element to the transmitter shall be provided. The cable shall be the type approved by the flowmeter manufacturer for the intended purpose of interfacing the element to the transmitter. Length of cable shall be a minimum of three meters or as indicated in the Instrument Data Sheet.

.11 For systems which require a dedicated programming device for calibration, maintenance, or troubleshooting, one such programming device shall be provided for each location. The programming device shall include appropriate operation manuals and shall be included in the training requirements. For systems which allow the programming device functions to be implemented in software, running on a laptop computer, the software shall be provided instead of the programming device.

.12 Transmitters indicated as requiring a serial interface shall be provided with all accessories required to properly communicate over the serial link. As a minimum, an appropriate cable shall be provided to allow the transmitter serial interface to be connected to a personal computer. One licensed copy of the diagnostic/interface software shall be provided for each facility (two total). Software shall be capable of running under Microsoft's Windows XP operating system. If the software furnished performs the same functions as the programming device, specified elsewhere, then the programming device shall not be furnished.

.13 Tools and spare parts shall be furnished as recommended by the manufacturer. As a minimum, the following spare parts shall be furnished:

.1 Two spare fuses of each type required.

.14 Acceptable Manufacturers:

.1 Siemens
.2 ABB
.3 Endress+Hauser
.4 Yokogawa

2.3 THERMAL MASS FLOW METERS

.1 Flow Element - The flow element shall be a thermal dispersion type, explosion-proof, stainless steel sensing element, suitable for insertion into the specified process piping. For process piping 50 mm and greater, the element shall be fabricated to allow insertion into the pipe, with the insertion length recommended by the manufacturer. For systems measuring flow in pipe sizes less than 50 mm, the sensor shall be integrally mounted to a pipe spool piece with flanged

connections. Spool piece materials of construction shall match the process pipe in which the flow meter is to be installed. Each removable sensor shall be provided with an isolation valve and packing gland which allows insertion removal, and adjustment while the piping is under pressure.

.2 Transmitter - The transmitter shall be a microprocessor based unit housed in a remote mounted NEMA Type 4 enclosure. The transmitter electronics shall accept the signal input from the flow element and output an isolated 4-20mA DC signal linearly proportional to the measured flow rate. The transmitter shall be provided with an integral 3-1/2 digit LCD indicator, calibrated in liters per second and m^3 per day. The transmitter shall also be capable of displaying a totalized flow rate and the process temperature.

.3 Mounting Hardware - Each flow metering system shall be provided with all required mounting hardware to mount both the element and transmitter according to the mounting requirements of the flowmeter manufacturer. Mounting and installation hardware shall be 316L stainless steel or other material approved by the sensor manufacturer and suited for use in the specified process stream (as indicated in the Instrument Data Sheets). The supplier shall include the restraints, retractors, cable glands, conduit seals, cable, compression fittings, packing glands and ball valves (see Section 44 10 74 for valve specification).

.4 Interconnecting Cable - For systems where the primary element and transmitter are physically separated, interconnecting cable from the element to the transmitter shall be provided. The cable shall be the type approved by the flowmeter system manufacturer for the intended purpose of interfacing the element to the transmitter. Length of cable shall be three meters minimum, or as indicated in the Instrument Data Sheet.

.5 Programming Device - For systems which require a dedicated programming device for calibration, maintenance, or troubleshooting, one such programming device shall be provided. The programming device shall include appropriate operation manuals and shall be included in the training requirements.

.6 Tools and Spare Parts - Tools and spare parts shall be furnished and packaged in accordance with Section 44 00 10. As a minimum, the following spare parts shall be furnished for each flow metering system:

.1 2 spare fuses for each type required.

.2 2 spare flow elements.

.7 Standard of Acceptance: Kurz Series 454FTB-

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install all instruments in strict accordance with the recommendation of the manufacturer.

.2 The in-line mechanical installation of items such as flow-meters, is specified in Division 44, Process Mechanical for all vendor packages.

.3 Carry out installation, calibration and adjustment in accordance with manufacturers installations instructions, recommended practices and as indicated on drawings and elsewhere in these specifications.

3.2 EQUIPMENT MOUNTING

.1 All mounting plates, pedestals, bolts, shims, angle iron and other miscellaneous steel or hardware items required for the securing of equipment shall be supplied unless specifically noted otherwise.

.2 All instruments to be installed in accordance with the Manufacturer's installation instructions.

.3 Each instrument sensing line shall be complete with an isolation valve. The isolation valves shall conform to Divisions 44 equipment requirements.

.4 Instruments or raceway will be installed so as not to obstruct access routes, equipment maintenance space or space for future equipment.

.5 Where the removal of filter cartridges and heater elements is necessary, attention will be paid to instrument locations and tubing runs.

.6 Instrument supports shall be located and installed to provide a fully supported, secure system with minimum vibration.

3.3 WIRE AND CABLE

.1 Instrumentation cables shall be as described by Division 25 and 26 of this specification. Single pair twisted shielded cable to be run in conduit. Multi-pairs shall be Teck run in cable tray.

.2 Control wiring shall be either multi-conductor Teck run in cable tray or single conductor wire run in conduit.

3.4 GAUGES AND INDICATORS

.1 Install primary sensors or indicators in uninterrupted straight pipe, minimum 3 pipe diameters downstream and 3 pipe diameters upstream, on supply lines downstream of pumps, or according to manufacturer's recommendations.

.2 Select instruments so that normal operating point is just above midpoint of instrument range. (60 – 70%)

.3 All indications shall be displayed on a linear scale unless otherwise specified. Local indicators shall be in engineering units.

3.5 TESTING

.1 These devices will be field calibrated by the Contractor. The Contractor shall be responsible for start-up and testing of the devices and shall perform loop or continuity testing to verify that all electrical connections are correct. Testing shall be in accordance with the testing standards, specified elsewhere in the Contract Documents.

.2 During testing demonstrate proper calibration and correct operation to the Owners Representative.

.3 Upon completion of testing of each device, affix a tag to the instrument certifying that calibration and testing have been completed and specifying the calibration points. Include loop check sheet and instrument calibration sheets in instruction books.

3.6 COMMISSIONING

.1 Notwithstanding the requirements of all other sections of this contract as they relate to commissioning, commissioning of the instrumentation and control system shall include, but not be limited to the following:

.1 Supervise installation of components, wiring connections and piping connections.

.2 Supervise wiring continuity and pipe leak tests.

.3 Verify instrument calibration and provide written report.

.4 Function check and adjust under operational conditions the instruments and control equipment.

.5 Coordinate instrument and control equipment supplier’s service personnel as required for complete system testing.

.6 Instruct plant personnel in correct method of operation of instruments and control equipment.

.7 Direct plant personnel at hand-over as to final adjustment to the system for correct operation of plant.

.8 Ensure that the instrumentation and control equipment suppliers cooperate to complete the work of this section.

.9 Verify signal levels and wiring connections to all instrumentation and control equipment.

END OF SECTION

INSTRUMENT DATA SHEET

FLOW TRANSMITTERS

Project	Client	Township of South Stormont	Project No.	19070
	Location	Ingleside WWTP	Instrument Spec.	25 10 05
			Revision	1

General	Tag Number	FE/FIT-2051	FE/FIT-2040	FE/FIT-2141
	Description of Instrument	Electromagnetic Flowmeter	Electromagnetic Flowmeter	Electromagnetic Flowmeter
	Service	Primary Sludge to Primary Digester	Waste Activated Sludge	Return Activated Sludge Pump 1
	Location	Pump Gallery Basement	Pump Gallery Basement	Pump Gallery Basement
	P&ID No.	P0013	P0009	P0009
Process / Fluid Data	Line Tag	100-PS-SS1	100-WAS-SS1	150-RAS-SS1
	Line Size (mm)	100	100	150
	Fluid	Primary Sludge	Activated Sludge	Activated Sludge
	Oper. Press Norm / Max (kPa)			
	Oper. Temp Norm / Max (°C)			
	Ambient Temperature	15 deg. C	15 deg. C	15 deg. C
	S.G. @ Oper. Temp			
	Viscosity @ Oper. Temp			
	Turbidity (NTU) / TDS (mg/L)			
	Measurement Function	Flow Rate	Flow Rate	Flow Rate
Transmitter	Tag No.	FIT-2051	FIT-2040	FIT-2141
	Transmitter Type	Remote	Remote	Remote
	Power Requirement	120VAC	120VAC	120VAC
	Electrical Connection	1/2" NPT	1/2" NPT	1/2" NPT
	Contact Type	n/a	n/a	n/a
	Display Type	Digital LCD Integral Display	Digital LCD Integral Display	Digital LCD Integral Display
	Instrument Range			
	Operating Range			
	Output Signal	4 - 20 mA	4 - 20 mA	4 - 20 mA
	Accuracy / Repeatability	±0.2% ± 1 mm/s	±0.2% ± 1 mm/s	±0.2% ± 1 mm/s
	Enclosure Rating	NEMA 4X	NEMA 4X	NEMA 4X
	Enclosure Material	Polyamid	Polyamid	Polyamid
	Mounting	Wall Mount	Wall Mount	Wall Mount
Element	Tag No.	FE-2051	FE-2040	FE-2141
	Sensor Type	DC MAG	DC MAG	DC MAG
	Measurement Range			
	Lining Material	NBR Hard Rubber	NBR Hard Rubber	NBR Hard Rubber
	Element Material	Hastelloy C276	Hastelloy C276	Hastelloy C276
	Line Size (mm)	100	100	150
	Enclosure Rating	NEMA 4X/6	NEMA 4X/6	NEMA 4X/6
	Enclosure Material	Carbon Steel	Carbon Steel	Carbon Steel
	Process Connection	ANSI B16.5, class 150	ANSI B16.5, class 150	ANSI B16.5, class 150
	Cable Length	As required	As required	As required
Access	Name Plate	Yes	Yes	Yes
	Connection Plug	Yes	Yes	Yes
	Mounting Bracket	Yes	Yes	Yes
	Isolation Valve and/or Manifold			
Approval / Enclosure		CSA, NEMA 4X	CSA, NEMA 4X	CSA, NEMA 4X
Class / Division / Group		Unclassified	Unclassified	Unclassified
Comment				
Manufacturer		Siemens	Siemens	Siemens
Model Number		Sitrans FM MAG 5100W c/w MAG6000	Sitrans FM MAG 5100W c/w MAG6000	Sitrans FM MAG 5100W c/w MAG6000
Alternates				

Notes:

1. Vendor to supply Stainless Steel Tag with Instrument Tag Number clearly stamped on it.
2. Vendor is to fill in missing data in this specification sheet relevant to the device (i.e. model #)
3. Contractor is to supply mounting hardwate appropriate for the application.
4. Dirty service transmitter to be factory installed and calibrated with Red Valve Series 40 Pressure Sensor.

No.	Date	By	Chkd	Appd	Revision	
1	2022-12-23	T.S.	J.B.	J.B.	Issued for Permit	

INSTRUMENT DATA SHEET

FLOW TRANSMITTERS

Project	Client	Township of South Stormont	Project No.	19070
	Location	Ingleside WWTP	Instrument Spec.	25 10 05
			Revision	1

General	Tag Number	FE/FIT-2241	FE/FIT-2341	FE/FIT-3052
	Description of Instrument	Electromagnetic Flowmeter	Electromagnetic Flowmeter	Electromagnetic Flowmeter
	Service	Return Activated Sludge Pump 2	Return Activated Sludge Pump 3	Thickened Waste Activated Sludge
	Location	Pump Gallery Basement	Pump Gallery Basement	Headworks Basement
	P&ID No.	P0009	P0009	P0010
Process / Fluid Data	Line Tag	150-RAS-SS1	150-RAS-SS1	75-TWAS-SS1
	Line Size (mm)	150	150	75
	Fluid	Activated Sludge	Activated Sludge	Activated Sludge
	Oper. Press Norm / Max (kPa)			
	Oper. Temp Norm / Max (°C)			
	Ambient Temperature	15 deg. C	15 deg. C	15 deg. C
	S.G. @ Oper. Temp			
	Viscosity @ Oper. Temp			
	Turbidity (NTU) / TDS (mg/L)			
	Measurement Function	Flow Rate	Flow Rate	Flow Rate
Transmitter	Tag No.	FIT-2241	FIT-2341	FIT-3052
	Transmitter Type	Remote	Remote	Remote
	Power Requirement	120VAC	120VAC	120VAC
	Electrical Connection	1/2" NPT	1/2" NPT	1/2" NPT
	Contact Type	n/a	n/a	n/a
	Display Type	Digital LCD Integral Display	Digital LCD Integral Display	Digital LCD Integral Display
	Instrument Range			
	Operating Range			
	Output Signal	4 - 20 mA	4 - 20 mA	4 - 20 mA
	Accuracy / Repeatability	±0.2% ± 1 mm/s	±0.2% ± 1 mm/s	±0.2% ± 1 mm/s
	Enclosure Rating	NEMA 4X	NEMA 4X	NEMA 4X
	Enclosure Material	Polyamid	Polyamid	Polyamid
	Mounting	Wall Mount	Wall Mount	Wall Mount
Element	Tag No.	FE-2241	FE-2341	FE-3052
	Sensor Type	DC MAG	DC MAG	DC MAG
	Measurement Range			
	Lining Material	NBR Hard Rubber	NBR Hard Rubber	NBR Hard Rubber
	Element Material	Hastelloy C276	Hastelloy C276	Hastelloy C276
	Line Size (mm)	150	150	75
	Enclosure Rating	NEMA 4X/6	NEMA 4X/6	NEMA 4X/6
	Enclosure Material	Carbon Steel	Carbon Steel	Carbon Steel
	Process Connection	ANSI B16.5, class 150	ANSI B16.5, class 150	ANSI B16.5, class 150
	Cable Length	As required	As required	As required
Access	Name Plate	Yes	Yes	Yes
	Connection Plug	Yes	Yes	Yes
	Mounting Bracket	Yes	Yes	Yes
	Isolation Valve and/or Manifold			
Approval / Enclosure		CSA, NEMA 4X	CSA, NEMA 4X	CSA, NEMA 4X
Class / Division / Group		Unclassified	Unclassified	Unclassified
Comment				
Manufacturer		Siemens	Siemens	Siemens
Model Number		Sitrans FM MAG 5100W c/w MAG6000	Sitrans FM MAG 5100W c/w MAG6000	Sitrans FM MAG 5100W c/w MAG6000
Alternates				

Notes:

1. Vendor to supply Stainless Steel Tag with Instrument Tag Number clearly stamped on it.
2. Vendor is to fill in missing data in this specification sheet relevant to the device (i.e. model #)
3. Contractor is to supply mounting hardwate appropriate for the application.
4. Dirty service transmitter to be factory installed and calibrated with Red Valve Series 40 Pressure Sensor.

No.	Date	By	Chkd	Appd	Revision	
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INSTRUMENT DATA SHEET

FLOW TRANSMITTERS

Project	Client	Township of South Stormont	Project No.	19070
	Location	Ingleside WWTP	Instrument Spec.	25 10 05
			Revision	1

General	Tag Number	FE/FIT-6061	FE/FIT-3081	FE/FIT-2052
	Description of Instrument	Electromagnetic Flowmeter	Electromagnetic Flowmeter	Electromagnetic Flowmeter
	Service	Service Water	Potable Water	RAS / TWAS to Primary Digester
	Location	UV Building	Headworks Basement	Pump Gallery Basement
	P&ID No.	P0011	P0011	P0013
Process / Fluid Data	Line Tag	150-SW-SS1-25A	75-SW-SS1-25A	
	Line Size (mm)	150	150	150
	Fluid	Final Effluent	Potable Water	Digested Sludge
	Oper. Press Norm / Max (kPa)			
	Oper. Temp Norm / Max (°C)			
	Ambient Temperature	15 deg. C	15 deg. C	15 deg. C
	S.G. @ Oper. Temp			
	Viscosity @ Oper. Temp			
	Turbidity (NTU) / TDS (mg/L)			
	Measurement Function	Flow Rate	Flow Rate	Flow Rate
Transmitter	Tag No.	FIT-6061	FIT-3081	FIT-2052
	Transmitter Type	Remote	Remote	Remote
	Power Requirement	120VAC	120VAC	120VAC
	Electrical Connection	1/2" NPT	1/2" NPT	1/2" NPT
	Contact Type	n/a	n/a	n/a
	Display Type	Digital LCD Integral Display	Digital LCD Integral Display	Digital LCD Integral Display
	Instrument Range			
	Operating Range			
	Output Signal	4 - 20 mA	4 - 20 mA	4 - 20 mA
	Accuracy / Repeatability	±0.2% ± 1 mm/s	±0.2% ± 1 mm/s	±0.2% ± 1 mm/s
	Enclosure Rating	NEMA 4X	NEMA 4X	NEMA 4X
	Enclosure Material	Polyamid	Polyamid	Polyamid
	Mounting	Wall Mount	Wall Mount	Wall Mount
Element	Tag No.	FE-6061	FE-3081	FE-2052
	Sensor Type	DC MAG	DC MAG	DC MAG
	Measurement Range			
	Lining Material	NBR Hard Rubber	NBR Hard Rubber	NBR Hard Rubber
	Element Material	Hastelloy C276	Hastelloy C276	Hastelloy C276
	Line Size (mm)	150	150	150
	Enclosure Rating	NEMA 4X/6	NEMA 4X/6	NEMA 4X/6
	Enclosure Material	Carbon Steel	Carbon Steel	Carbon Steel
	Process Connection	ANSI B16.5, class 150	ANSI B16.5, class 150	ANSI B16.5, class 150
	Cable Length	As required	As required	As required
Access	Name Plate	Yes	Yes	Yes
	Connection Plug	Yes	Yes	Yes
	Mounting Bracket	Yes	Yes	Yes
	Isolation Valve and/or Manifold			
Approval / Enclosure		CSA, NEMA 4X	CSA, NEMA 4X	CSA, NEMA 4X
Class / Division / Group		Unclassified	Unclassified	Unclassified
Comment				
Manufacturer		Siemens	Siemens	Siemens
Model Number		Sitrans FM MAG 5100W c/w MAG6000	Sitrans FM MAG 5100W c/w MAG6000	Sitrans FM MAG 5100W c/w MAG6000
Alternates				

Notes:

1. Vendor to supply Stainless Steel Tag with Instrument Tag Number clearly stamped on it.
2. Vendor is to fill in missing data in this specification sheet relevant to the device (i.e. model #)
3. Contractor is to supply mounting hardwate appropriate for the application.
4. Dirty service transmitter to be factory installed and calibrated with Red Valve Series 40 Pressure Sensor.

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INSTRUMENT DATA SHEET

FLOW TRANSMITTERS

Project	Client	Township of South Stormont	Project No.	19070
	Location	Ingleside WWTP	Instrument Spec.	25 10 05
			Revision	1

General	Tag Number	FE/FIT-2042	FE/FIT-7030	FE/FIT-2041
	Description of Instrument	Electromagnetic Flowmeter	Electromagnetic Flowmeter	Electromagnetic Flowmeter
	Service	Sludge Transfer To Storage	Sludge Removal from Storage	Return Activated Sludge, Combined
	Location	Pump Gallery Basement	Pump Gallery Basement	Pump Gallery Basement
	P&ID No.	P0013	P0014	P0009
Process / Fluid Data	Line Tag	150-DS-SS1	150-DS-SS1	200-RAS-SS1
	Line Size (mm)	150	150	150
	Fluid	Digested Sludge	Digested Sludge	Activated Sludge
	Oper. Press Norm / Max (kPa)			
	Oper. Temp Norm / Max (°C)			
	Ambient Temperature	15 deg. C	15 deg. C	15 deg. C
	S.G. @ Oper. Temp			
	Viscosity @ Oper. Temp			
	Turbidity (NTU) / TDS (mg/L)			
	Measurement Function	Flow Rate	Flow Rate	Flow Rate
Transmitter	Tag No.	FIT-2042	FIT-	FIT-2041
	Transmitter Type	Remote	Remote	Remote
	Power Requirement	120VAC	120VAC	120VAC
	Electrical Connection	1/2" NPT	1/2" NPT	1/2" NPT
	Contact Type	n/a	n/a	n/a
	Display Type	Digital LCD Integral Display	Digital LCD Integral Display	Digital LCD Integral Display
	Instrument Range			
	Operating Range			
	Output Signal	4 - 20 mA	4 - 20 mA	4 - 20 mA
	Accuracy / Repeatability	±0.2% ± 1 mm/s	±0.2% ± 1 mm/s	±0.2% ± 1 mm/s
	Enclosure Rating	NEMA 4X	NEMA 4X	NEMA 4X
	Enclosure Material	Polyamid	Polyamid	Polyamid
	Mounting	Wall Mount	Wall Mount	Wall Mount
Element	Tag No.	FE-2042	FE-	FE-2041
	Sensor Type	DC MAG	DC MAG	DC MAG
	Measurement Range			
	Lining Material	NBR Hard Rubber	NBR Hard Rubber	NBR Hard Rubber
	Element Material	Hastelloy C276	Hastelloy C276	Hastelloy C276
	Line Size (mm)	150	150	150
	Enclosure Rating	NEMA 4X/6	NEMA 4X/6	NEMA 4X/6
	Enclosure Material	Carbon Steel	Carbon Steel	Carbon Steel
	Process Connection	ANSI B16.5, class 150	ANSI B16.5, class 150	ANSI B16.5, class 150
	Cable Length	As required	As required	As required
Access	Name Plate	Yes	Yes	Yes
	Connection Plug	Yes	Yes	Yes
	Mounting Bracket	Yes	Yes	Yes
	Isolation Valve and/or Manifold			
Approval / Enclosure		CSA, NEMA 4X	CSA, NEMA 4X	CSA, NEMA 4X
Class / Division / Group		Unclassified	Unclassified	Unclassified
Comment				
Manufacturer		Siemens	Siemens	Siemens
Model Number		Sitrans FM MAG 5100W c/w MAG6000	Sitrans FM MAG 5100W c/w MAG6000	Sitrans FM MAG 5100W c/w MAG6000
Alternates				

Notes:

1. Vendor to supply Stainless Steel Tag with Instrument Tag Number clearly stamped on it.
2. Vendor is to fill in missing data in this specification sheet relevant to the device (i.e. model #)
3. Contractor is to supply mounting hardwate appropriate for the application.
4. Dirty service transmitter to be factory installed and calibrated with Red Valve Series 40 Pressure Sensor.

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INSTRUMENT DATA SHEET

FLOW TRANSMITTERS

Project	Client	Township of South Stormont	Project No.	19070
	Location	Ingleside WWTP	Instrument Spec.	25 10 05
			Revision	1

General	Tag Number	FIT-2150	FIT-2250	FIT-2100
	Description of Instrument	Thermal Mass Flowmeter	Thermal Mass Flowmeter	Thermal Mass Flowmeter
	Service	Proc. Air, Pri. Digester	Proc. Air, Sec. Digester & Bio. Tank 1	Proc. Air, Aeration Tank 1
	Location	Pump Gallery Basement	Pump Gallery Basement	Pump Gallery Basement
	P&ID No.	P0012	P0012	P0012
Process / Fluid Data	Line Tag	300AA-SS1-25PP	400-AA-SS1-25PP	200-AB-SS1-25PP
	Line Size (mm)	300	400	200
	Fluid	Blower Air	Blower Air	Blower Air
	Oper. Press Norm / Max (kPa)			
	Oper. Temp Norm / Max (°C)			
	Ambient Temperature	15 deg. C	15 deg. C	15 deg. C
	S.G. @ Oper. Temp	n/a	n/a	n/a
	Viscosity @ Oper. Temp	n/a	n/a	n/a
	Turbidity (NTU) / TDS (mg/L)	n/a	n/a	n/a
	Measurement Function	Flow Rate	Flow Rate	Flow Rate
Transmitter	Tag No.	FIT-2150	FIT-2250	FIT-2100
	Transmitter Type	Integral	Integral	Integral
	Power Requirement	120VAC	120VAC	120VAC
	Electrical Connection	3/4" NPT	3/4" NPT	3/4" NPT
	Contact Type	n/a	n/a	n/a
	Display Type	Digital LCD Integral Display	Digital LCD Integral Display	Digital LCD Integral Display
	Instrument Range			
	Operating Range			
	Output Signal	4 - 20 mA (dual) flow and temp	4 - 20 mA (dual) flow and temp	4 - 20 mA (dual) flow and temp
	Accuracy / Repeatability	Flow: ± 1% / Temp: ±0.5%	Flow: ± 1% / Temp: ±0.5%	Flow: ± 1% / Temp: ±0.5%
	Enclosure Rating	NEMA 4	NEMA 4	NEMA 4
	Enclosure Material	Aluminum	Aluminum	Aluminum
	Mounting	Process Piping	Process Piping	Process Piping
Element	Tag No.	n/a	n/a	n/a
	Sensor Type	Equal Mass	Equal Mass	Equal Mass
	Measurement Range			
	Lining Material	n/a	n/a	n/a
	Element Material	C276 alloy	C276 alloy	C276 alloy
	Line Size (mm)	300	400	200
	Enclosure Rating	n/a	n/a	n/a
	Enclosure Material	n/a	n/a	n/a
	Process Connection	3/4" or 1" NPT	3/4" or 1" NPT	3/4" or 1" NPT
	Cable Length	n/a	n/a	n/a
Access	Name Plate	Yes	Yes	Yes
	Connection Plug	Yes	Yes	Yes
	Mounting Bracket			
	Isolation Valve and/or Manifold			
Approval / Enclosure		CSA, NEMA 4X	CSA, NEMA 4X	CSA, NEMA 4X
Class / Division / Group		Unclassified	Unclassified	Unclassified
Comment				
Manufacturer		Kurz	Kurz	Kurz
Model Number		Series 454 FTB	Series 454 FTB	Series 454 FTB
Alternates				

Notes:

1. Vendor to supply Stainless Steel Tag with Instrument Tag Number clearly stamped on it.
2. Vendor is to fill in missing data in this specification sheet relevant to the device (i.e. model #)
3. Contractor is to supply mounting hardwate appropriate for the application.
4. Dirty service transmitter to be factory installed and calibrated with Red Valve Series 40 Pressure Sensor.

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1	44918	T.S.	J.B.	J.B.	Issued for Permit	

INSTRUMENT DATA SHEET

FLOW TRANSMITTERS

Project	Client	Township of South Stormont	Project No.	19070
	Location	Ingleside WWTP	Instrument Spec.	25 10 05
			Revision	1
General	Tag Number	FIT-2200		
	Description of Instrument	Thermal Mass Flowmeter		
	Service	Proc. Air, Aeration Tank 2		
	Location	Pump Gallery Basement		
	P&ID No.	P0012		
Process / Fluid Data	Line Tag	200-AB-SS1-25PP		
	Line Size (mm)	200		
	Fluid	Blower Air		
	Oper. Press Norm / Max (kPa)			
	Oper. Temp Norm / Max (°C)			
	Ambient Temperature	15 deg. C		
	S.G. @ Oper. Temp	n/a		
	Viscosity @ Oper. Temp	n/a		
	Turbidity (NTU) / TDS (mg/L)	n/a		
	Measurement Function	Flow Rate		
Transmitter	Tag No.	FIT-2200		
	Transmitter Type	Integral		
	Power Requirement	120VAC		
	Electrical Connection	3/4" NPT		
	Contact Type	n/a		
	Display Type	Digital LCD Integral Display		
	Instrument Range			
	Operating Range			
	Output Signal	4 - 20 mA (dual) flow and temp		
	Accuracy / Repeatability	Flow: ± 1% / Temp: ±0.5%		
	Enclosure Rating	NEMA 4		
	Enclosure Material	Aluminum		
	Mounting	Process Piping		
Element	Tag No.	n/a		
	Sensor Type	Equal Mass		
	Measurement Range			
	Lining Material	n/a		
	Element Material	C276 alloy		
	Line Size (mm)	200		
	Enclosure Rating	n/a		
	Enclosure Material	n/a		
	Process Connection	3/4" or 1" NPT		
	Cable Length	n/a		
Access	Name Plate	Yes		
	Connection Plug	Yes		
	Mounting Bracket	No		
	Isolation Valve and/or Manifold			
Approval / Enclosure		CSA, NEMA 4X		
Class / Division / Group		Unclassified		
Comment				
Manufacturer		Kurz		
Model Number		Series 454 FTB		
Alternates				

Notes:

1. Vendor to supply Stainless Steel Tag with Instrument Tag Number clearly stamped on it.
2. Vendor is to fill in missing data in this specification sheet relevant to the device (i.e. model #)
3. Contractor is to supply mounting hardwate appropriate for the application.
4. Dirty service transmitter to be factory installed and calibrated with Red Valve Series 40 Pressure Sensor.

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INSTRUMENT DATA SHEET

FLOW TRANSMITTERS

Project	Client	Township of South Stormont	Project No.	19070
	Location	Ingleside WWTP	Instrument Spec.	25 10 05
			Revision	1
General	Tag Number			
	Description of Instrument			
	Service			
	Location			
	P&ID No.			
Process / Fluid Data	Line Tag			
	Line Size (mm)			
	Fluid			
	Oper. Press Norm / Max (kPa)			
	Oper. Temp Norm / Max (°C)			
	Ambient Temperature			
	S.G. @ Oper. Temp			
	Viscosity @ Oper. Temp			
	Turbidity (NTU) / TDS (mg/L)			
	Measurement Function			
Transmitter	Tag No.			
	Transmitter Type			
	Power Requirement			
	Electrical Connection			
	Contact Type			
	Display Type			
	Instrument Range			
	Operating Range			
	Output Signal			
	Accuracy / Repeatability			
	Enclosure Rating			
	Enclosure Material			
	Mounting			
Element	Tag No.			
	Sensor Type			
	Measurement Range			
	Lining Material			
	Element Material			
	Line Size (mm)			
	Enclosure Rating			
	Enclosure Material			
	Process Connection			
	Cable Length			
Access	Name Plate			
	Connection Plug			
	Mounting Bracket			
	Isolation Valve and/or Manifold			
Approval / Enclosure				
Class / Division / Group				
Comment				
Manufacturer				
Model Number				
Alternates				

Notes:

1. Vendor to supply Stainless Steel Tag with Instrument Tag Number clearly stamped on it.
2. Vendor is to fill in missing data in this specification sheet relevant to the device (i.e. model #)
3. Contractor is to supply mounting hardwate appropriate for the application.
4. Dirty service transmitter to be factory installed and calibrated with Red Valve Series 40 Pressure Sensor.

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DIVISION 26 INDEX

PART 1 GENERAL

1.1 DESCRIPTION

.1 This Section covers items common to Sections of Division 26. This section also supplements requirements of Division 1, Division 23, Division 25, Division 28, Division 33 and Division 44.

1.2 REFERENCE STANDARDS

.1 Canadian Standards Association (CSA)

.1 CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations, and Ontario Amendments to CSA C22.1 (Ontario Electrical Safety Code).

.2 CSA-22.3 No.1, Overhead Systems.

.3 CSA-22.3 No.7, Underground Systems.

.4 CAN3-C235, Preferred Voltage Levels for AC Systems, 0 to 50,000 V.

.5 CSA Z462, Workplace Electrical Safety

.6 CSA Z463, Maintenance of Electrical Systems

.7 CSA Z85-1983, Abbreviations for Scientific and Engineering Terms.

1.3 CARE, OPERATION AND START-UP

.1 Instruct Contract Administrator and operating personnel in the operation, care and maintenance of systems, system equipment and components.

.2 Operating instructions to include following:

.1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.

.2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.

.3 Safety precautions.

.4 Procedures to be followed in event of equipment failure.

.5 Other items of instruction as recommended by manufacturer of each system or item of equipment.

.3 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance, and calibrate components and instruct operating personnel.

.4 Provide these services for such period, and for as many visits as necessary to put equipment in operation and ensure that operating personnel are conversant with all aspects of its care and operation.

1.4 DESIGN REQUIREMENTS

.1 Perform complete installation in accordance with the latest edition of the Ontario Electrical Safety Code, including latest published Amendments and Bulletins.

.1 The design intent of the Contract Documents is for the completed Work to comply with the Electrical Code and not require a deviation or postponement by the Inspection Authority, as defined in Section 2 of the Electrical Code.

.2 Refer to Section 1.15 - ACCEPTANCE OF WORK.

.2 Do complete installation in accordance with the following:

.1 Ontario Building Code (OBC).

.2 Electrical Safety Authority (ESA) inspection permits.

.3 Local code of governing authorities.

.3 Operating voltages: to CAN3-C235

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

.2 Product Data: submit manufacturer's instructions, printed product literature and data sheets, including product characteristics, performance criteria, physical size, finish, and limitations.

.3 Shop Drawings

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.

.2 Submit wiring diagrams and installation details of equipment indicating proposed location, layout, and arrangement, proposed conduit routing, control panels, accessories, piping, ductwork, and other items that must be shown to ensure coordinated installation.

.3 Identify on wiring diagrams: circuit terminals, internal wiring for each item of equipment, and interconnection wiring between each item of equipment.

.4 Indicate on drawings: clearances for operation, maintenance, and replacement of operating equipment devices.

.5 Submit conduit sleeve plan for wall penetrations.

.6 Submit routing plan for under-slab conduits.

.4 Descriptive System Document

.1 For all device & wiring circuits to be installed in hazardous locations, submit a Descriptive System Document, as per OESC rule 18-066 and in accordance with OESC Appendix F.

.5 Equipment Tagging

.1 Submit list of lamicoid labels for approval.

.6 Quality Control: in accordance with Specification 01 45 00 - Quality Control.

.1 Provide CSA certified, or certified by recognized organizations as detailed in ESA Bulletin 2-7-*, equipment and material.

.2 Where CSA certified, or ESA recognized approval equipment and material is not available, submit such equipment and material to authority having jurisdiction for approval before delivery to site.

.3 Submit test results of installed electrical systems and instrumentation.

.4 Submit, upon completion of Work, load balance report as described in section 3.8.6 - Load Balance.

.5 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Contract Administrator.

.7 Manufacturer's Field Reports: submit to Contract Administrator within seven (7) working days of review, verifying compliance of Work, electrical system and instrumentation testing, as described in section 3.8 - FIELD QUALITY CONTROL.

.8 Single Line Electrical Diagrams

.1 Provide single line electrical diagrams in glazed frames as follows:

.1 Electrical distribution system: locate in main electrical room.

.2 Drawings: 600 x 600 mm minimum size.

.9 Arc-Flash Study

.1 Contractor shall supply an arc-flash study to the latest edition of CSA Z462, of the building’s entire distribution system. Study to be performed by the successful electrical equipment Supplier.

.2 Contractor shall furnish the Supplier with distances, wire lengths and transformer shop drawings as required.

.3 Contractor shall supply stick-on labels for all equipment, identifying the arc-flash hazard rating of each distribution board and panel board. Such labelling shall meet the latest edition of CSA Z462.

.4 Contractor shall supply one full set of Personal Protective Equipment required for each identified hazard rating in the arc-flash study.

.5 The arc-flash study shall be submitted with the electrical distribution equipment shop drawings. The electrical distribution equipment shop drawings will not be reviewed until the arc-flash study is received.

.10 Co-ordination Study

.1 Submit co-ordination study as described in section 3.8.6 - LOAD BALANCE.

1.6 DELIVERY, STORAGE AND HANDLING

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

.2 Waste Management and Disposal:

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

1.7 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 associated with this Work.

.3 Notify Contract Administrator of changes required by Electrical Inspection Division prior to making changes.

.4 Furnish Certificates of Acceptance from Electrical Inspection Division or authorities having jurisdiction on completion of Work to Contract Administrator.

1.8 SEISMIC RESTRAINTS

.1 The contractor shall retain a specialty Engineer to develop seismic restraints and perform seismic calculations in accordance with Ontario Building Code. Calculations, restraint selections and installation details shall be done by a professional engineer experienced in seismic restraint design and installation and licensed in the Province of Ontario.

.2 The seismic restraint calculations, selections and installation details shall be submitted as a shop drawing submittal. This submittal shall be signed and sealed by a professional engineer as stated above.

.3 The Design Criteria in accordance with Ontario Building Code for a post disaster building. The seismic restraints design to cover all electrical equipment and cable tray/supports.

.4 At the completion of the installation, the seismic specialist shall visit the site and review the installation is done in accordance with their design. Once complete the specialist shall provide written certification that the equipment and components have been correctly restrained. This report to forwarded to the Engineer.

.5 At the completion of the installation the seismic specialist shall visit the site and review the installation of the seismic restraints. The specialist shall provide written certification that the systems have been correctly restrained.

1.9 CO-ORDINATION

.1 Co-ordinate electrical 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, Contract Administrator 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 Contract Administrator shall decide the extent of relocation required.

1.10 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.

1.11 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.

1.12 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.

1.13 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 the Contractor's requirement to comply with work phasing conditions.

1.14 INSPECTION OF WORK

.1 The Contract Administrator 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 their work in conformity with the construction documents and with the requirements of the Inspection Authority.

1.15 ACCEPTANCE OF WORK

.1 The Work of this division shall be completed to the satisfaction of the Contract Administrator, including but not limited to compliance with the Electrical Code.

.2 Any Work requiring a deviation or postponement by the Inspection Authority, as defined in Section 2 of the Electrical Code, shall also require approval by the Contract Administrator.

.1 The Contractor shall notify the Contract Administrator of any Work of this nature within 48 hours of discovery, and shall submit detailed plans to the Contract Administrator for review and approval before completion of the Work.

.3 No additional monies will be paid for the Contractor's requirement to complete the work to the satisfaction of the Contract Administrator.

1.16 FIRE RATING OF PENETRATIONS

.1 Maintain fire ratings around conduits passing through floors, ceilings and fire rated walls.

.2 When cables or conduits penetrate or pass through fire rated assemblies such as walls, floor/ceiling, roof/ceiling or columns protection, do fire stopping and smoke sealing in accordance with an approved system specified in Section 07 84 00 to match the rating of the assembly being penetrated. Refer to architectural drawings to ascertain locations and degree of the fire rated assemblies. Refer to detail ULC System No. SP341 for fire-stopping cable tray floor and wall partitions.

PART 2 PRODUCTS

2.1 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

.1 Responsibility of supply and installation 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 for all conduit, wiring and connections related to control systems specified in Division 25 and shown on Mechanical, Process and Civil drawings. Division 26 is responsible for all conduit, wiring, and connections of 120V and below, 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 or ESA recognized certifications, as detailed above. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from CSA Electrical Inspection Division.

.3 Factory-assemble control panels and component assemblies.

2.3 FINISHES

.1 Shop-finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

.1 Paint outdoor electrical equipment "equipment green" finish to EEMAC Y1-1.

.2 Paint indoor switchgear and distribution enclosures light grey to EEMAC 2Y-1.

2.4 WARNING SIGNS

.1 As specified and to meet requirements of Electrical Inspection Department and Contract Administrator.

.2 Porcelain enamel decal signs, minimum size 175 x 250 mm.

2.5 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with nameplates and labels according to its Specifcation Section, and as follows.

.1 Allow for minimum of twenty-five (25) letters per nameplate and label.

.2 Nameplates:

.1 Lamicoid 3 mm thick plastic engraving sheet, white face, black core, mechanically attached with self-tapping screws.

.2 Sizes as follows:

NAMEPLATE SIZES

Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters

.3 Wording on nameplates and labels to be approved by Contract Administrator prior to manufacture.

.4 Identification to be English (and French where applicable).

.5 Disconnects, starters and contactors: indicate equipment being controlled, voltage and circuit fed from.

.6 Instrumentation: label shall include tag name and circuit fed from.

.7 Terminal cabinets, junction boxes and pull boxes: indicate system name and voltage.

.8 Transformers: indicate capacity, primary and secondary voltages, circuit fed from, and equipment being fed.

.3 Labels:

.1 Embossed plastic labels with 6 mm high letters unless specified otherwise.

.2 Receptacles: indicate panel name and circuit number.

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 conduits, boxes and metallic sheathed cables.

.2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.

.3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

Conduit System	Prime Color	Auxiliary Color
up to 250 V	Yellow	
up to 600 V	Yellow	Green
up to 5 kV	Yellow	Blue
up to 15 kV	Yellow	Red
Telephone	Green	
Other Communication Systems	Green	Blue
Fire Alarm	Red	
Emergency Voice	Red	Blue
Other Security Systems	Red	Yellow

PART 3 EXECUTION

3.1 NAMEPLATES AND LABELS

.1 Ensure manufacturer's nameplates, CSA labels, and identification nameplates are visible and legible after equipment is installed.

3.2 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 ENVIRONMENTAL CONDITIONS

.1 Provide NEMA 4X rated equipment for:

.1 All areas exposed to exterior elements
.2 Building 6000 – Tertiary/UV Disinfection
.3 As otherwise indicated on contract documents

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: 300 mm.
  - .2 Above top of continuous baseboard heater: 200 mm.
  - .3 Above top of counters or counter splash backs: 175 mm.
  - .4 In mechanical rooms: 1400 mm.
- .3 Panelboards: as required by Code or as indicated.
- .4 Telephone and interphone outlets: 300 mm.
- .5 Wall mounted telephone and interphone outlets: 1400 mm.
- .6 Fire alarm stations: 1200 mm.
- .7 Fire alarm bells: 2400 mm.
- .8 Television outlets: 300 mm.
- .9 Wall mounted speakers: 2400 mm.
- .10 Clocks: 2400 mm.
- .11 Door bell pushbuttons: 1200 mm.
- .12 Exit lights: 2400 mm.
- .13 Emergency lighting heads: 2400 mm.

3.5 POWER SHUTDOWNS

.1 Power shutdowns shall be kept to a minimum. Schedule shutdowns well in advance with Contract Administrator stating time(s) and duration(s). Maintain all electrical services to the occupied areas of the buildings. Power shutdowns will be allowed during normal working hours and must be approved by the Owner. Shutdowns to be 4 hours maximum.

.2 Provide temporary services, equipment and wiring as necessary to maintain continuity of services throughout, during construction of this project.

.3 Ensure all services, i.e. security, fire alarm, telephone, LAN, normal and essential power, etc. remain operational during construction.

.4 Refer to construction phasing Section 00 13 14 and perform work as required to meet the multiple phases of completion steps to ensure the plant services are maintained.

3.6 REMOVALS

.1 Remove existing electrical equipment, wiring, conduit and other devices.

.2 Where existing walls and partitions are to be removed, remove existing outlets, devices and wiring located therein and make safe. Remove existing equipment, devices and outlets as necessary. Relocate or reinstall these items as indicated and as required. Co-ordinate with applicable trades.

.3 Maintain continuity of power, lighting, fire alarm and communication circuits as required.

.4 Remove all existing redundant wiring associated with all devices. Co-ordinate and arrange for telephone company to remove redundant telephone cables.

.5 Any material the Contract Administrator does not want, shall be removed from the site by this contractor.

3.7 CO-ORDINATION OF PROTECTIVE DEVICES

.1 Immediately on award of Contract, prepare a co-ordination study and submit for approval.

.2 The co-ordination study data shall be presented in tables and on composite charts and shall include but not be limited to the following:

.1 Minimum and Maximum available short circuit current 600V, and 120/208V systems based on available MVA at the source. This shall be calculated for every bus down to the lighting panel level.

.2 Minimum and Maximum available ground fault current of 600V, and 120/208V systems.

.3 Power transformer thermal short circuit damage curve, 3 phase, phase to ground.

.4 Main and feeder circuit breakers.

.5 Distribution transformer and generator thermal short circuit damage curves.

.6 Largest distribution breaker characteristics in each panel.

.7 Largest branch breaker in each panel.

.8 Establish the required setting for all ground fault protective devices.

.9 General damage and decrement curves.

.10 Cable damage curves.

.11 Co-ordination charts shall be drawn in ink on log paper or printed if computer generated. Each chart shall include a single line diagram of the appropriate devices with description and numbering matching that shown on the contract documents. Transformers shall be shown complete with KVA rating, primary and secondary voltages, winding connections, grounding method and impedance.

.12 The study shall meet the requirements of IEEE 242.

.3 The co-ordination study shall include a list of recommendations to improve co-ordination or protection where possible and minimize arc fault energy levels.

.4 A copy of the single line diagram in AutoCAD (.dwg) format will be made available if requested.

3.8 FIELD QUALITY CONTROL

.1 All electrical work to be carried out by qualified, licensed electricians or apprentices. Employees registered in a provincial apprentice's 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 Master Electrical Contractor License as issued by the Province.

.3 In addition to the inspection and acceptance by the electrical authority having jurisdiction, the Work of this division shall meet the acceptance of the Contract Administrator. Refer to Section 1.15 - ACCEPTANCE OF WORK.

.4 Conduct and pay for following tests:

.1 Distribution system including phasing, voltage, grounding, and load balancing.

.2 Circuits originating from branch distribution panels.

.3 Lighting and its control.

.4 VFD configuration, testing, commissioning, and training by manufacturer's factory trained and certified technician.

.5 Motors, heaters, and associated control equipment including sequenced operation of systems where applicable.

.6 Systems: fire alarm system, security, and communications.

.5 Furnish manufacturer's certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturer's instructions.

.6 Load Balance

.1 Measure phase current to panelboards 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.

.7 Insulation resistance testing.

.1 Megger and record circuits, feeders, and equipment up to 350V with a 500V instrument.

.2 Megger and record 350 – 600V circuits, feeders, and equipment with a 1000V instrument.

.3 Check resistance to ground before energizing and record value.

.8 Carry out tests in presence of Contract Administrator.

.9 Provide instruments, meters, equipment, and personnel required to conduct tests during and conclusion of project.

.10 Submit test results for Contract Administrator's review and include in Commissioning Manuals specified in Section 01 91 13 – Commissioning (Cx) Requirements.

3.9 CLEANING

.1 Do cleaning in accordance with Section 01 74 11 - Cleaning.

.2 Progress Cleaning:

.1 Leave work area clean at end of each day.

.3 Final Cleaning:

.1 upon completion remove surplus materials, rubbish, tools and equipment.

.2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

.3 Clean and prime exposed non-galvanized hangers, racks, and fastenings to prevent rusting.

.4 Remove construction materials from wiring devices, cover plates, outlets, cabinets, enclosures, tubs, etc.

END OF SECTION

WIRING AND BOX CONNECTORS, 0-1000V

PART 1 GENERAL

1.1 SECTION INCLUDES

.1 Material and installation specifications for wire and box connectors for low voltage (LV) systems operating between 0-1000 Volts.

1.2 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Requirements Electrical.

1.3 REFERENCE STANADARDS

.1 Canadian Standards Association (CSA International)

.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)

1.4 SUBMITTALS

.1 Provide submittals in accordance with Section 26 05 00 – Common Work Requirements Electrical.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for wire and box connectors and include product characteristics, performance criteria, physical size, finish and limitations.

1.5 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data:

.1 Submit operation and maintenance data for wire and box connectors for incorporation into manual.

1.6 DELIVERY, STORAGE AND HANDLING

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

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 12 AWG or less unless noted otherwise.

.3 Compression lugs/splices required for all terminations 10 AWG and larger.

.4 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.

.5 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 compression lugs with lug manufacturer's compression tool and corresponding dies appropriate to wire size.
.4 Install bushing stud connectors in accordance with EEMAC 1Y-2.

END OF SECTION

WIRING AND CABLES 0-1000V

PART 1 GENERAL

1.1 SECTION INCLUDES

.1 Material and installation requirements for wire and cables operating between 0-1000 Volts.

.2 This section does not include HV wiring in excess of 1000 Volts. Refer to 26 05 14 for hv wiring and cable requirements.

1.2 RELATED SECTIONS

.1 Section 01 33 00 – Submittals

.2 Section 01 78 00 – Closeout Submittals

.3 Section 01 91 13 – Commissioning Requirements

.4 Section 26 05 00 – Common Work Requirements Electrical

.5 Section 26 05 34 – Conduits, Fastenings and Fittings

1.3 REFERENCE STANDARDS

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No. 0.3-09, Test Methods for Electrical Wires and Cables
.2 CSA C22.2 No. 38-14, Thermoset-insulated Wires and Cables
.3 CSA C22.2 No. 51-14, Armoured Cables
.4 CSA C22.2 No. 131-14, Type TECK 90 Cable
.5 CSA C22.2 No. 174, Cables and Cable Glands for Use in Hazardous Locations
.6 CSA C22.2 No. 214-17, Communications Cables
.7 CSA C22.2 No. 239-17, Control and Instrumentation Cables

1.4 SUBMITTALS

.1 Provide submittals in accordance with Section 26 05 00 – Common Work Requirements Electrical.

.1 Provide manufacturer's printed product literature, specifications, data sheet and include product characteristics, performance criteria, physical size, finish and limitations.

PART 2 PRODUCTS

2.1 BUILDING WIRES FOR 0 - 1000 V POWER WIRING IN CONDUIT

.1 Conductors: stranded copper, number and size as indicated. Minimum #12 AWG.

.2 Insulation: chemically cross-linked thermosetting polyethylene (XLPE) material.

.1 RWU90 in Wet or Damp Locations.

.2 RW90 in Dry Locations Only.

2.2 TECK 90 CABLE FOR 0 – 1000 V POWER WIRING

.1 TECK 90 cable to CAN/CSA-C22.2 No.131.

.2 Conductors:

.1 Grounding conductor: stranded copper.

.2 Circuit conductors: stranded copper, number and size as indicated. Minimum #12 AWG.

.3 Insulation:

.1 Chemically cross-linked thermosetting polyethylene rated type RW90, XLPE 1000 V.

.2 Hazardous location rating.

.4 Inner jacket: polyvinyl chloride material.

.5 Armour: interlocking aluminum.

.6 Overall covering: polyvinyl chloride material with LFS/LGE (low fire spread/low gas evolution) FT4 rating.

.7 Connectors:

.1 Explosion-proof approved for TECK cable in classified areas.

.2 Teck connectors c/w sealing ring in non-classified areas.

2.3 CONTROL & INSTRUMENTATION WIRING

.1 Analog 4-20mA signals (installed in conduit):

.1 CSA, 300V control and instrumentation cable (CIC) to CAN/CSA C22. No. 239

.2 Twisted shielded pair #16, stranded tinned copper cable assembly. Shield consisting of 100% aluminum/polyester foil with #18 AWG drain wire.

.3 100% overall foil shield and drain wire for multi-pair cables.

.4 Standard of Acceptance: Belden 22646 or multi-pair equivalent with individually shielded pairs and overall shield.

.2 Analog 4-20mA signals (installed in cable tray):

.1 CSA, 600V armored control and instrumentation cable (ACIC) to CAN/CSA C22. No. 239

.2 Twisted shielded pair #16, stranded tinned copper cable assembly (installed in conduit). Shield consisting of 100% aluminum/polyester foil with #18 AWG drain wire insulated with 600V rated chemically cross linked thermosetting polyethylene material rated RW90 XLPE c/w hazardous location rating, inner jacket of polyvinyl chloride material, armor of interlocking aluminum and over all covering of polyvinyl chloride material with LES/LGE (low fire spread, low gas evolution) rating.

.3 Standard of Acceptance: Belden 24500 or multi-pair equivalent with individually shielded pairs and overall shield.

.4 Connectors:

.1 Explosion-proof approved for TECK cable in classified areas.

.2 Teck connectors c/w sealing rings

.3 24V to 120V control wiring in conduit:

.1 Stranded copper #14 AWG, insulation rated 600V of chemically cross-linked thermosetting polyethylene material rated RW90 XLPE.

.4 24V to 120V multiconductor TECK control wiring:

.1 CSA TECK 90 cable to CAN/CSA-C22.2 No.131.

.2 Stranded copper #14 AWG insulated with 600V rated chemically cross-linked thermosetting polyethylene material rated RW90 XLPE c/w hazardous location rating, inner jacket of polyvinyl chloride material, armor of interlocking aluminum and over all covering of polyvinyl chloride material with LES/LGE (low fire spread, low gas evolution) rating.

.3 Standard of Acceptance: Belden C5500 or multi-conductor equivalent as indicated.

.4 Connectors:

.1 Explosion-proof approved for TECK cable in classified areas.

.2 Teck connectors c/w sealing rings.

.5 Modbus TSIPC.

.1 Low capacitance single pair, twisted shielded, #24 AWG - Belden 9841.

.6 RS485 cables:

.1 2 pair, 18 AWG stranded copper, separately twisted pairs, overall 100% aluminum-polyester shield, tinned copper stranded drain wire by Belden Wire and Cable.

PART 3 EXECUTION

3.1 INSTALLATION OF BUILDING WIRES

.1 Installed in conduit to Section 26 05 34 – Conduits, Fastenings and Fittings.

3.2 INSTALLATION OF TECK90 CABLE FOR 0-1000V POWER WIRING

.1 Install TECK90 cables within (or passing thru) all Class I, Div.I, and Div.II, Group 'D' locations.

.2 Installed in cable tray to Section 26 05 36 – Cable Trays for Electrical Systems.

.3 Prior to cable installation, indicate on a set of drawings proposed cable type, routing and grouping. Keep on same drawing indicating cable tray routing from Section 26 05 36 – Cable Trays for Electrical Systems. Review drawings with general contractor and other trades to eliminate interferences. Review drawings with engineer before proceeding with installation.

3.3 INSTALLATION OF CONTROL AND INSTRUMENTATION CABLES

.1 Type RW90 and CIC installed in conduit to Section 26 05 34 – Conduits, Fastenings and Fittings.

.2 Type TECK90 and ACIC installed in cable tray to Section 26 05 36 – Cable Trays for Electrical Systems.

.3 Ground control cable shield at controller end only.

.4 Field terminations and joints shall be made on labelled terminal blocks installed in terminal boxes suitable for the classification of location installed. Crimped connections are not acceptable.

.5 Termination of Data line cable by Division 26

END OF SECTION

GROUNDING – SECONDARY

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Requirements Electrical.

.2 Section 26 24 02 – Incoming Entrance Board

.3 Section 26 11 13 – Liquid Filled Padmount Transformer

.4 Section 26 32 13 – Diesel Fired Generator

1.2 REFERENCE STANADARDS

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No.41-13 Grounding and Bonding Equipment

.2 American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE)

.1 ANSI/IEEE 837, Qualifying Permanent Connections Used in Substation Grounding.

1.3 SUBMITTALS

.1 Provide submittals in accordance with Section 26 05 00 – Common Work Requirements Electrical.

.2 Product Data:

.1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish, and limitations.

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 diameter by 3 m long.

.4 Grounding conductors: bare stranded copper, soft annealed, size as indicated.

.5 Insulated grounding conductors: green, type RW90, rated 1kV, stranded copper conductor.

.6 Ground bus: copper, 50mm x 6mm, complete with 25mm insulated supports, fastenings, connectors.

.7 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:

.1 Grounding and bonding bushings.
.2 Protective type clamps.
.3 Thermit welded type conductor connectors, as indicated.
.4 Bonding jumpers, straps.
.5 Burndy Hyground compression 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 and bond EMT at both ends.

.2 Install connectors in accordance with manufacturer's instructions. Use manufacturer’s crimping tool for compression connectors.

.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 electrodes and make grounding connections – either cad-weld or compression type.

.5 Bond separate, multiple electrodes together.

.6 Use size 2/0 AWG copper conductors for connections to electrodes.

.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 secondary 208 V system.

.2 347/600V system neutral to be solidly grounded at service entrance only.

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 and cable trays.

3.6 GROUNDING BUS

.1 Install copper grounding bus 50mm x 6mm around the perimeter of electrical room mounted on 25mm insulated supports on wall.

3. Ground items of electrical equipment in electrical room to ground bus with individual bare stranded copper connections size as indicted on drawings, where not indicted use #6 AWG stranded copper.

3.7 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.

3.8 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 Contract Administrator and local authority having jurisdiction over installation.

.3 Perform tests before energizing electrical system.

.4 Disconnect ground fault indicator during tests.

END OF SECTION

HANGERS AND SUPPORTS

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Requirements Electrical.

.2 Section 26 05 21 – Wires and Cables 0-1000V.

.3 Section 26 05 34 – Conduits, Fastenings and Fittings.

.4 Section 25 05 36 – Cable Trays for Electrical Systems

PART 2 PRODUCTS

2.1 SUPPORT CHANNELS

.1 U shaped aluminum channel, size 41 x 41mm, 2.5 thick, suspended or surface mounted. For use with PVC conduit and rigid aluminum conduit in corrosive areas.

.2 U shaped galvanized steel channel, size 41 x 41mm, 2.5 thick, suspended or surface mounted, for use with EMT conduit, rigid galvanized steel conduit and supports for junction boxes, wall mounted VFD's and disconnects in non-corrosive areas. On cut ends of the channel apply cold enriched zinc compound until the cut has been covered.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Secure equipment to 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 with toggle bolts.

.4 Secure surface mounted equipment to T bar ceilings with twist clip fasteners. 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 Suspended support systems:

.1 Provide suspended support systems where direct fastening to building structure is impractical.

.2 Support individual cable or conduit runs with 6 mm (1/4”) diameter threaded rods and spring clips.

.3 Support 2 or more cables or conduits on channels supported by 10 mm (3/8”) diameter threaded rod hangers.

.4 Support suspended cable tray on channels supported by 13 mm (1/2”) diameter threaded rod hangers.

.5 On cut ends of the rod, apply cold enriched zinc compound until the cut end has been covered.

.7 For surface mounting of two or more conduits use channels at 1.5 m on centre spacing.

.8 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.9 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support. Provide bolted baseplates for vertical supports mounted with stainless steel anchors and leveling nuts. Fill void between underside of baseplate and slab below with non-shrink grout.

.10 Do not use wire lashing, wood blocking, plastic strap or perforated strap to support or secure raceways or cables.

.11 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Contract Administrator.

.12 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

.13 Deburr all ends of U channel and threaded rods. Provide rubber caps for the ends of all U channels.

END OF SECTION

SPLITTERS, JBS, PBS AND CABS

PART 1 GENERAL

1.1 REALTED SECTIONS

.1 Section 26 05 00 – Common Work Results – Electrical.

1.2 SUBMITTALS

.1 Submit shop drawings and product data for cabinets in accordance with Section 26 05 00 – Common Work Results – Electrical.

.2 Product Data:

.1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish, and limitations.

PART 2 PRODUCTS

2.1 BUS SPLITTERS

.1 Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.

.2 Main and branch drilled for NEMA compression lugs to match required size and number of incoming and outgoing conductors as indicated.

.3 Bus style splitters only.

2.2 JUNCTION AND PULL BOXES

.1 Welded steel construction. NEMA 12 for indoor dry locations. NEMA 4X for outdoor locations.

.2 Hinged covers for surface mounting with quarter-turn latch.

.1 Screw-on covers for boxes with largest dimension less than of 200mm.

.3 Screw-on covers with 25 mm minimum extension all around, for flush mounting.

.4 Cast feraloy bodies c/w cast aluminum threaded covers and threaded hubs suitable for installation in Class 1, Div. 1 and Div. 2, Group 'D' locations.

2.3 TERMINAL BOXES

.1 Welded steel construction. NEMA 12 for indoor dry locations. NEMA 4X for outdoor locations.

.2 Hinged covers with quarter-turn latch and removable back plane.

.3 Install screw-type terminal blocks on back plane.

2.4 CABINETS

.1 Type E: sheet steel, hinged door and return flange overlapping sides, handle, lock and catch, for surface mounting.

PART 3 EXECUTION

3.1 SPLITTER INSTALLATION

.1 Install splitters and mount plumb, true and square to the building lines.

.2 Extend splitters full length of equipment arrangement except where indicated otherwise.

.3 Provide air space with wall if mounted on exterior walls.

3.2 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

.1 Install pull boxes in inconspicuous but accessible locations.

.2 Mount cabinets with top not higher than 2 m above finished floor.

.3 Provide air space with wall if mounted on exterior walls.

.4 Only main junction and pull boxes are indicated. Install pull boxes so as not to exceed 30 m of conduit run between pull boxes.

3.3 IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results - Electrical.

.2 Install size 2 identification labels indicating system name voltage and phase.

END OF SECTION

OUTLET BOXES AND FITTINGS

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Requirements Electrical.

1.2 REFERENCE STANADARDS

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1-02 Canadian Electrical Code, Part 1

PART 2 PRODUCTS

2.1 OUTLET AND CONDUIT BOXES GENERAL

.1 Size boxes in accordance with CSA C22.1-02.

.2 102 mm square or larger outlet boxes as required for special devices.

.3 Gangboxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

.5 Combination boxes with barriers where outlets for more than one system are grouped.

2.2 SHEET STEEL OUTLET BOXES

.1 Electro-galvanized steel singleand 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.

.2 102 mm square or octagonal outlet boxes for lighting fixture outlets.

.3 102 mm square outlet boxes with extension and plaster rings for flush mounting devices in finished plaster or tile 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-galvanized sheet steel concrete type boxes for flush mount in concrete with matchingextension and plaster rings as required.

2.5 CONDUIT BOXES

.1 Cast FS or FD aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacles. Suitable for installation in Class I, Div.I and Div.II Group D locations.

2.6 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.

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.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

.1 Specifications for the supply and installation of electrical conduits, fastenings and fittings.

1.2 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Requirements Electrical.

.2 Section 26 05 29 – Hangers and Supports

1.3 REFERENCE STANDARDS

.1 Canadian Standards Association (CSA)

.1	CSA C22.2 No. 18.3-12	Conduit, Tubing, and Cable Fittings
.2	CSA C22.2 No. 18.4-15	Hardware for the Support of Conduit, Tubing, and Cable
.3	CSA C22.2 No. 45.1-07	Electrical Rigid Metal Conduit – Steel
.4	CSA C22.2 No. 45.2-08	Electrical Rigid Metal Conduit – Aluminum, Red Brass, and Stainless Steel
.5	CSA C22.2 No. 56-13	Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
.6	CSA C22.2 No. 83-M1985	Electrical Metallic Tubing
.7	CSA C22.2 No. 83.1-07	Electrical Metallic Tubing – Steel
.8	CSA C22.2 No. 85-14	Rigid PVC Boxes and Fittings
.9	CSA C22.2 No. 211.1-06	Rigid Types EB1 and DB2/ES2 PVC Conduit
.10	CSA C22.2 No. 211.2-06	Rigid PVC (Unplasticized) Conduit.
.11	CSA C22.2 No. 227.2.2-14	Liquid-Tight Flexible Nonmetallic Conduit
.12	CSA C22.2 No. 227.3-15	Mechanical Protection Tubing (MPT) and Fittings

1.4 SUBMITTALS

.1 Provide submittals in accordance with Section 26 05 00 – Common Work Requirements Electrical.

.2 Product Data:

.1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish, and limitations.

.3 Conduit Routing Plan:

.1 Submit conduit routing plans per section 3 of this specification.

PART 2 PRODUCTS

2.1 CONDUITS

.1 Rigid metal conduit: to CSA C22.2 No. 45.1, hot dipped galvanized steel threaded.

.2 Epoxy coated conduit: to CSA C22.2 No. 45.1, with zinc coating and corrosion resistant epoxy finish inside and outside.

.3 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings, galvanized steel.

.4 Rigid PVC conduit: to CSA C22.2 No. 211.2., schedule 40

.5 Flexible metal conduit: to CSA C22.2 No. 56, aluminum liquid-tight flexible metal.

.6 FRE conduit: to CSA C22.2.

.7 Flexible braided explosion proof conduit.

.8 Minimum conduit size: 19 mm.

2.2 CONDUIT FASTENINGS

.1 Fasten surface mounted conduit to building construction using straps.

.1 One-hole straps to secure conduits 50 mm and smaller.

.2 Two-hole straps for conduits larger than 50 mm.

.3 Two-hole PVC straps for PVC conduit

.4 Straps shall be hot dipped galvanized when used with rigid galvanized conduit and EMT conduit.

.5 Straps shall be aluminum when used with ridged aluminum conduit.

.2 Provide galvanized steel beam clamps to secure conduit to exposed steel work.

.3 Provide channel type supports, U-shape, for two or more conduits to Section 26 05 29 – Hangers and Supports.

.4 Provide suspended channel supports as required to Section 26 05 29 – Hangers and Supports.

2.3 CONDUIT FITTINGS

.1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.

.1 Factory "ells" where 90º, 45 º or 22.5 º bends are required for 25 mm and larger conduits.

.2 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.

.3 Connectors and couplings for EMT. Steel set-screw type, size as required.

2.4 EXPANSION FITTINGS FOR RIGID CONDUIT

.1 Weatherproof expansion fittings suitable for 100mm linear expansion.

.2 Integral bonding jumper suitable for linear expansion and 19mm deflection in all directions for metallic conduit.

2.5 FISH CORD

.1 Polypropylene 6mm minimum.

PART 3 EXECUTION

3.1 CONDUIT LAYOUT

.1 Contract drawings do not indicate all conduit runs. Those indicated are in diagrammatic form only.

.2 Prior to conduit installation, indicate on a set of drawings proposed conduit type, routing, and grouping. Review drawings with General Contractor and other trades to eliminate interferences. Submit reviewed conduit layout drawings for Engineer’s approval. Approval required before proceeding with installation.

3.2 MANUFACTURER'S INSTRUCTIONS

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

3.3 CONDUIT KEY PLAN

.1 Use rigid hot dipped galvanized steel threaded conduit in hazardous areas and for exposed work below 2.4m above finished floor or where otherwise subject to mechanical injury in dry locations.

.2 Use epoxy coated threaded conduit for exposed work below 2.4m above finished floor or where otherwise subject to mechanical injury in damp, wet or corrosive locations.

.3 Use electrical metallic tubing (EMT), except in cast concrete, for exposed work above 2.4m and not subject to mechanical injury in dry locations, as well as concealed work in hollow masonry construction.

.4 Use Schedule 40 rigid PVC conduit in cast concrete, underground ductbanks and under concrete slab on grade unless otherwise noted on contract drawings. Also use rigid PVC for exposed work above 2.4m and not subject to mechanical injury in damp, wet or corrosive locations.

.5 Use flexible metal conduit for connection to motors in dry areas, connection to recessed and surface mount light fixtures without a prewired outlet box.

.6 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.

.7 Use explosion proof flexible conduit for connection to explosion proof motors.

3.4 INSTALLATION - GENERAL

.1 Install all conduit, conduit fittings and accessories in accordance with the Ontario Electrical Safety Code (OESC) 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 conduit below concrete slab, in applicable areas, to minimize conduit installation on walls.

.3 Install conduit sleeves: at points where conduit pass through masonry, concrete or fire rated assemblies and as indicated.

.1 Sleeves through concrete: schedule 40 galvanized steel pipe.

.2 Sizes: maximum 6mm clearance all around, between sleeve and conduit.

.3 Terminate sleeves flush with surface of concrete and masonry walls.

.4 Fill voids around conduit:

.1 Caulk between sleeve and conduit in foundation walls with waterproof fire retardant non-hardening mastic.

.2 Where sleeves pass through walls, provide space for fire-stopping. Where conduit passes through fire rated walls, maintain fire rating integrity.

.3 Ensure no contact between copper conductor and ferrous sleeve.

.4 Fill future-use sleeves with lime plaster or other easily removable filler.

.5 Coat exposed exterior surfaces of ferrous sleeves with heavy application of zinc rich paint to CGSB 1-GP-181M+Amdt.

.5 This Division shall prepare sleeving drawings indicating the size and locations of openings required in concrete walls for conduit. In case of failure to provide information in time (i.e. before the concrete is poured) any extras incurred shall be at the expense of this Division.

.6 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.7 Conceal conduits unless otherwise noted.

.8 Surface mounted conduit in unfinished areas, electrical and mechanical service rooms, industrial process areas, service garages or otherwise noted on contract drawings.

.9 Install conduit sealing fittings in hazardous areas. Fill with compound.

.10 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.11 Mechanically bend steel conduit over 19mm diameter.

.12 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.13 Install fish cord 6mm in empty conduits.

.14 Run 2 - 25mm spare conduits up to ceiling space above and 2 - 25mm spare conduits down to ceiling space below from each flush mounted panel. Terminate these conduits in 152 x 152 x 102mm junction boxes in ceiling space or in case of an exposed concrete slab, terminate each conduit in flush concrete type box.

.15 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.

.16 Dry conduits out before installing wire.

3.5 SURFACE CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Locate conduits behind infrared or gas fired heaters within 1.5m clearance.

.3 Run conduits in flanged portion of structural steel.

.4 Group conduits wherever possible on surface mounted or suspended channels.

.5 Do not pass conduits through structural members except as indicated.

.6 Do not locate conduits less than 75mm parallel to steam or hot water lines. Cross at right angles with minimum of 25mm clearance at crossovers.

.7 Do not enter conduit at tops of disconnect switches, terminal boxes, junction boxes, splice boxes or control panels. Boxes with penetrations placed in the top shall be replaced at no cost to the contract.

3.6 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.

3.7 CONDUITS IN CAST IN PLACE CONCRETE SLABS ON GRADE.

.1 Do not run conduit horizontally within concrete slabs, except as otherwise detailed in contract drawings.

.2 Horizontal conduit to be run beneath slab with minimum 75mm cover between top of conduit and underside of concrete slab.

.3 Conduit to stub up vertically and perpendicular to concrete slab. Protect conduits from damage where they stub out of concrete slab.

.4 Install conduit prior to slab installation. Locate to suit reinforcing steel.

3.8 CONDUITS UNDERGROUND

.1 Slope conduits to provide drainage.

.2 Waterproof joints (PVC excepted) with heavy coat of bituminous paint.

3.9 EXPANSION FITTINGS FOR RIGID PVC CONDUIT

.1 Provide minimum of 150mm of expansion joints for conduit exposed to ambient air conditions with minimum (1) expansion joint between fixed points. The point at which conduits rise up out of ground shall be treated as a fixed point.

END OF SECTION

CABLE TRAYS FOR ELECTRICAL SYSTEMS

PART 1 ENERAL

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 26 05 00 – Common Work Results - Electrical.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CAN/CSA C22.1 No. 126.1 – Metal Cable Tray Systems.

.2 National Electrical Manufacturers Association (NEMA).

.1 NEMA FG 1, Fibreglass and Cable Tray Systems.

.2 NEMA VE 1, Metal Cable Tray Systems.

1.3 SUBMITTALS

.1 Submit shop drawings and product data in accordance with Section 01 33 00 – Submittal Procedures.

.2 Product Data: submit manufacturer's product data sheets for cable tray indicating dimensions, materials, and finishes, including classifications and certifications.

.3 Shop Drawings: submit shop drawings showing materials, finish, dimensions, accessories, layout, and installation details. Shop drawings shall include coordinated routing of cable trays and supports.

.4 Submit cable tray routing plans per Part 3 of this specification.

.1 Identify types of cable trays used.

.2 Show actual cable tray installation details and suspension system.

PART 2 PRODUCTS

2.1 CABLE TRAY

.1 Aluminum, Ladder type, Class D1 with 300mm rung spacing to CAN/CSA C22.2 No.126.

.2 Width and depth as required and/or indicated on contract drawings.

.3 Ventilated Aluminum channel tray for nominal width of 150mm and less.

.4 Horizontal elbows, end plates, drop outs, vertical risers and drops, tees, wyes, expansion joints and reducers where required. Fittings: manufactured accessories

for cable tray supplied. Radii on fittings: 610mm minimum for 610mm tray, 305mm minimum for 305mm tray, 102mm deep.

.1 Radii on fittings: 900 mm minimum on all larger cable tray.

.5 Solid covers for complete cable tray system including fittings.

2.2 SUPPORTS

.1 Provide supports as required – refer to typical details on contract drawings and manufacturers installation instruction.

.2 Support cable tray on both ends.

.3 Submit for review – support details.

2.3 BARRIERS

.1 Provide barriers to separate power, control and instrumentation cables when in same cable tray. Barriers to be supplied by cable tray manufacturer.

2.4 GROUNDING

.1 Run a bare stranded #2/0 CW bond conductor the full length of each power tray run. Bond to tray every 15m. Provide all bonding to meet ESA requirements.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Prior to cable tray installation, indicate on a set of drawings proposed tray type, routing, and grouping. Review drawings with General Contractor and other trades to eliminate interferences. Submit reviewed cable tray layout drawings for Engineer's approval. Approval required before proceeding with installation

.2 Cable trays are shown on Contract Drawings with approximate routing. The number of tiers of cable tray runs is to be determined by Div. 26 contractor.

.3 Install vertical cable tray for vertical cable runs. Vertical drops are not detailed on plan views - refer to details.

.4 Maintain minimum 300mm vertical clearance from top of tray to underside of floors, ducts and other continuous planes above the tray. 150mm minimum clearance at crossings.

.5 Install complete cable tray systems.

.6 Support cable tray on both sides.

.7 Remove sharp burrs or projections to prevent damage to cables or injury to personnel.

.8 Bond cable tray to ground wire every 15 meters or part thereof.

.9 Prime all bare metal surfaces with zinc rich primer.

.10 Provide continuous cable tray through wall/floor/ceiling assemblies. Provide fire/smoke stopping around penetrations to Section 26 05 00 – Common Work Results – Electrical.

3.2 CABLES IN CABLE TRAY

.1 Install cables individually.

.2 Lay cables into cable tray. Use rollers when necessary to pull cables.

.3 Secure cables in cable tray at 1.5 m centres, with nylon ties. UV resistant ties in outdoor locations.

.4 Identify cables accordance with Section 26 05 00 – Common Work Results - Electrical.

.1 Every 30 m with size 2 nameplates in

.2 At terminations and both sides of wall penetrations with universal carrier strips.

.5 Space cables as per electrical code requirements.

.6 Separate control, power and instrumentation cables with barriers supplied by tray manufacturer unless Teck cable is used.

END OF SECTION

INSTALLATION OF CABLES IN TRENCHES AND IN DUCTS

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 31 23 33.01 – Excavating, Trenching and Backfilling.

.2 Section 26 05 00 – Common Work Requirements Electrical.

PART 2 PRODUCTS

2.1 MARKER TAPE

.1 Red warning tape with “Caution Buried Electric Line Below” or equivalent caution message.

.2 Aluminum foil backed. Detectable with non-ferrous metal detector.

PART 3 EXECUTION

3.1 DIRECT BURIAL OF CABLES

.1 Direct burial of cables is not permitted unless specifically detailed in contract drawings.

.2 Provide offsets for thermal action and minor earth movements. Offset cables 150 mm for each 60 m run maintaining minimum cable separation and bending radius requirements.

.3 Leave minimum 0.6m of surplus cable in each direction at terminations and splices.

.4 Direct buried cable shall not be spliced unless specifically detailed in contract drawings.

.1 Underground Splices shall be made within approved underground handhole/pedestals to allow for future access suitable mechanical protection.

.2 Make splices and terminations in accordance with manufacturer’s instructions using approved splicing kits.

.5 Maintain minimum bending radius per OESC and manufacturer requirements.

.6 Cable separation:

.1 Refer to contract drawings for minimum separations between cables installed in a common trench.

.2 Maintain minimum 75 mm separation between cables of different circuits.

.3 Maintain 300 mm separation between low and high voltage cables.

.4 When low voltage cable cross high voltage cables, maintain 300 mm vertical separation with low voltage cables in upper position.

.5 Maintain 75 mm vertical separation where low voltage cables cross each other.

.6 Maintain 150 mm vertical separation where high voltage cables cross each other.

.7 Maintain 300 mm minimum lateral and vertical separation for fire alarm and control cables when crossing other cables, with fire alarm and control cables in the upper position.

3.2 CABLE INSTALLATION IN UNDERGROUND DUCTS

.1 Install underground duct bank per contract drawings. Underground duct bank shall be completely installed between end points prior to pulling in cables.

.2 Do not pull spliced cables inside of ducts.

.3 Install multiple cables simultaneously.

.4 Use CSA approved lubricants with cable jacket to reduce pulling tension.

.5 To facilitate matching of colour coded multiconductor cables reel off in same direction during installation.

.6 Before pulling cable into ducts and until cables are properly terminated, seal ends of lead covered cable with wiping solder; seal ends of non-leaded cables with moisture seal tape.

.7 After installation of cables, seal duct ends with sealing compound.

3.3 MARKING

.1 Install continuous marking tape along the length of the buried conduit/cable installation.

.2 Marker tape to be buried approximately half-way between top of conduit and final grade along the centerline of the underground duct bank.

3.4 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 Perform tests using qualified personnel. Provide necessary instruments and equipment.

.3 Check phase rotation and identify each phase conductor of each feeder.

.4 Check each feeder for continuity, short circuits and grounds. Ensure resistance to ground of circuits is not less than 50 megohms.

.5 Pre-acceptance tests:

.1 After installing cable but before splicing and terminating, perform insulation resistance test with 1000 V megger on each phase conductor.

.2 Check insulation resistance after each splice and/or termination to ensure that cable system is ready for acceptance testing.

.6 Acceptance Tests:

.1 Ensure that terminations and accessory equipment are disconnected.

.2 Ground shields, ground wires, metallic armour and conductors not under test.

.1 High Potential (Hipot) Testing.

.1 Conduct hipot testing of original factory test voltage in accordance with manufacturer's recommendations.

.2 Leakage Current Testing.

.1 Raise voltage in steps from zero to maximum values as specified by ICEA manufacturer for type of cable being tested.

.2 Hold maximum voltage for specified time period by ICEA manufacturer.

.3 Record leakage current at each step.

.7 Provide Engineer with list of test results showing location at which each test was made, circuit tested and result of each test.

.8 Remove and replace entire length of cable if cable fails to meet any of test criteria.

END OF SECTION

DRY TYPE TRANSFORMERS, 0-600 V

PART 1 General

1.1 RELATED DOCUMENTS

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

1.2 SECTION INCLUDES

.1 Materials, components, identification, and installation of dry type transformers up to 600 V primary.

.2 This Section includes the following types of dry-type transformers rated 600 V and less, with capacities up to 1000 kVA:

.1 Distribution transformers.

1.3 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 91 13 – General Commissioning (Cx) Requirements.

.3 Section 26 05 00 – Common Work Results - Electrical.

1.4 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CAN/CSA-C22.2 No.47, Air-Cooled Transformers (Dry Type).

.2 CSA C9, Dry-Type Transformers.

.2 National Electrical Manufacturers Association (NEMA)

1.5 SUBMITTALS

.1 Product Data for each type and size of transformer indicated.

.1 Physical: Include rated nameplate data, impedance, X/R ratio, capacities, weights, dimensions, minimum clearances, installed devices, installation recommendations and features.

.2 Product warranty.

.3 Efficiency Data

.1 No load and full load losses per NEMA TP-1.

.2 Linear load Efficiency data @ 1/6, 1/4, 1/2, 3/4, & full load.

.3 Linear Load Efficiency @ 35% loading tested per NEMA TP-2.

.4 Efficiency under K4 load profile at 15%, 25%, 50%, 75%, 100% of nameplate rating.

.2 Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

.1 Wiring Diagrams: Power, signal, and control wiring.

.3 Qualification Data: For testing agency.

.4 Source quality-control test reports.

.5 Field quality-control test reports.

.6 Operation and Maintenance Data: For transformers to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

.1 Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7.

.1 Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

.2 Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7.

.3 Source Limitations: Obtain each transformer type through one source from a single manufacturer.

.4 Electrical Components, Devices and Accessories: Listed and labelled as defined in NFPA 70, Article 100, and to Canadian Electrical Code (CEC), by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

.5 Comply with IEEE C57.12.91, "Test Code for Dry-Type Distribution and Power Transformers."

.6 Comply with IEEE C57.110-1998-IEEE recommended practise for establishing transformer capability when feeding non-sinusoidal load currents.

1.7 DELIVERY, STORAGE, AND HANDLING

.1 Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods

during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

1.8 COORDINATION

.1 Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and form work requirements are specified in Division 03.

.2 Coordinate installation of wall-mounting and structure-hanging supports with actual transformer provided.

PART 2 PRODUCTS

2.1 GENERAL TRANSFORMER REQUIREMENTS

.1 Description: Factory-assembled and tested, ventilated enclosure, convection air-cooled units for 60 Hz service.

.1 Transformer shall be designed, constructed, and rated to in accordance with UL, CSA, and NEMA standards.

.2 Comply with NEMA ST 20, and list and label as complying with UL 1561.

.2 Cores: Grain-oriented, non-aging silicon steel.

.1 One leg per phase.

.2 All three-phase transformers shall be constructed with three coils on a single 3-leg core.

.3 Coils: Continuous windings without splices except for taps.

.1 Internal Coil Connections: Brazed or pressure type.

.2 Coil Material: Copper.

.4 Enclosure: Ventilated, NEMA 3R, with removable front cover.

.1 Core and coil shall be vacuum pressure impregnated within resin compound, sealing out moisture and air.

.2 Finish Colour: Manufacturer’s Standard

.3 Anti-vibration pads/isolators between transformer core/coil assembly and transformer enclosure.

.4 Sound Level to NEMA ST-20.

.5 Mounting:

.1 Units up to 750lbs: factory installed brackets for floor, wall and suspension mounting with drip plate.

.2 Units over 750lbs: factory installed brackets for floor mounting only.

.6 Options:

.1 Type 4X - Stainless Steel enclosure in corrosive or wet environments.

.7 Warranty:

.1 Provide a 25-year pro-rated product Warranty.

2.2 RATINGS

.1 Primary Voltage: as indicated.

.2 Secondary Voltage: as indicated.

.3 kVA Rating: as indicated.

.4 System Frequency: 60 Hertz.

2.3 DISTRIBUTION TRANSFORMERS

.1 Insulation Class H: 220 deg C

.2 Temperature Rise: 150 deg C rise above 40 deg C ambient temperature.

.3 Efficiency: to NRCan, Energy Efficiency Act SOR/2018-201 and O.Reg. 404-12

.4 Taps for Transformers:

.1 Smaller than 3 kVA: None.

.2 7.5 to 24 kVA: One 5 percent tap above and one 5 percent tap below normal full capacity.

.3 25 kVA and larger: Two 2.5 percent taps above and four 2.0 percent taps below normal full capacity.

.5 K-Factor Rating: Transformers shall be K-Factor 4 or higher rated and comply with UL 1561 requirements for non-sinusoidal load current-handling capability to the degree defined by designated K-factor.

.1 Unit shall not overheat when carrying full-load current with harmonic distortion corresponding to designated K-factor.

.2 Indicate value of K-factor on transformer nameplate.

.6 Electrostatic Shielding: Each winding shall have an independent, single, full-width copper electrostatic shield arranged to minimize inter-winding capacitance.

.1 Arrange coil leads and terminal strips to minimize capacitive coupling between input and output terminals.

.2 Include special terminal for grounding the shield.

.3 Shield Effectiveness:

.1 Capacitance between Primary and Secondary Windings: Not to exceed 33 picofarads over a frequency range of 20 Hz to 1 MHz.

.2 Common-Mode Noise Attenuation: Minimum of minus 120 dB at 0.5 to 1.5 kHz; minimum of minus 65 dB at 1.5 to 100 kHz.

.3 Normal-Mode Noise Attenuation: Minimum of minus 52 dB at 1.5 to 10 kHz.

2.4 IDENTIFICATION DEVICES

.1 Nameplates: Engraved, laminated-plastic or metal nameplate for each distribution transformer, mounted with corrosion-resistant screws. Name-plated label products are specified in Division 26 Section “Identification for Electrical Systems”.

2.5 SOURCE QUALITY CONTROL

.1 Test and inspect transformers according to IEEE C57.12.91.

2.6 MANUFACTURERS

.1 Use transformers of one manufacturer throughout project.

.2 Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include, but are not limited to the following:

.1 Hammond Power Solutions Inc.;

.2 Marcus

.3 Delta

.4 Square D; Schneider Electric.

PART 3 EXECUTION

3.1 EXAMINATION

.1 Examine conditions for compliance with enclosure and ambient temperature requirements for each transformer.

.2 Verify that field measurements are as needed to maintain working clearances required by CEC-2009 and manufacturer’s written instructions.

.3 Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.

.4 Verify that ground connections are in place and requirements in Division 26 Section “Grounding and Bonding for Electrical System’s have been met. Maximum ground resistance shall be 5 ohms at location of transformer.

.5 Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

.1 Install wall-mounting transformers level and plumb with wall brackets fabricated by transformer manufacturer.

.1 Brace wall-mounting transformers as specified in Division 26 Section "Vibration and seismic Controls for Electrical Systems".

.2 Construct concrete bases and anchor floor-mounting transformers according to manufacturer's written instructions, seismic codes applicable to Project, and requirements in Division 26 Section "Vibration and Seismic Controls for Electrical Systems".

3.3 CONNECTIONS

.1 Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems".

.2 Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables".

3.4 FIELD QUALITY CONTROL

.1 Perform tests and inspections and prepare test reports.

.1 Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

.2 Tests and Inspections:

.1 Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

.2 Test transformers for losses and efficiency. Verify results are consistent with the loss data provided on the submittal documenting compliance with DOE CSL 3 class efficiency.

.3 Remove and replace units that do not pass tests or inspections and retest as specified above.

.4 Infrared Scanning: Two months after Substantial Completion, perform an infrared scan of transformer connections.

.1 Use an infrared-scanning device designed to measure temperature or detect significant deviations from normal values. Provide documentation of device calibration.

.2 Perform 2 follow-up infrared scans of transformers, one at 4 months and the other at 11 months after Substantial Completion.

.3 Prepare a certified report identifying transformer checked and describing results of scanning. Include notation of deficiencies detected, remedial action taken, and scanning observations after remedial action.

.5 Test Labelling: On completion of satisfactory testing of each unit, attach a dated and signed “Satisfactory Test” label to tested component.

3.5 ADJUSTING

.1 Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding name plate voltage plus 10 percent and not being lower than name plate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.

.2 Connect buck-boost transformers to provide name plate voltage of equipment being served, plus or minus 5 percent, at secondary terminals.

.3 Output Settings Report: Prepare a written report recording output voltages and tap settings.

3.6 CLEANING

.1 Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END OF SECTION

SWITCHBOARDS

PART 1 GENERAL

1.1 SCOPE

.1 This section includes the requirements for the modifications to existing service entrance switchboard DP-1.

1.2 RELATED SECTIONS

.1 Section 01 33 00 – Submittals

.2 Section 01 78 00 – Closeout Submittals

.3 Section 01 91 13 – Commissioning Requirements

.4 Section 26 05 00 – Common Work Requirements Electrical.

.5 Section 26 28 16 – Moulded Case Circuit Breakers

1.3 REFERENCE STANADARDS

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No. 31, Switchgear Assemblies

.2 The switchboard shall be designed, manufactured, and tested in facilities registered to ISO 9001.

1.4 SUBMITTALS

.1 Prior to manufacturing, submit shop drawings and product data in accordance with Section 01 33 00 - Submittals. Note: shop drawing submittal time limit.

.2 Include time-current characteristic curves for circuit breakers.

1.5 SOURCE QUALITY CONTROL

.1 Submit pdf copy of certified test results.

1.6 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for products for incorporation into manual specified in Section 01 77 00 - Closeout Submittal.

1.7 DELIVERY, STORAGE AND HANDLING

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

PART 2 PRODUCTS

2.1 MANUFACTURERS

.1 Existing Switchboard DP-1 is a Cutler-Hammer PRL-3000 switchgear unit, nameplate below:

2.2 MOULDED CASE CIRCUIT BREAKERS

.1 Moulded case circuit breakers to Section 26 28 16 – Moulded Case Circuit Breakers

2.3 DIGITAL OWNER'S METERING

.1 Provide digital owner's mains power metering cubicle within the switchboard assembly including:

.1 CT's and PT's for digital metering 0.5% accuracy c/w shorting terminal blocks for CT's.

.2 Digital 3-phase true RMS power meter with the following features:

.1 Capability of measuring and displaying:

.1 Line to neutral volts – Va, Vb, Vc.

.2 Line to line volts – Vab, Vac, Vbc.

.3 Line current - Ia, Ib, Ic.

.4 Real power - kW total.

.5 Reactive power - kVAR total

.6 Apparent power - kVA total

.7 Real energy – kWHr total.

.8 Reactive energy – kVARh total

.9 Power Factor

.10 Frequency – Hz

.11 Harmonics to 63rd, K-factor and THD.

.2 Sliding window KW peak demand and kWHr total to mimic billing from supply authority.

.3 Meter accuracy:

.1 Voltage 0.5% RSD

.2 Current 0.5% FSD

.3 Power 1.0% FSD

.4 4-20mA output proportional to instantaneous real power to CP-81.

.5 Access to device event history details c/w time stamps directly from digital display.

.6 Standard of Acceptance: Schneider PowerLogic model PM8240 power meter.

PART 3 EXECUTION

3.1 EXAMINATION

.1 Examine equipment exterior and interior prior to installation. Report any damage and do not install any equipment that is structurally, moisture, or mildew damaged.

3.2 INSTALLATION

.1 Replace existing door mounted digital metering unit as indicated. Existing CT/PT wiring to remain. Provide new door for metering compartment with finish to match existing.

.2 Provide new distribution breakers as indicated on contract drawings.

.3 Connect load terminals of distribution breakers to feeders.

.4 Check all factory made connections for mechanical security and electrical continuity.

END OF SECTION

SPD SURGE PROTECTION DEVICES

PART 1 GENERAL

1.1 SUMMARY

.1 This specification describes the requirements for a high-performance tracking hybrid filter designed to provide voltage surge suppression device SPD and high-frequency electrical noise filtering while connected in parallel with a facility's distribution system as defined in ANSI/IEEE C62-41-1991R1995.

.2 The specified unit shall be compatible with non-linear loads and provide effective high-energy transient voltage suppression, surge current diversion and high-frequency electrical line noise attenuation.

.3 For the purpose of this document, this device shall be known and shown in all drawings as a SPD.

.4 Only approved manufacturers and products shall be accepted. All other applications for approval shall provide detailed compliance on exception statements to the specifications herein 10 days prior to bid closing.

1.2 REFERENCES

.1 The specified unit shall be designed, manufactured, tested and installed in compliance with the following standards:

.1 American National Standards Institute/ Electrical and Electronic Engineers (ANSI/IEEE C62.41-1991-R1995, C62.45-1992-R1997, C62.1 and C62.11-1999.

.2 Canadian Standards CSA and CUL.

.3 International Electro technical Commission (IEC 61643-11:2011)

.4 Federal Information Processing Standards Publication 94 (FIPS PUB 94), National Fire Protection Association (NFPA 70).

.5 Ontario Electrical Safety Code.

.6 National Manufacturers Association (NEMA LS1-1992 R2000 Guidelines).

.7 Underwriters Laboratories UL1449 Second Edition and 1283. ANSI/IEEE C67.41, C62.45.

1.3 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 01 91 13 – General Commissioning (Cx) Requirements.

.3 Section 26 05 00 – Common Work Results – Electrical.

.4 Section 26 24 02 – Service Entrance Board.

.5 Section 26 23 00 – Low Voltage Switchgear.

1.4 SUBMITTALS

.1 Submittal for approval: Provide the following surge protection device submittals:

.1 Dimensional drawing of each SPD type, indicating proposed mounting arrangements.

.2 Written functional description of the surge protection circuit in terms of components, configuration, design approach, and performance capability per NEMA LS1.

.3 The means of connection of the SPD to the electrical distribution system per NEMA LS1.

.2 Provide UL-1449, Second Edition data card from manufacturer showing the Suppressed Voltage Rating (SVR) for the specific catalog number submitted. Typical UL 1449, Second Edition data is not acceptable.

.3 Per the requirements of NEC Article 285.6, mark the devices with the short circuit current rating. Meet or exceed the available fault current. Provide test data from an independent testing laboratory to demonstrate the short circuit current rating has been tested on a complete device.

.4 System shall be clearly UL and cUL Listed under UL 1449 4th Edition for Surge Protection Devices and labeled accordingly.

.5 Submit test report data clearly demonstrating the maximum surge current rating has been tested on a COMPLETE SPD unit including all necessary fusing/overcurrent protection, thermal disconnects, integral disconnects and monitoring systems.

.6 Submit data demonstrating the SPD unit, including all overcurrent protection, is fully capable of a minimum repetitive surge current rating of 10,000 ANSI/IEEE C62.41, Category C3 (10kA) impulses without failure or a change in performance characteristics of more than 10%.

1.5 WARRANTY

.1 Provide manufacturer a product warranty against defects in operation and material for a period of not less than 10 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 ENVIRONMENTAL

.1 General Requirements:

.1 The panel mounted SPD device shall be suited for operation in a 120/208VAC, 3 pole, wye, 4 wire, electrical configuration. The operating environment is classified by IEEE C62.41-1991 R1995 as Category B.

.2 The service entrance switchboard mounted SPD devices shall be suited for operation in a 600 VAC, 3 pole, wye, 4 wire, solidly grounded neutral, electrical configuration. The operating environment is classified by IEEE C62.41-(1991) R1995 as Category B.

.3 Operating temperature range shall be -40° to +85°C.

.4 Operation shall be reliable in an environment with 0% to 95% non-condensing relative humidity.

.5 The unit shall not generate any audible noise during normal operation.

.6 No appreciable magnetic fields shall be generated by the TVSS. The unit shall be capable of use directly in computer rooms in any location without danger to data storage systems or devices.

2.2 VOLTAGE SURGE PROTECTION DEVICES

.1 Protection Modes. voltage surge suppression components shall be provided for all possible common and normal modes as described in NEMA LS-1-1992 R2000 paragraph 2.2.7 and IEEE 1100-1992.

.2 Maximum Continuous Operating Voltage (MCOV). The maximum continuous operating voltage of the suppressor unit shall be greater than 125% of the facility nominal operating voltage and in compliance with test and evaluation procedures outlined in NEMA LS1-1992 R2000 paragraphs 2.2.6 and 3.6.

.3 Surge Current. The maximum peak surge current capacity per phase of the specified unit, based on ANSI/IEEE C62.41-1991 R1995.

.4 Let-Through Voltage. The TVSS shall demonstrate peak voltage Let Through characteristics as listed below. Voltage is measured L-N for WYE configurations.

CAT A3	CAT B3	CAT C1
Ring Wave	Ring Wave	Impulse
200 A	500 A	3000 A
6 kV PK 300 V	325 V	400 V

.5 Testing shall be performed in accordance with Category A3, B3 and C1 test wave forms as described in ANSI/IEEE C62.41-1991 R1995 (Guidelines for Surge Voltages in Low Voltage AC Power Circuits). The test procedure shall be in accordance with ANSI/IEEE C62.45-1992 R1997 (Guidelines on Surge Testing for Equipment Connected to Low Voltage AC Power).

.6 UL 1449 Second Edition Suppression Voltage Performance Testing. Each design configuration shall have a UL 1449 Second Edition Suppression Voltage Rating that has been tested and assigned by Underwriters Laboratories utilizing the following waveforms and procedure. The test shall be initiated with a surge of 6,000V/500A, using waveshapes defined within ANSI/IEEE C62.41-1991 R1995 as a 1.2 x 50

microsecond open circuit voltage waveform and an 8 x 20 microsecond short circuit current waveform, to benchmark the unit's suppression voltage. The unit shall then be subjected to 10 positive polarity and 10 negative polarity 1.2 x 50 microsecond 6,000V open circuit voltage waveforms and an 8 x 20 microsecond 3,000A short circuit current waveforms. For comparison with the initial benchmark voltage reading, another ANSI/IEEE surge defined as 1.2 x 50 microsecond 6000V open circuit voltage waveform and an 8 x 20 microsecond 500A short circuit current waveform shall be applied. Deviation from initial to final sampling value may not exceed ±10%. Upon successful completion, an appropriate UL 1449 Second Edition Suppression Voltage Rating is assigned by Underwriters Laboratories.

.7 Suppression System. The SPD unit shall include a solid-rate high-performance suppression system, utilizing non-linear voltage dependent metal oxide variators. The suppression system's components shall not utilize gas tubes, spark gaps, silicon avalanche diodes or other components in such fashion that they may short or crowbar the line, thus leading to interruption of normal power flow.

.8 The SPD components shall have a response time rated less than 1 nanosecond. Filter components shall respond instantaneously.

2.3 SUPPRESSION TECHNOLOGY

.1 SPD component shall incorporate a single Metal Oxide Varistor (MOV) and not a battery of individual MOV’s.

2.4 FILTERING

.1 The unit shall include a high-frequency extended range tracking filter. The filter shall reduce fast rise-time, high frequency, transients and electrical line noise. Attenuation shall be a minimum of 60dB at 100 kHz based on actual insertion loss data obtained utilizing the M1L-STD-E220A,50ohm insertion loss methodology.

.2 The SPD shall have the ability to absorb reactive current associated with the facility's non-linear loads. The sink current for the unit shall be 15 Amps.

.3 Filter attenuation high frequency power filter attenuation valves shall comply with test and evaluation procedures outlined in NEMA LS-1-1992 R2000, Paragraphs 2.2.11 and 3.11 with 6" hookup wire and 50' noise source path. Attenuation to be minimum -50dB at 100KHz, -34dB at 1MHz, -34dB at 10MHz and -47dB at 100MHz.

2.5 GENERAL FEATURES

.1 Connector. Terminals shall be provided for all of the necessary power on the SPD as determined by its model number.

.2 Internal Connections. All surge current diversion connections shall be by way of low impedance wiring. No circuit boards shall be used in transient energy paths.

.3 SPD system connections. No plug-in component modules, quick-disconnect terminals or printed circuit board shall be used in surge current-carrying paths.

.4 Enclosure. The specified system shall be approved in a heavy duty NEMA 4 dust tight, flush mount enclosure with no ventilation openings. The cover of the enclosure shall require a tool for access to internal components. A drawing pocket shall be provided inside the door. Indication of TVSS filter status shall be visible without opening the door.

.5 Unit Status Indicators. Red status indicator lamps shall be provided on the hinged front cover to indicate the protection status on all phases. The absence of the red light shall reliably indicate that one or more surge current diversion modes have failed and that service is needed to restore full operation.

.6 Dry contact for fault status to PLC-1: SCADA PLC.

.7 Warranty. The manufacturer shall provide a Five-Year repair or replacement Warranty for each item supplied.

.8 Standard of Acceptance:

.1 RayCap SPD's

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

.1 Install suppression system immediately next to or on top of service equipment where so approved by the Owner's Representative.

.2 Install conductors between suppressor and point of attachment to service equipment sized in accordance with manufacturer's Shop Drawings and conductor lengths as short as possible, preferably not to exceed 600 mm. Provide information from manufacturers who offer an integrated SPD in the main service entrance equipment clearly showing lead lengths, including the neutral and ground connections.

.3 Grounding: Bond suppressor ground to the equipment grounding conductor and service entrance ground.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 – Common Work results - Electrical and in accordance with Section 01 91 13 – General Commissioning (Cx) Requirements.

.2 Install with conductors tapped from the electrical service. Conductors are to be as short and straight as possible; no greater than 200mm in length. Input conductors to the SPD shall be twisted to reduce impedance during high frequency filtering. The

SPD should be installed following the manufacturer's recommended practices and in compliance with all applicable codes.

.3 Inspect primary and secondary connections for tightness and signs of overheating.

.4 Check fuses for correctness of type and size.

.5 Check grounding connections.

END OF SECTION

PANEL BOARDS BREAKER TYPE

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 Submit shop drawings in accordance with Section 01 33 00 – Submittals.

.2 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 25,000 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 copper bus with neutral of same ampere rating as mains.

.7 Mains: suitable for bolt-on breakers.

.8 Trim with concealed front bolts and hinges.

.9 Trim and door finish: baked grey enamel.

2.2 CUSTOM BUILT PANELBOARD ASSEMBLIES

.1 125 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.

2.5 ACCEPTABLE MANUFACTURERS

.1 Square D (Schneider).

.2 Cutler Hammer (Eaton).

.3 Siemens.

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

MOTOR CONTROL CENTRES

PART 1 General

1.1 SCOPE

.1 This section includes the requirements for 600V-class Low Voltage Motor Control Centers (MCCs) for use on alternating current power systems.

.2 The MCCs shall be furnished and installed as specified in this section and as shown on the contract drawings.

.3 **Note:** MCC Sections required for the provisional items shall be provided - whether the provisional items are included in the contract or not.

1.2 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 01 91 13 – General Commissioning (Cx) Requirements.

.3 Section 26 05 00 – Common Work Results - Electrical.

.4 Section 26 28 21 – Moulded Case Circuit Breakers

.5 Section 26 29 10 – Motor Starters to 600 V.

.6 Section 26 29 20 – Variable Frequency Drives

.7 Section 26 29 03 - Control Devices

1.3 REFERENCES

.1 The MCC shall meet or exceed the requirements within the following standards for MCCs.

.1 NEMA ICS 18 - Industrial Control and Systems: Motor Control Centers

.2 UL 845 - UL Standard for Safety for Motor Control Centers NOTE: UL 845 is a harmonized standard consisting of:

.3 Underwriters Laboratories Inc. (UL) UL 845

.4 Canadian Standards Association (CSA) C22.2 No. 254-05

.5 Association of Standardization and Certification (ANCE) NMX-J-353-ANCE-2006

.6 CSA C22.1 – Canadian Electrical Code with Ontario Amendments as defined in the Ontario Electrical Safety Code.

1.4 SHOP DRAWING SUBMITTALS

.1 Submit WHMIS MSDS - Material Safety Data Sheets. WHMIS acceptable to Labour Canada, and Health and Welfare Canada.

.2 Submit product data sheets for sills, busbars and compartments. Include product characteristics, physical size and finish.

.3 Manufacturer's Instructions: Provide to indicate special handling criteria, installation sequence and cleaning procedures.

.4 Prior to manufacturing, submit shop drawings and product data in accordance with Section 01 33 00 - Submittals. Note: shop drawing submittal time limit.

.5 Indicate on shop drawings:

- .1 Outline dimensions
- .2 Configuration of identified compartments.
- .3 Floor anchoring method and dimensioned foundation template.
- .4 Cable entry and exit locations.
- .5 Dimensioned position and size of busbars and details of provision for future extension.
- .6 Schematic and wiring diagrams.

1.5 SOURCE QUALITY CONTROL

.1 The MCC shall be designed, manufactured, and tested in facilities registered to ISO 9001.

.2 Provide manufacturer's type test certificates including short circuit fault damage certification up to short circuit values specified under bus bracing.

.3 Provide Owner's Representative with certified copy of standard factory tests of complete motor control centre including operation of switches, circuit breakers, starters and controls.

.4 Manufacturer to provide proof of quality control program in accordance with ISO 9001.

1.6 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for motor control centre for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

.2 Include data for each type and style of starter.

PART 2 Products

2.1 ACCEPTABLE MCC MANUFACTURERS

.1 Allen-Bradley

.2 Square-D (Schneider)

.3 Cutler-Hammer (Eaton)

2.2 RATINGS

.1 The MCC shall be rated for the system voltage as indicated on the contract drawings.

.2 The MCC horizontal and vertical power bus bracing shall be rated to meet or exceed the available fault current as shown on the contract drawings, but shall not be less than 42,000 A rms symmetrical.

.3 All MCC units shall have a full rated short-circuit rating that meets or exceeds the available fault current as shown on the contract drawings.

.1 The use of series short-circuit ratings shall be permitted only for panelboards; series short-circuit ratings for other types of units is not acceptable

.4 All circuit breakers used in the motor control center shall have full-rated short-circuit interrupting ratings based on the applied MCC voltage.

.1 Slash rated short-circuit interrupting ratings for circuit breakers are not acceptable.

2.3 ENCLOSURE

.1 The MCC enclosure shall be NEMA Type 1 with gasket around perimeter of doors.

.2 Each section shall be equipped with two full-metal side sheets to isolate each vertical section and to help reduce the likelihood of fault propagation between sections.

.3 All interior and exterior surfaces shall be painted ANSI 49 medium-light gray. The vertical wireways and unit back plates shall be painted high-visibility gloss white.

.4 All unpainted parts shall be plated for corrosion resistance.

.5 Removable closing plates on each end of the MCC shall cover all horizontal bus and horizontal wireway openings.

2.4 STRUCTURE

.1 The MCC shall be of dead front construction and shall consist of one or more vertical sections bolted together to form a rigid, free-standing assembly. The systems shall be designed to allow for the addition of future sections at either end and to permit the interchanging of units.

.2 Vertical sections shall be rigid, free-standing structures.

.1 Vertical sections shall have internal mounting angles running continuously within the shipping block

.2 An external mounting channel that is required to maintain structure integrity is not acceptable

.3 Vertical sections shall be 2286mm high and 508mm wide except where larger dimensions are required.

.4 Reduced height sections shall be provided, if specified on the contract drawings.

.5 Vertical section depth shall be based on largest required depth within MCC lineup assembly.

.6 Vertical sections shall be provided with a removable steel lifting angle on all shipping blocks. The angle shall run the length of the shipping block

.7 Lifting eyes are not acceptable

.8 Each standard section shall be capable of being subdivided into 12 usable, unit spaces

.9 Two unit spaces shall constitute one space factor and shall be minimum 305mm in height

.10 One unit space shall constitute one-half space factor and shall be minimum 152mm height

.3 Horizontal wireways.

.1 Horizontal wireways shall be located at the top and bottom of the MCC

.2 Horizontal wireways shall be minimum 152mm in height and extend the full depth of the vertical section to allow maximum flexibility in locating conduit for MCC feeds and loads

.1 Pull-boxes to extend the height of the top horizontal wireway by 305mm shall be provided, if specified on the contract drawings

.3 Horizontal wireways shall be continuous across the length of the MCC, except where access needs to be denied due to electrical isolation requirements

.4 The horizontal wireways shall be isolated from the power bus

.5 The horizontal wireways shall have removable covers held in place by captive screws

.4 Provide a full height vertical wireway, independent of the plug-in units, in each standard vertical section.

.1 The vertical wireway shall be isolated from the vertical and horizontal buses

.2 The vertical wireway shall be covered with a hinged and secured door

.3 Wireway tie bars shall be provided

.4 Isolation between the wireway and units shall be provided

2.5 SILLS

.1 Continuous 100 mm channel iron floor sills for mounting bases with 19 mm diameter holes for bolts.

2.6 BUSBARS

.1 Main horizontal and branch vertical, three phase high conductivity tin plated copper busbars in separate compartment, bare, self-cooled, extending entire width and height of motor control centre, supported on insulators and rated:

.1 Main horizontal busbars: 600 A or as indicated.

.2 Branch vertical busbars: 300 A or as indicated.

.2 Branch vertical busbars for distribution of power to units in vertical sections.

.3 No other cables, wires, equipment in main and branch busbar compartments.

.4 Brace buswork to withstand effects of short-circuit current of 42 kA rms symmetrical.

.5 Bus supports: with high dielectric strength, low moisture absorption, high impact material and long creepage surface designed to discourage collection of dust.

.6 Provide automatic shutters in every MCC bucket position to guard the busbars from inadvertent contact when the starter bucket is disconnected from the bus.

2.7 GROUND BUS

.1 300A Copper ground bus size 50 x 7 mm extending entire width of motor control centre, located at top and bottom.

.2 Vertical ground bus strap, full height of section, tied to horizontal ground bus, engaged by plug-in unit ground stab.

.3 Provide lugs (2) suitable for termination to #2/0 AWG copper (stranded) conductors.

2.8 ETHERNET/IP COMMUNICATION

.1 The MCC shall have Ethernet wiring incorporated into its design.

.1 The MCC shall have factory installed industrial Ethernet cabling incorporated throughout the vertical section across the entire lineup

.2 Each motor starter, electronic overload relay, power monitor, AC drive, and soft starter unit in the MCC shall be supplied with a means to communicate via EtherNet/IP network prewired to Ethernet Switch located within MCC lineup.

.3 Plug-in units should be able to move around without impacting the network

.4 Maintenance activities should be able to be performed without impacting the network

.2 Industrial Ethernet Switch.

.1 The MCC shall have a managed industrial Ethernet switch mounted in the top or bottom horizontal wireway or in fixed mounted units within the lineup.

.1 EtherNet/IP, DIN-rail mounted, 24 VDC power supply, operating temperature between 0- and 45-degrees C.

.2 Ethernet switches shall have 20% spare RJ45 ports, minimum 2.

.3 If required, fiber ports shall be SC type. Number of fiber ports as shown in Network Topology Drawing plus minimum 1 spare.

.4 Acceptable manufacturers: Phoenix Contact, Hirschmann, Cisco Stratix, or approved equivalent.

.2 Provide 120Vac input terminal blocks for power supply wiring from remote UPS backed up power supply.

.3 Industrial Ethernet Cabling.

.1 Industrial Ethernet Cable Ratings

.1 The industrial Ethernet cable shall be 600V UL Category 5e PLTC rated.

.2 The use of a 300V rated cable is not acceptable

.4 Layout

.1 The industrial Ethernet cable shall connect each switch to one another in a linear topology.

.2 The industrial Ethernet cable through the MCC section shall be routed from the top or bottom horizontal wireways. To prevent accidental mechanical damage during MCC installation, the cable shall be located behind barriers to isolate the cable from the unit space and wireways

2.9 UNIT CONSTRUCTION (GENERAL REQUIREMENTS)

.1 NEMA Class IIS with Type B wiring.

.2 The minimum compartment height shall be 150mm and this shall be considered one-half space factor.

.3 Each unit to have complete top and bottom steel plate for isolation between units.

.4 NEMA Size 5 FVNR starters and below shall be provided as plug-in units.

.5 Plug-in units:

.1 Plug-in units shall consist of a unit assembly, unit support pan, and unit door assembly

.2 Units shall be supplied with removable doors. The unit doors shall be fastened to the structure so that the doors can be closed when the unit is removed

.3 A unit support pan shall be provided for support and guiding units. Unit support pans shall remain in the structure when units are removed to provide isolation between units

.4 A service position shall be provided for plug-in units that allows for the unit to be supported, but disengaged from the bus. The unit shall be capable of being padlocked in the service position. This position is to be used to isolate a unit from the bus to allow service to be performed on the connected load equipment

.6 Power Stabs:

.1 Unit stabs for engaging the power bus shall be tin-plated copper and provided with stainless back-up springs to provide and maintain a high pressure 4-point connection to the vertical bus

.2 Wiring from the unit disconnecting means to the plug-in stabs shall not be exposed on the rear of the unit. A separate isolated pathway shall be provided for each phase to minimize the possibility of unit fault conditions reaching the power bus system

.3 Power cable termination at the plug-in stab shall be a maintenance-free crimp type connection

.7 Withdrawable Power Stabs:

.1 Plug-in units shall have the capacity of withdrawing the power stabs, allowing the primary voltage to be disconnected with the unit door closed.

.2 The withdrawable assembly shall accept a standard 1/4’ hex-style drive socket

.1 A complete power engagement shall occur when turning the mechanism ¼ turn in clockwise direction

.2 Complete power disengagement shall occur when turning the mechanism ¼ turn in counter-clockwise direction

.3 The withdrawable stabs design shall include a set of stab assembly-mounted shutters

.1 shutters shall automatically open before the power stabs can extend and connect to the vertical bus

.2 shutters shall close as soon as the power stabs are disconnected from the vertical bus and are completely inside the stab housing

.4 The withdrawable stabs design shall include interlock mechanisms

.1 A through-the-door mechanism shall allow the unit to be locked in the ‘Power Stabs Disconnected’ position

.1 This mechanism shall be such that it can be padlocked to prevent the connection of the stabs to the vertical bus even when the unit is inserted into the vertical section

.2 Unit door shall be capable of opening with the padlock and lockout engaged

.2 Unit disconnect handle must be in the OFF position (load side of the disconnect device removed from line power) before the stabs can be disconnected from the vertical bus

.1 Mechanism shall also allow the removal of the unit from the vertical section but only after the disconnect handle has been turned OFF and the power stabs have been disconnected from the vertical bus

.2 Unit stabs have to be disconnected (withdrawn) before the unit can be re-inserted into the vertical section

.5 The withdrawable stabs design shall include feedback mechanisms that are verifiable with the unit door closed

.1 A two-position indication system shall be provided (Power Stabs Connected/Disconnected) and shall be visible from the door

.1 Connected with Red Indication–Primary voltage stabs fully engaged and connected to the vertical bus

.2 Disconnected with Green Indication–Primary voltage stabs fully disconnected from the vertical bus

.2 A set of test points shall be located on the front of the unit for identification of:

.1 Power stabs position: a positive continuity check between these probes shall verify that all three power stabs have been disconnected from the vertical bus and completely withdrawn inside the stabs housing

.2 Stab-mounted shutters position: a positive continuity check between these probes shall verify that the shutters are closed, meaning that all three power stabs have been disconnected and withdrawn inside the stab housing

.6 Withdrawable power stabs with door closed mechanism shall not increase the original unit height design so total space in the motor control center is optimized

.7 A remote operating device shall be supplied to allow the connection and disconnection of the power stabs with the door closed

.1 The minimum distance shall be not less than three times the minimum default value recommended by the NFPA 70E (Arc Flash Protection Boundary–Annex D)

.8 Disconnect Handle:

.1 Units shall be provided with a heavy-duty, non-conductive, industrial duty, flange mounted handle mechanism for control of each disconnect switch or circuit breaker provided.

.2 Use of rotary operators is not acceptable

.3 Disconnect handles may pivot in the vertical or horizontal plane

.4 On-off condition shall be indicated by the handle position, red and green color indicators with the words ON and OFF, and the international symbols 1 and O along with a pictorial indication of the handle position

.5 Handles shall be capable of being locked in the OFF position with up to three padlocks

.6 Plug-in units shall be provided with interlocks per NEMA and UL requirements

.7 Interlocks shall be provided for the following:

.1 Prevention of unit insertion or withdrawal with the disconnect in the ON position

.2 Prevention of the unit door from being opened when the disconnect is in the ON position

.1 A feature for intentionally defeating this interlock by qualified personnel shall be provided

.3 Prevention of the disconnect switch from being moved to the ON position if the unit door is open

.1 A feature for intentionally defeating this interlock by qualified personnel shall be provided

.9 Pilot Devices.

.1 Where specified, units shall be furnished with pushbuttons, selector switches, or pilot lights as shown on the contract drawings

.2 Pilot devices shall be rated NEMA Type 4/13 water tight/oil tight

.3 For units with vertically operated disconnect handles:

.1 When three or less pilot devices are utilized, they shall be Allen-Bradley Bulletin 800T or 800H 30.5mm devices or approved equal

.2 When more than three devices are required, the use of Allen-Bradley Bulletin 800F 22.5mm devices (or approved equal) is permitted

.10 For units with horizontally operated disconnect handles:

.1 The devices shall be Allen-Bradley Bulletin 800F or approved equivalent.

.11 Terminal Blocks:

.1 Control terminal blocks shall be provided on all contactor and starter units.

.2 Control terminal blocks shall be a pull-apart design on all plug-in units for easy removal of the unit from the structure

.3 Control terminal blocks on non-plug-in contactor and starter units shall be fixed type.

.4 Power terminal blocks shall be provided on all contactor and starter units, rated NEMA size 3 (100 A) and below that utilize vertically operated disconnects

.1 Power terminal blocks shall be pull-apart for NEMA size 1 and 2 (30 A and 60 A contactors)

.2 Power terminal blocks for NEMA size 3 starters (100 A contactors) shall be non-pull-apart

.5 Terminal blocks shall not be located adjacent to or inside the vertical wireway

.12 Doors:

.1 Each unit shall be provided with a removable door mounted on removable pin-type hinges

.2 The unit doors shall be capable of being opened at least 110 degrees

.3 The unit doors shall be removable from any location in the MCC without disturbing any other unit doors

.4 The unit door shall be fastened to the structure so it can be closed to cover the unit space when the unit is removed

.5 The unit doors shall be held closed with quarter-turn latches

2.10 DISCONNECTS

.1 Main Lugs:

.1 If no overcurrent protection is indicated, provide a main incoming-line lug compartment

.2 Lugs to accommodate the incoming power conductors as indicated on the contract drawings shall be provided by MCC Manufacturer.

.2 Main Fusible Disconnect Switch (if specified in contract drawings):

.1 Lugs to accommodate the incoming power conductors as indicated on the contract drawings shall be provided by the MCC manufacturer.

.2 Power fuses to be provided by MCC manufacturer.

.3 Size fuses as shown on the drawings.

.4 Provide a removable protective barrier to reduce the possibility of contact with the line terminals

.5 Provide one normally open and one normally closed auxiliary contact

.3 Main Circuit Breaker Disconnect (if specified in contract drawings):

.1 Lugs to accommodate the incoming power conductors as indicated on the contract drawings shall be provided by the MCC manufacturer

.2 Size the circuit breaker frame and trip rating as shown on the drawings

.3 The interrupting capacity rating shall meet or exceed the available fault current as shown on the contract drawings

.1 Interrupting capacity based on a slash rating is not acceptable

.4 Provide a circuit breaker to Section 26 28 21 Moulded Case Circuit Breakers.

.5 Provide a removable protective barrier to reduce the possibility of incidental contact with the line terminals

.6 Provide one normally open and one normally closed circuit breaker auxiliary contact that follows the position of the circuit breaker main contacts for indication of 'On' or 'Off/Tripped'

.4 Feeder Disconnects:

.1 Disconnecting means for feeders shall be circuit breakers to Section 26 28 21 Moulded Case Circuit Breakers.

.2 Interrupting capacity rating shall meet or exceed the available fault current as shown on the contract drawings

.3 Interrupting capacity based on a slash rating is not acceptable

.4 Minimum frame size shall be 125 A

.5 Provide one normally open and one normally closed circuit breaker auxiliary contact which follows the position of the circuit breaker main contacts for indication of 'On' or 'Off/Tripped'

2.11 COMBINATION NEMA ACROSS THE LINE STARTERS

.1 Disconnecting means shall be motor circuit protectors.

.1 Unit short circuit rating shall be greater than or equal to the available fault current as shown on the contract drawings

.2 Minimum MCP frame size shall be 125 A

.3 Provide one normally open and one normally closed circuit breaker auxiliary contact that follows the position of the circuit breaker main contacts for indication of 'On' or 'Off/Tripped'

.2 Starters shall meet applicable NEMA and UL requirements.

.3 Starters shall be minimum NEMA Size 1.

.4 Fractional NEMA sizes are not acceptable

.5 Starters shall be provided with a 3-pole solid state overload relay that includes the following features:

.1 EtherNet/IP communication, refer to the part of this section titled 'EtherNet/IP Interface for Motor Starter Units', which takes precedence over this overload relay requirement

.2 Selectable trip classes of 10, 15, 20, or 30

.3 Set for class 20 unless otherwise indicated on the contract drawings

.4 Overload protection

.5 Phase loss protection

.6 Trip current adjustment range of 5:1

.7 Visual trip status indication

.8 Test/Reset button

.9 Bipolar latching relay with one normally open and one normally closed contact, rated NEMA B600 for use in motor contactor control circuits

.10 Thermal memory circuit to model the heating and cooling effects of motor on and off periods

.11 The overload relay shall be Allen-Bradley E300 or equal.

.6 In addition to the hold-in contact, starters shall be provided with auxiliary contacts shown on the contract drawing wiring diagrams. The starter shall be capable of accommodating up to six contact in addition to the hold-in contact.

.7 Provide a control power transformer with a rated secondary voltage of 120V AC. The control power transformer shall be provided with primary and secondary fusing.

.1 Size transformer for connected load plus 100VA spare capacity.

.8 Overload relays shall have a reset button located on the outside of the unit door.

.9 Provide a door mounted selector switch for Local-Off-Remote operation. The Local mode shall provide local control at the MCC unit door. In the Remote mode, control shall be provided through a remote contact.

.10 Provide door mounted 120V AC push-to-test pilot lights with LED lamps for Ready [Green], Running [Red], and Fault [Amber] status indication.

.1 Provide additional wiring and terminals to support remote installation of status lights wired in parallel with local status lights per contract drawings.

.11 Provide additional control relays, wiring and terminals as indicated on contract drawings to support the integration of remotely installed status lights, motor protection, and control devices (temp/leak, seal water valve, mechanical interlocks).

2.12 COMBINATION SOFT STARTER UNITS

.1 Provide a control power transformer with a rated secondary voltage of 120V AC. The control power transformer shall be provided with primary and secondary fusing.

.2 The controller shall be Allen-Bradley SMC Flex **or equal** and shall include the following features:

.1 Integrated bypass contactor that is closed once the motor is up to full speed

.2 Electronic overload protection with adjustable trip class

.3 Four programmable auxiliary contacts

.4 Selectable control capabilities: soft start, kickstart, current limit start, dual ramp, full voltage, linear speed, preset slow speed, soft stop

.5 Additional control capabilities: Pump Control

.6 LCD display

.7 Keypad programming for configuration

.8 Built-in, selectable protective functions for: overload, jam, stall, excessive starts per hour, underload, over/under voltage, voltage unbalance

.9 Metering capabilities for: current, voltage, kW, kWH, power factor, motor thermal capacity utilized, elapsed time

.10 Ground fault protection (1 A to 5 A) not required

.3 Provide an input isolation contactor.

.4 The SMC unit shall be provided with line side protective modules. The modules shall contain capacitors and metal oxide varistors (MOVs) that protect the internal power circuitry from severe electrical transients and/or high electrical noise.

.5 Provide door-mounted pilot devices as shown on the contract drawing wiring diagrams.

.6 Provide door-mounted 120V AC push-to-test pilot lights with LED lamps as indicated on contract drawings.

.7 Emergency run bypass contactor is not required.

.1 If required, emergency run bypass shall be fully rated for the motor load and be capable of starting the motor at full voltage. The emergency run bypass shall be provided with the same type of solid-state overload relay protection as for the electromechanical starter units

2.13 VARIABLE FREQUENCY DRIVES

.1 Provide variable frequency drives to Section 26 29 23 – Variable Frequency Drives.

2.14 WIRING IDENTIFICATION

.1 Provide wiring identification in accordance with Section 26 05 00 – Common Work Results - Electrical.

2.15 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results - Electrical.

.1 Motor control centre main nameplate: size No. 7, engraved as indicated.

.2 Individual compartment nameplates: size No. 5, engraved as indicated.

2.16 FINISHES

.1 Apply finishes in accordance with Section 26 05 00 – Common Work Results - Electrical.

.2 Paint motor control centre exterior light gray and interiors white.

PART 3 Execution

3.1 INSTALLATION

.1 Contractor shall install MCC in accordance with manufacturer's instructions.

.2 Set and secure motor control centre in place on channel bases, rigid, plumb and square to building floor and wall.

.3 Contractor shall tighten accessible bus connections and mechanical fasteners to the manufacturer's torque requirements.

.4 Contractor shall select and install fuses in fusible switches based upon field requirements.

.5 Contractor shall adjust circuit breaker settings based upon field requirements.

.6 Contractor shall adjust solid state overloads to match the installed motor characteristics.

.7 Ensure correct overload heater elements are installed.

.8 Make field power and control connections as indicated.

.9 Connect network switch to building control panel.

.1 Configuration of network devices by div 25 contractor.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 – Common Work Results - Electrical and Section 01 91 13 – General Commissioning (Cx) Requirements.

.2 Ensure moving and working parts are lubricated where required.

.3 Operate starters in sequence to prove satisfactory performance of motor control centre every hour for an 8 hour period.

END OF SECTION

WIRING DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

.1 Switches, receptacles, wiring devices, cover plates and their installation.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 91 13 – General Commissioning (Cx) Requirements.

.3 Section 26 05 00 – Common Work Results - Electrical.

1.3 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CSA-C22.2 No.42, General Use Receptacles, Attachment Plugs and Similar Devices.

.2 CSA-C22.2 No.42.1, Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).

.3 CSA-C22.2 No.55, Special Use Switches.

.4 CSA-C22.2 No.111, General-Use Snap Switches (Bi-national standard, with UL 20, twelfth edition).

1.4 SUBMITTALS

.1 Submit shop drawings and product data related sections to Section 01 33 00 – Submittal Procedures.

PART 2 PRODUCTS

2.1 SWITCHES

.1 20 A, 120 V, & 347 V as noted, single pole, three-way and four-way switches as indicated to: CSA-C22.2 No.55 and CSA-C22.2 No.111.

.2 Manually-operated general purpose ac switches with following features:

.1 Terminal holes approved for No. 10 AWG wire.

.2 Silver alloy contacts.

.3 Urea or melamine moulding for parts subject to carbon tracking.

.4 Suitable for back and side wiring.

.5 White toggle.

.6 Extra Heavy Duty Industrial Grade.

.3 Toggle operated fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads.

.4 20A, 120V as noted, single pole, three-way and four-way switches single and two gang, dead end and feed through c/w threaded hubs, boxes and covers of copper free aluminum suitable for Class I, Div. I & Div. II, Group 'D' installation.

.5 Switches of one manufacturer throughout project.

.6 Acceptable products:

.1 Hubbel HBL 1221 W,

.2 Leviton 1221-2W,

2.2 RECEPTACLES

.1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, to: CSA-C22.2 No.42 with following features:

.1 Ivory thermoplastic moulded housing.

.2 Suitable for No. 10 AWG for back and side wiring.

.3 Break-off links for use as split receptacles.

.4 Eight back wired entrances, four side wiring screws.

.5 Triple wipe contacts and rivetted grounding contacts.

.2 Simplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground with following features:

.1 Ivory thermoplastic moulded housing.

.2 Suitable for No. 10 AWG for back and side wiring.

.3 Four back wired entrances, 2 side wiring screws.

.3 Other receptacles with ampacity and voltage as indicated.

.4 Receptacles of one manufacturer throughout project.

.5 Specification grade.

.6 Acceptable products:

.1 Hubbel 5262-W,

.2 Leviton 5262-W,

2.3 SURGE SUPPRESSION RECEPTACLES

.1 Duplex receptacle, CSA 5-15R 125V, 15Amp, 'U' ground with following features.

.1 Blue urea molded housing.

.2 Suitable for no 10AWG for back and side wiring.

.3 Damage alter-alarm with muting screw.

.4 Power-on indicator.
.5 CSA certified to C22.2 No.42m.
.6 120V-60Hz.
.7 Response time 5NS.
.8 Peak energy 210 joules.
.9 Peak current 13000 amps.
.10 EMI/RFI attenuation at 50 OHMS-500KHZ-100MHZ.

2.4 SPECIAL WIRING DEVICES

.1 Special wiring devices:

.1 Clock hanger outlets, 15 A, 125 V, 3 wire, grounding type, suitable for No. 10 AWG for installation in flush outlet box.
.2 Pilot lights: heavy duty, oil tight, LED cluster Push-To-Test type, 30 mm diameter, lens colour as indicated, 120V supply voltage, labels as indicated.
.3 GFCI to trip on 5mA ground fault.
.4 Hatch switches: Turck Rectangular Inductive Proximity Sensors, Intrinsically Safe, 35mm sensing range.
.5 Motion sensors: GE Precision Line Dual Technology sensors.
.6 Intrinsically safe motion sensors: GE 6190 series sensors.
.7 Adjustable CT current relays: Hawkeye Series H735 or approved alternate
.8 Door switches: GRI 4460A

2.5 WIRING DEVICES FOR COMPUTER ROOMS

.1 As indicated.

2.6 COVER PLATES

.1 Cover plates for wiring devices to: CSA-C22.2 No.42.1.

.2 Cover plates from one manufacturer throughout project.

.3 Stainless steel cover, thickness 1 mm for wiring devices mounted in flush-mounted outlet box.

.4 Sheet metal cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.

.5 Weatherproof, Extra Duty, while in use, cast aluminum cover plates, complete with gaskets for duplex receptacles as indicated.

.6 Gang type coverplates when more than one switch or outlet is required.

.7 Label cover plates to Section 26 05 00 – Common Work Requirements

PART 3 EXECUTION

3.1 INSTALLATION

.1 Switches:

.1 Install single throw switches with handle in "UP" position when switch closed.

.2 Install switches in gang type outlet box when more than one switch is required in one location.

.3 Mount toggle switches at height in accordance with Section 26 05 00 – Common Work Results - Electrical.

.2 Receptacles:

.1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.

.2 Mount receptacles at height in accordance with Section 26 05 00 – Common Work Results - Electrical.

.3 Where split receptacle has one portion switched, mount vertically and switch upper portion.

.3 Cover plates:

.1 Protect cover plate finish with paper or plastic film until painting and other work is finished.

.2 Install suitable common cover plates where wiring devices are grouped.

.3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

END OF SECTION

FUSES, LOW VOLTAGE

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 78 00 – Closeout Submittals.

.2 Section 01 91 13 – Commissioning (Cx) Requirements.

.3 Section 26 05 00 – Common Work Results - Electrical.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CSA C22.2 No.248.1 to .16, Low Voltage Fuses Parts 1 to 16, edition as shown in Appendix A of Ontario Electrical Safety Code.

1.3 SUBMITTALS

.1 Submit shop drawings and product data in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit fuse performance data characteristics for each fuse type and size above 200 A. Performance data to include: average melting time-current characteristics.

1.4 DELIVERY AND STORAGE

.1 Ship fuses in original containers.

.2 Do not ship fuses installed in switchboard.

.3 Store fuses in original containers in moisture free location.

1.5 MAINTENACE MATERIALS

.1 Provide maintenance materials in accordance with Section 01 33 00 – Closeout Submittals.

.2 Provide three spare fuses of each type and size installed above 200A.

PART 2 PRODUCTS

2.1 FUSES GENERAL

.1 Fuse type references L1, L2, J1, R1, etc. have been adopted for use in this specification.

.2 Fuses installed in fused disconnect switches shall have blown fuse indictors.

.3 Fuses: product of one manufacturer for entire project.

2.2 FUSE TYPES

.1 Class J fuses (formerly HRCI- J).

.1 Type J1, time delay, capable of carrying 500% of its rated current for 10 s minimum.

2.3 FUSE STORAGE CABINET

.1 Fuse storage cabinet, manufactured from 2.0 mm thick aluminum 750 mm high, 600 mm wide, 300 mm deep, hinged, lockable front access door finished in accordance with Section 26 05 00 – Common Work Results - Electrical.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install fuses in mounting devices immediately before energizing circuit. Ensure correct fuses fitted to physically matched mounting devices.

.1 Install Class R rejection clips for HRCI-R fuses.

.2 Ensure correct fuses fitted to assigned electrical circuit.

.3 Where UL Class RK1 fuses are specified, install warning label "Use only UL Class RK1 fuses for replacement" on equipment.

.4 Install spare fuses in fuse storage cabinet.

END OF SECTION

MOULDED CASE CIRCUIT BREAKERS

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.

.4 Section 26 24 02 – Service Entrance Board

.5 Section 26 24 17 – Panelboards Breaker Type

1.2 SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00 – Submittals.

.2 Include time-current characteristic curves for all breakers.

PART 2 PRODUCTS

2.1 BREAKERS GENERAL

.1 Bolt-on moulded case circuit breaker: quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40°C ambient.

.2 Common-trip breakers: with single handle for multi-pole applications.

.3 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting. Trip settings on breakers with adjustable trips to range from 3-8 times current rating.

.4 Circuit breakers with interchangeable trips as indicated.

.5 Provide electronic trip units for all breakers sized 100 amps and upwards.

2.2 THERMAL MAGNETIC BREAKERS DESIGN A

.1 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide:

.1 inverse time current tripping under overload condition, and

.2 instantaneous tripping for short circuit protection.

2.3 SOLID STATE TRIP BREAKERS DESIGN C

.1 Moulded case circuit breaker to operate by means of a solid-state trip unit with associated current monitors and self-powered shunt trip to provide:

.1 inverse time current trip under overload condition, and

.2 long-time, short-time, and instantaneous tripping for phase and ground fault short circuit protection.

2.4 OPTIONAL FEATURES

.1 Include:

.1 on-off locking device.

.2 handle mechanism.

.3 shunt trip as indicated.

.4 auxiliary switch as indicated.

.5 motor-operated mechanism c/w time delay unit as indicated.

.6 under-voltage release as indicated.

2.5 ENCLOSURE

.1 Mounted in NEMA 1A type enclosure, sprinkler proof as indicated.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install circuit breakers as indicated.

END OF SECTION

DISCONNECT SWITCHES FUSED AND NON-FUSED

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 for Electrical.

.4 Section 26 28 13 – Fuses – Low Voltage.

1.2 REFERENCE STANDARDS

.1 CSA-C22.2 No.4, Enclosed and Dead-Front Switches.

.2 CSA C22.2 No.39, Fuseholder Assemblies.

1.3 SUBMITTALS

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

.2 Submit product data and dimensions.

PART 2 PRODUCTS

2.1 DISCONNECT SWITCHES

.1 Fusible and non-fusible disconnect switches shall be sized as indicated on drawings and enclosed in:

.1 NEMA 12 enclosures in indoor, non-hazardous, dry locations.
.2 NEMA 7 enclosures in hazardous areas, or
.3 NEMA 4X enclosures unless indicated otherwise.

.2 Service entrance type where required.

.3 Flange mounted, visible blade c/w viewing window.

.4 Provision for padlocking in on-off switch position by three locks.

.5 Mechanically interlocked door to prevent opening when handle in ON position.

.6 Fuses: type and size as indicated, to Section 26 28 13.01 - Fuses - Low Voltage.

.7 Fuse-holders: suitable without adaptors, for type and size of fuse indicated.

.8 Quick-make, quick-break action.

.9 ON-OFF switch position indication on switch enclosure cover.

.10 Manufacturer:

.1 Use products of a single manufacturer throughout project.

.2 Acceptable Manufacturers:

.1 Square 'D' Heavy Duty

.2 Siemens Heavy Duty

.3 Eaton / Cutler Hammer Heavy Duty.

2.2 PLUG/RECEPTACLE SWITCHES

.1 Decontactor series, HP rated to suit load.

.2 Padlockable in OFF position.

.3 Decontactor to include 3 pilot contacts for motor temperature and moisture protection wiring. Also required for pumps with motor leads and pump protection wiring in same cable.

.4 Manufacturer: Meltric "Decontactor" series switch rated plugs and receptacles.

2.3 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results for 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.

.2 Ensure all wiring enters/exits the sides or bottom. (Do not enter top of unit).

.3 Ensure line and load conductors enter/exit the disconnect switch in separate conduits.

.4 Ensure line and load side conductors do not come into contact with or cross each other inside the disconnect switch.

.5 Install SS drip hoods over all disconnects installed in sprinklered areas and outdoors.

END OF SECTION

CONTACTORS

PART 1 GENERAL

1.1 SECTION INCLUDES

.1 Materials and installation for contactors for system voltages up to 600 V

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 91 13 – General Commissioning (Cx) Requirements.

.3 Section 26 05 00 – Common Work Results - Electrical.

.4 Section 26 29 03 - Control Devices.

1.3 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CSA C22.2 No.14, Industrial Control Equipment.

1.4 SUBMITTALS

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

PART 2 PRODUCTS

2.1 CONTACTORS

.1 Contactors: to CSA C22.2 No.14, NEMA rated.

.2 Electrically held controlled by pilot devices as indicated and rated for type of load controlled. Half size contactors not accepted.

.3 Fused switch combination contactor as indicated.

.4 Complete with 2 normally open and 2 normally closed auxiliary contacts unless indicated otherwise.

.5 Mount in NEMA 12 enclosure unless otherwise indicated.

.6 Include following options in cover:

.1 Red indicating lamp.

.2 Hand-Off-Auto selector switch.

.7 Control transformer: in accordance with Section 26 29 03 - Control Devices, in contactor enclosure. Oversized capacity of 100VA.

.8 Combination starters to be supplied with oversized enclosure with din rail space for dry run protection relays.

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results - Electrical.

.2 Size 4 nameplate indicating name of load controlled as indicated.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install contactors and connect auxiliary control devices.

END OF SECTION

CONTROL DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

.1 Materials and installation for industrial control devices including pushbutton stations, local control panels, and relay panels.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 26 05 00 – Common Work Results - Electrical

1.3 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CSA C22.2 No.14, Industrial Control Equipment.

.2 National Electrical Manufacturers Association (NEMA)

.1 NEMA ICS 1, Industrial Control and Systems: General Requirements.

1.4 SUBMITTALS

.1 Submit shop drawings in accordance with Section 01 33 00 – Submittals Procedures.

.1 Include schematic, wiring, and interconnection diagrams.

1.5 QUALITY ASSURANCE

.1 Submit to Owner's Representative one copy of test results.

PART 2 PRODUCTS

2.1 AC CONTROL RELAYS

.1 Control Relays: to CSA C22.2 No.14 and NEMA ICS 1.

.2 Sealed contact type: electrically held with 2 DDT contacts and indicating light.

.1 Coil rating: 120Vac, 5VA.

.2 Contact rating: 120V, 10A.

.3 Socket bases and DIN rail mounting.

2.2 RELAY ACCESSORIES

.1 Standard contact cartridges: normally-open, convertible to normally-closed in field.

2.3 OILTIGHT LIMIT SWITCHES

.1 Snap action type: roller rod or fork lever, top, side, push or wobble stick actuator, CSA type 1 enclosure. Contact rating as indicated.

.2 Surface mounted.

.3 Standard contact block.

2.4 SEALED CONTACT OILTIGHT LIMIT SWITCHES

.1 Lever type switches: roller fork or rod operated, single or double pole, double throw. Contact rating: as indicated.

.2 Push type switches: actuated by rod or plunger located on side of operating head, spring return single pole, throw. Contact rating: as indicated.

.3 Wobble stick cat whisker type switches: actuated by rod or stick extending from tip of operating head. Moving rod in any direction operates contacts. Single pole, double throw. Contact rating: as indicated.

.4 Lever operated: time delay switch: adjustable time delay from 1/2s to 15s plus 25%. Contact rating: as indicated.

.5 Plug-in construction switches: CSA Type 4, two or four circuit, lever push or wobble stick type, contact rating: as indicated.

2.5 SOLID STATE TIMING RELAYS

.1 Construction: AC operated electronic timing relay with solid-state timing circuit to operate output contact. Timing circuit and output contact completely encapsulated to protect against vibration, humidity and atmospheric contaminants.

.2 Operation: on-delay or off-delay.

.3 Potentiometer: self contained to provide time interval adjustment.

.4 Supply voltage: 120VAC or 24 VAC, 60 Hz, as indicated.

.5 Temperature range: -20 degrees C to +60 degrees C.

.6 Output contact rating: maximum voltage 300 V AC or DC. Current: NEMA ICS 1 as indicated.

.7 Timing ranges: minimum 0.5 maximum 60s.

2.6 INSTANTANEOUS TRIP CURRENT RELAYS

.1 Enclosure: CSA Type 1.

.2 Contacts: NO, NC automatic reset with adjustable tripping point.

.3 Control: 3 wire, with provision for shorting contacts during accelerating period of motor.

.4 Contact rating: NEMA ICS 1 as indicated.

2.7 OPERATOR CONTROL STATIONS

.1 Enclosure: CSA Type 12 enclosure, surface mounting.

.2 Wiring: tin-plated copper stranded conductors, 19 strands minimum, thermosetting type insulation.

2.8 PUSHBUTTONS

.1 Momentary contact type: Heavy duty – oil tight, operator flush type, 30mm diameter, colour as indicated, 1-NO and 1-NC contacts rated 10A at 120VAC, labels as indicated.

.2 Push-pull contact type: Heavy duty – oil tight, operator mushroom head type, 30mm diameter, red colour, provision for padlocking in “OFF” position, 2-NO and 2-NC contacts rated 10A at 120VAC, labels as indicated.

2.9 SELECTOR SWITCHES

.1 Maintained contact type: 2 or 3 positions (as indicated), heavy duty – oil tight, operator’s standard knob, 30mm diameter, contact arrangement as indicated rated 10A at 120V AC, labels as indicated.

.2 Rotary potentiometer type: heavy duty, oil tight, operator’s standard knob, 30mm diameter, label as indicated.

.1 Coordinate power requirements with device being wired to.

2.10 INDICATING LIGHTS

.1 Heavy duty – oil tight, LED cluster Push-To-Test type, 30mm diameter, lens colour: as indicated, supply voltage: 120VAC, labels as indicated.

2.11 LOCAL CONTROL AND RELAY PANELS

.1 NEMA 4X stainless steel enclosure. Surface mount with hinged padlockable access door, accommodating relays, timers, labels, as indicated.

.2 Provide identified terminals for field wiring termination.

.3 Wiring: tin-plated copper stranded conductors, 19 strands minimum, thermosetting type insulation.

.1 Crimped ferrules on all wires terminating on terminal blocks

.2 Digital control wiring: type REW wire, irradiated (cross-linked) PVC insulation.

.3 Analog control wire: type CIC wire, XLPE insulation, twisted-shielded pair/triad as required.

.4 Anti-condensation heater c/w thermostat control and insulated enclosure for outdoor locations.

.5 Factory assembled by CSA certified panel shop.

2.12 CONTROL CIRCUIT TRANSFORMERS

.1 Single phase, dry type.

.2 Primary: 208, 240 or 600 V, 60 Hz ac.

.3 Secondary: 120 V, or 24V ac.

.4 Rating: 50, 150, 250, 350 or 500 VA, as indicated, oversized by 100VA.

.5 Secondary fuse: size as required.

.6 Close voltage regulation as required by magnet coils and solenoid valves.

2.13 THERMOSTAT (LINE VOLTAGE)

.1 Wall mounted, for exhaust fan control.

.2 Full load rating: Amps as indicated at 120 V.

.3 Temperature setting range: 10 degrees C to 30 degrees C.

.4 Thermometer Range: 10 degrees C to 30 degrees C.

.5 Markings in 5 degrees increments.

.6 Differential temperature fixed at 20 degrees C.

.7 Standard of Acceptance: Crouse-Hinds Eaton HRC Thermostat with Honeywell Control Model HRC85.

2.14 MOTION DETECTOR (HMS-1)

.1 CSA Approved, Explosion Proof

.2 Motion Detection

.3 Tilt Angles: -90° to +30° in elevation

.4 Output Hold Time: 0.5 s to 15 min (Adjustable)

.5 Standard of Acceptance: Larson Electronics Part # EXP-MS-N4X-AT-HV

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install pushbutton stations, control and relay panels, control devices as indicated.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Electrical General Requirements.

.2 Depending upon magnitude and complexity, divide control system into convenient sections, energize one section at a time and check out operation of section.

.3 Upon completion of sectional test, undertake group testing.

.4 Check out complete system for operational sequencing.

.5 Submit to Engineer one copy of test results.

END OF SECTION

MOTOR STARTERS TO 600V

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.

.4 Section 26 24 19 – Motor Control Center

.5 Section 26 29 03 – Control Devices.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CAN/CSA-C22.2 No.14, Industrial Control Equipment

.2 National Electrical Manufacturer's Association (NEMA)

.1 NEMA ICS 2 - Industrial Control and Systems: Controllers, Contactors and Overload Relays Rated 600 Volts

1.3 SUBMITTALS

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

.2 Shop Drawing Submittals:

.1 Submit to engineer for approval for each type of starter provided.

.1 Mounting method and dimensions.

.2 Starter size and type.

.3 Layout of identified internal and front panel components.

.4 Enclosure types.

.5 Wiring diagram for each starter.

.6 Interconnection diagrams.

.2 For factory manufactured motor starters, submit shop drawings from a manufacturer certified by CSA, IEC or CUL.

.3 For custom/built assembled motor starters/control panels, submit shop drawings and control diagrams from a CSA certified Control Panel Supplier.

1.4 CLOSEOUT SUBMITTALS

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

.2 Include operation and maintenance data for each type and style of starter.

1.5 EXTRA MATERIALS

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Provide listed spare parts for each different size and type of starter:

.1 3 contacts, stationary.
.2 3 contacts, movable.
.3 1 contacts, auxiliary.
.4 1 control transformer.
.5 1 operating coil.
.6 2 fuses.
.7 10% indicating lamp bulbs used.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Starters to NEMA/EEMAC 1CS2 and CSA C22.2 No.14.

.2 Minimum starter size: Size 1.

2.2 MANUAL MOTOR STARTERS

.1 Single and Three phase manual motor starters with components as follows:

.1 Switching mechanism, quick make and break.
.2 One and Three overload heaters, as indicated, manual reset, trip indicating handle.

.2 Accessories:

.1 Toggle switch or pushbutton: heavy duty labelled as indicated.
.2 Indicating light: heavy duty type and colour as indicated.
.3 Locking tab to permit padlocking in "ON" or "OFF" position.

2.3 FULL VOLTAGE NON-REVERSING MAGNETIC STARTERS

.1 Magnetic and combination magnetic starters of size, type, rating and enclosure type as indicated with components as follows:

.1 Contactor solenoid operated, rapid action type.
.2 Motor electronic overload protective device in each phase, manually reset from outside enclosure.
.3 Wiring and schematic diagram inside starter enclosure in visible location.

.4 Identify each wire and terminal for external connections, within starter, with oil resistant permanent number marking identical to diagram.

.2 Combination type starters to include motor circuit protector with flange mounted operating lever on outside of enclosure to control motor circuit protector, and provision for:

.1 Locking in "OFF" position with up to 3 padlocks.

.2 Independent locking of enclosure door.

.3 Provision for preventing switching to "ON" position while enclosure door open.

2.4 FULL VOLTAGE REVERSING MAGNETIC STARTERS

.1 Full voltage reversing magnetic starters of size, type, rating and enclosure type as indicated with components as follows:

.1 Two - 3 pole magnetic contactors mounted on common base.

.2 Mechanical and electrical interlocks to prevent both contactors from operating at same time.

.3 Electronic overload relays, manually reset on door.

.2 Accessories:

.1 Pushbuttons and selector switches: heavy duty, oil tight, labelled as indicated.

.2 Indicating lights: heavy duty, oil tight type, LED type and color as indicated.

.3 Auxiliary control devices as indicated.

2.5 MULTI-SPEED STARTERS

.1 2 speed starters of size, type, rating, and enclosure type as indicated. Starter suitable for constant kW type motor and with components as follows:

.1 One-3 pole contactor for each winding for separate winding motors.

.2 One-3 pole and one-5 pole contactor for each reconnectable winding for consequent pole type motors.

.3 Electronic overload relays and manual reset for each speed on door.

.2 Accessories:

.1 Pushbuttons and selector switches: heavy duty, oil tight, labelled as indicated.

.2 Indicating lights: heavy duty, oil tight type and color as indicated.

.3 Auxiliary control devices as indicated.

.4 Automatic sequence relays for each speed.

2.6 MAGNETIC STARTER, REDUCED VOLTAGE, AUTO-TRANSFORMER

.1 Auto-transformer starter closed circuit transition type, of size, type, rating and enclosure type as indicated and with following components:

.1 Three-3 pole contactors.

.2 Auto-transformer with 50%, 65% and 80% taps.

.3 One adjustable pneumatic timing relay.

.4 One-3 pole manual reset overload device.

.5 Electronic overload protection of auto-transformers.

.2 Accessories:

.1 Pushbuttons and selector switches: heavy duty, oil tight, labelled as indicated.

.2 Indicating lights: heavy duty, oil tight type, LED type and color as indicated.

.3 Auxiliary control devices as indicated.

2.7 2.7 MAGNETIC STARTER REDUCED VOLTAGE STAR-DELTA

.1 Reduced voltage star-delta open transition starter, of size, type, rating and enclosure type as indicated, with components as follows:

.1 Two-3 pole delta contactors with auxiliary relays and interlocks.

.2 One-3 pole star contactor with auxiliary relays and interlocks.

.3 Mechanical interlock to interlock one delta contactor and the star contactor.

.4 One timing relay.

.5 Three pole manual reset electronic overload relays.

.6 Reduced voltage star-delta closed transition starter, of size, type, rating and enclosure type as indicated, with components as follows:

.7 Two-3 pole delta contactors with auxiliary relays and interlocks.

.8 One-3 pole star contactor with auxiliary relay and interlocks.

.9 One-3 pole transition contactor.

.10 One set of transition resistors.

.11 Mechanical interlock, to interlock one delta contactor and the star contactor.

.12 One timing relay.

.13 Three pole manual reset electronic overload relays.

.2 Accessories:

.1 Pushbuttons and selector switches: heavy duty, oil tight, labelled as indicated.

.2 Indicating lights: heavy duty, oil tight type, LED type and color as indicated.

.3 Auxiliary control devices as indicated.

2.8 MAGNETIC STARTER REDUCED VOLTAGE PART WINDING

.1 Two-step reduced voltage, part winding starter of size, type, rating and enclosure type as indicated, with components as follows:

.1 Two-3 pole contactors.

.2 Adjustable pneumatic timer.

.3 Six manual reset electronic overload relays.

.4 Three step reduced voltage part winding starter of size, type, rating and enclosure type as indicated, with components as follows:

.5 Three-3 pole contactors.

.6 One set starting resistors.

.7 Six manual reset electronic overload relays.

.2 Accessories:

.1 Pushbuttons and selector switches: heavy duty, oil tight, labelled as indicated.

.2 Indicating lights: heavy duty, oil tight type, LED type and color as indicated.

.3 Auxiliary control devices as indicated.

2.9 THREE PHASE MANUAL REVERSING STARTER

.1 Three phase manual reversing starter of size, type, rating and enclosure type as indicated, with components as follows:

.1 Two-3 pole manual motor starters, quick make and break.

.2 Six overload relays and manual reset.

.3 Mechanical interlock to prevent both switches from closing at same time.

.2 Accessories

.1 Pushbuttons and selector switches: heavy duty, oil tight, labelled as indicated.

.2 Indicating lights: heavy duty, oil tight type and color as indicated.

2.10 THREE PHASE MANUAL TWO SPEED SEPARATE WINDING STARTERS

.1 Three phase manual two speed separate winding starters of size, type, rating and enclosure type as indicated with components as follows:

.1 Two-3 pole manual motor starters, quick make and break.

.2 Six overload relays and manual reset.

.3 Mechanical interlock to prevent both switches from closing at same time.

.2 Accessories:

.1 Pushbuttons and selector switches: heavy duty, oil tight, labelled as indicated.

.2 Indicating lights: heavy duty, oil tight type and color as indicated.

2.11 DC FULL VOLTAGE NON-REVERSING STARTERS

.1 DC full voltage non-reversing starters of size, type, rating and enclosure type as indicated, with components as follows:

.1 Contactor: single or two pole solenoid operated type as required.

.2 Indirectly-heated, manual reset thermal overload relay.

.2 Accessories:

.1 Pushbuttons: heavy duty, oil tight labelled as indicated.

.2 Selector switches: heavy duty, oil tight labelled as indicated.

.3 Indicating lights: heavy duty type and colour as indicated.

2.12 DC FULL VOLTAGE REVERSING STARTERS

.1 DC full voltage reversing starter of size, type, rating and enclosure type as indicated, with components as follows:

.1 Two contactors: single or two pole solenoid operated type, mechanically and electrically interlocked.

.2 Indirectly-heated, manual reset thermal overload relay.

.2 Accessories:

.1 Pushbuttons and selector switches: heavy duty, oil tight, labelled as indicated.

.2 Indicating lights: heavy duty, oil tight type and color as indicated.

.3 Auxiliary control devices as indicated.

2.13 CONTROL TRANSFORMER

.1 Single phase, dry type, control transformer with primary voltage as indicated and 24 or 120 V secondary, complete with secondary fuse, installed in with starter as indicated.

.2 Size control transformer for control circuit load plus 100VA spare capacity.

2.14 ENCLOSURE

.1 Welded steel enclosure with hinged front cover suitable for surface mounting.

.1 NEMA 12 enclosures in indoor, non-hazardous, dry locations.

.2 NEMA 7 enclosures in hazardous areas, or

.3 NEMA 4X stainless steel enclosures unless indicated otherwise.

.2 Oversized enclosure with DIN rail space and unused terminal blocks where pump protection relays or additional control relays are required as indicated on contract drawings.

.3 Apply finishes to enclosure in accordance with Section 26 05 00 – Common Work Results - Electrical.

2.15 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results - Electrical.

.2 Manual starter designation label, white plate, black letters, size 1, engraved as indicated.

.3 Magnetic starter designation label, white plate, black letters, size 2 engraved as indicated.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install starters, connect power and control as indicated.

.2 Ensure correct fuses and electronic overload devices set correctly.

.3 Confirm motor nameplate and adjust overload device settings to suit.

.4 Ensure all wiring enters/exits the sides or bottom of starter. (Do not enter top of unit.).

.5 Ensure line and load conductors enter/exit the disconnect switch in separate conduits.

.6 Ensure line and load side conductors do not come into contact with or cross each other inside the starter enclosure.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 – Common Work Results - Electrical, manufacturer's instructions and Section 01 91 13 – General Commissioning (Cx) Requirements.

.2 Operate switches, contactors to verify correct functioning.

.3 Perform starting and stopping sequences of contactors and relays.

.4 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

END OF SECTION

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittals.

.2 Section 01 91 13 –Commissioning Requirements.

.3 Section 25 05 01 – Control Panels.

.4 Section 26 05 00 – Common Work Requirements Electrical.

.5 Division 44 07 51 – Submersible Pumps.

1.2 REFERENCES

.1 Variable Frequency drives standard of acceptance shall be Allen Bradley Powerflex 753 Class with ethernet communication module

.2 The drive shall meet the following specifications:

.1 NFPA 70-US National Electrical Code.

.2 NEMA ICS 3.1 - Safety standards for Construction and Guide for Selection, Installation and Operation of Adjustable Speed Drive Systems.

.3 NEMA 250 - Enclosures for Electrical Equipment.

.4 CAN/CSA-C22 No.14-95R2001. - Canadian Standards Association.

.5 IEC 146 - International Electrical Code.

1.3 REGULATORY REQUIREMENTS

.1 The drive conforms to the following requirements:

.1 NFPA 70.

.2 IEC 146.

.3 C-UL marking to provide an approved listing for Canadian users.

.4 UL listing.

.1 Manufacturer will furnish the product as listed and classified by Underwriter's Laboratories as suitable for the purpose specified and indicated.

.5 EN Standard/CE marked for the following directives:

.1 Low Voltage Directive (73/23/EEC) EN50178 Electronic Equipment for use in power installations.

.2 EMC Directive (89/336/EEC) EN61800-3 Adjustable Speed electrical power drive systems Part 3.

.2 The drive shall have an internal EMC filter capable of meeting the Second Environment levels for the EMC directive without the need for additional

components. First environment classification shall require an additional, external filter.

1.4 SUBMITTALS

.1 All submittals shall be in accordance with the Submittal Procedures – Specification Section 01 33 00.

.2 Submit shop drawings to indicate:

.1 Mounting method and dimensions.
.2 VFD size and type.
.3 Layout of identified internal and front panel components.
.4 Enclosure types.
.5 Wiring diagram for each VFD.
.6 Interconnection diagrams.

.3 For factory manufactured Variable Frequency Drives, submit shop drawings from a manufacturer certified by CSA, IEC or CUL.

1.5 CLOSEOUT SUBMITTALS

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

.2 Include operation and maintenance data for each type and style of VFD.

PART 2 PRODUCTS

2.1 GENERAL

.1 Furnish complete variable frequency drives utilizing pulse width modulated (PWM) design as specified herein for the motors indicated on the drawings and in the specifications to be speed controlled by frequency drives. All features shall be included within the VFD enclosure, unless otherwise specified. VFD enclosure shall be minimum NEMA 12. The VFD shall be rated 600 volt ±10% and shall operate continuously without failure when connected to a three phase supply line. The VFD shall be highly reliable and rated for 250,000 hours mean time before failure (MTBF).

.2 The VFD and options shall be tested to ANSI/UL Standard 508. The complete VFD, including all specified options, shall be assembled by the manufacturer, which shall be UL-508 certified for the building and assembly of option panels. Assembly of the option panels by a third-party panel shop is not acceptable. The appropriate UL stickers shall be applied in both the VFD and option panel, in the case where these are not contained in one panel. When these VFD's are to be located in Canada, CSA or C-UL certifications shall apply.

.3 Acceptable manufacturer: Allen Bradley.

2.2 BASIC DESIGN

.1 The adjustable frequency drive shall produce adjustable frequency output. Drives utilizing six step technology are not acceptable. To eliminate the need for isolation transformers and/or line suppression equipment, input line passive harmonic filter will be an integral part of the input section of the drive. If isolation transformers or other external suppression equipment is needed to meet this specification, the supply and additional electrical installation, shall be included as part of this work. The VFD shall have an internally mounted passive harmonic filter as a minimum to reduce input current harmonic content and provide isolation from power line transients such as utility power factor correction capacitor switching transients and to reduce RFI emissions. The enclosure shall also house the dV/dT output filter.

.2 Line noise shall be no greater than 3% harmonic distortion and no more than a 16,400 volt-microsecond commutation notch area, in accordance with IEEE Standard 519-1992 for special applications.

.3 The VFD shall be capable of starting into a rotating load (forward or reverse) and accelerating to setpoint without tripping or damaging components.

.4 The VFD shall have five programmable critical frequency lockout ranges to prevent the VFD from operating at an unstable speed.

.5 The VFD shall have an intelligent motor overload feature to protect the motor at different operating speeds and loads. The VFD shall provide electronic motor overload protection qualified per UL508C.

.6 The VFD shall protect against a stalled motor. The stall frequency/time shall be programmable.

.7 The unit and internal components shall be enclosed within a NEMA 12 enclosure.

.8 The output current rating of the VFD shall exceed the motor nameplate full load current rating as indicated on drawings.

.9 Appropriate enclosure cooling design to operate indoors in a maximum ambient temperature of 40^{o}C.

2.3 LOCAL/HAND CONTROL PANEL

Interface to the drive shall be a removable Human Interface Module (HIM) with integral display. The door-mounted display shall be an IP66/UL Type 4X LCD style consisting of 4 lines by 20 characters back lit alphanumeric display and a key pad. The control panel shall include the following:

.1 Hand/Off/Auto switch

.2 Local/Remote switch

.3 Manual speed control

.4 Meter function selector

.2 The control panel shall include a back lit LCD meter that will display % speed, % load, or output voltage. The desired display is selected by a pushbutton. The following drive status indicator displays shall be included on the control panel. Faults shall be displayed in plain English.

.1 Power ON

.2 Ready

.3 Run

.4 Running at commanded speed

.5 Reverse

.6 Fault

.7 Overload

.8 Phase loss

.9 Overtemperature

.10 Overcurrent

.11 Undervoltage

.12 Overvoltage

.13 Ground fault

.14 External fault

2.4 INTERNAL ADJUSTMENTS

.1 All adjustments noted below should be programmable only. Potentiometers and DIP switches are not acceptable.

.1 Minimum speed adjustment

.2 Maximum speed adjustment

.3 Gain and offset adjustments for signal follower

.4 Overload

.5 Current limit

.2 In addition, the drive shall be programmable to control the following functions from the local/hand control panel.

.1 Acceleration time - programmable from approximately 3 to 280 seconds.

.2 Deceleration time - programmable from approximately 3 to 280 seconds.

.3 Fault counter reset - to limit fault reset attempts to 7, the fault counter reset is turned on.

.4 Variable overload - to protect motor from excess current at low speeds.

.5 Individually selectable, resettable fault control - automatic functioning of the fault counter reset can be allowed or denied for ground fault, overvoltage fault, undervoltage fault, overcurrent fault, and phase-loss fault.

.6 Follower selection.
.7 Deceleration control or coast-to-rest.
.8 Reverse rotation.
.9 Output frequency - 30 to 60 Hz.
.10 Output voltages.
.11 Provide at least storage for 4 parameter sets.
.12 Speed Control functions include:
  .1 Adjustment min/max speed.
  .2 Three preset speeds.
  .3 At least two sets of critical speed lockouts.
  .4 At least 1 PID control loop.
  .5 Three analog inputs.
.13 Output control functions:
  .1 Flux optimization or automatic voltage optimization to limit audible motor noise.
  .2 Current and torque limit.
  .3 Torque regulated operating mode.

2.5 INTERNAL INDICATORS

.1 The key pad is to be used for troubleshooting.

2.6 SERVICE CONDITIONS

.1 Elevation to 1,000 m ASL without derating.

.2 Ambient temperature -10 to 60°C.

.3 Humidity to 95% non-condensing.

2.7 FEATURES

.1 Control interface inputs/outputs. Supply as standard all independently programmable:

  .1 Three analog inputs, one 0-10v and two 4-20ma.
  .2 Six discrete inputs.
  .3 Two analog outputs.
  .4 Relay contact outputs as required.
  .5 Communication capabilities shall include RS232 and Ethernet/IP

.2 In addition to the start/stop and variable speed features in the drive, the following protective functions shall be supplied as standard:

.1 A minimum of 32 most recent fault codes and drive status information at the time of fault occurrence (c/w time stamps) shall be stored in the drives fault history.

.2 The VFD shall include MOV's for phase to phase to ground line voltage transient protection.

.3 Output short circuit and ground fault protection rated for 65,000 amps per UL508C without relying on fuses.

.4 Electronic class 10 motor overload protection per UL508C.

.5 AC line or DC bus over voltage and under voltage.

.6 Power loss ride through.

.7 Stall protection shall be programmable.

.8 Underload protection shall be programmable.

.9 VFD overtemperature protection.

2.8 SPECIAL FEATURES

.1 The VFD shall be factory installed within:

.1 An MCC lineup to Section 26 24 19 by MCC equipment manufacturer, or

.2 Suitable wall/floor mounted control panel assembled by CSA authorized panel shop.

.2 In either case, the following special features shall be included in the VFD enclosure.

.1 The unit shall maintain its UL or ETL Listing.

.2 Appropriate enclosure cooling design to operate indoors in a maximum ambient temperature of 40^{o}C.

.3 Flange mounted disconnect switch interlocked to door.

.4 Line side overcurrent protection as indicated on contract drawings.

.5 Provide a control power transformer with a rated secondary voltage of 120V AC. The control power transformer shall be provided with primary and secondary fusing.

.6 Provide door-mounted pilot devices per the contract drawing wiring diagrams.

.7 Provide door-mounted 120V AC push-to-test pilot lights with LED lamps as indicated on contract drawings.

.8 Provide a door-mounted human interface module for programming, display and control.

.9 Provide a door-mounted motor protection relay as indicated on contract drawings.

.10 Input Line Reactors, as indicated on contract drawings: 5% impedance

.11 Passive Harmonic input filter, as indicated on contract drawings:

.1 Passive Input Harmonic filter c/w Capacitor contactor and over temperature interlock contact:

.2 VFD supplied with 3-phase power: Mirus Lineator AUHF or approved equivalent, size to be coordinated with VFD size.

.3 VFD supplied with 1-phase power: Mirus Lineator 1Q3 or approved equivalent, size to be coordinated with VFD size.

.12 Output Line Reactor, as indicated on contract drawings: 3%

.13 Output dv/dt Filter, as indicated on contract drawings:

.1 TCI series or approved equivalent, size to be coordinated with VFD size.

.14 Relay contacts shall be provided for Ready, Running, and Fault Status

.3 The design shall provide for short circuit and locked rotor protection for the motor in both the line and drive position.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install drives within the control panels as shown on the design drawings.

.2 Power and control wiring for drive to be by Division 26.

3.2 START UP SERVICE

.1 The manufacturer shall provide start-up commissioning of the variable frequency drive and its optional circuits by a factory certified service technician who is experienced in start-up and repair services. The commissioning personnel shall be the same personnel that will provide the factory service and warranty repairs at the customer's site. Sales personnel and other agents who are not factory certified technicians for drive field repair shall not be acceptable as commissioning agents.

.2 Start-up services shall include checking for verification of proper operation and installation for the VFD, its options and its interface wiring to the building automation system. Included in this service shall be (as a minimum):

.1 Verification of contractor wire terminations to the VFD and its operational circuitry.

.2 Installation verification for proper operation and reliability of the VFD, the motor being driven, and the building automation system.

.3 Up to eight hours of customer operator training on operation and service diagnostics at the time of the equipment commissioning. This is a requirement for substantial completion.

.4 Measurement for verification of proper operation on each of the following items:

.1 Motor voltage and frequency. Verification of proper motor operation.

.2 Control input for proper building automation system interface and control calibration.

.3 Calibration check for the following setpoints (and adjustment as necessary) (1) minimum speed, (2) maximum speed, (3) acceleration and deceleration rates.

3.3 CONFIGURATION

.1 Auto Restart

.1 The drive provides up to nine automatic fault resets and restarts following a fault condition before locking out and requiring manual restart. The automatic mode is not applicable to a ground fault, shorted output faults, and other internal microprocessor faults. The time between restarts is adjustable from 0.5 to 30.0 seconds. Final parameter values will be determined during installation and should initially be configured for 3 reset/restarts, 30 seconds apart.

.2 Minimum speed

.1 The minimum drive speed parameter shall be set by the PLC and communicated to the drive over the Ethernet connection.

3.4 WARRANTY

.1 The VFD shall be warranted by the manufacturer for a period of 36 months from date of shipment. The warranty shall include parts, labour, travel costs and living expenses incurred by the manufacturer to provide factory authorized on-site service.

3.5 EXAMINATION

.1 Contractor to verify that job site conditions for installation meet factory recommended and code required conditions for VFD installation prior to start-up. These shall include as a minimum:

.1 Clearance spacing.

.2 Temperature, contamination, dust, and moisture of the environment.

.3 Separate conduit installation of the motor wiring, power wiring, and control wiring.

.4 Installation per the manufacturer's recommendations.

.2 The VFD is to be covered and protected from installation dust and contamination until the environment is cleaned and ready for operation. The VFD shall not be operated while the unit is covered.

3.6 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 – Common Work Requirements Electrical, manufacturer's instructions and Section 01 91 13 – Commissioning Requirements.

.2 Submit test record to Engineer.

.3 Submit configuration parameter settings printouts and PDF copy.

.4 Provide electronic data sheet files on USB Drive for each variable frequency drive.

.5 Submit manufacturer's factory trained technician's commissioning and configuration report to Engineer.

3.7 COMMISSIONING

.1 Submit the start-up report to the Engineer. Assist the Commissioning Agent in performing verification testing. Include all time required in the tendered price to assist the commissioning agent.

END OF SECTION

DIESEL FIRED GENERATOR

Part 1 GENERAL

1.1 SCOPE

.1 Provide complete factory assembled generator set equipment with digital electronic controls.

.2 Provide factory test, startup by a supplier authorized by the manufacturer, and on-site testing of the system.

.3 The generator set manufacturer shall warrant all equipment provided under this section, whether or not it is manufactured by the generator set manufacturer, so that there is one source for warranty and product service. Technicians specifically trained and certified by the manufacturer to support the product and employed by the generator set supplier shall service the generator sets.

1.2 CODES AND STANDARDS

.1 The generator set and its installation and on-site testing shall conform to the requirements of the following codes and standards:

.1 CSA C22.2, No.14-M91 Industrial Control Equipment.

.2 EN50082-2, Electromagnetic Compatibility - Generic Immunity Requirements, Part 2: Industrial.

.3 EN55011, Limits and Methods of Measurement of Radio Interference Characteristics of Industrial, Scientific and Medical Equipment.

.4 FCC Part 15, Subpart B.

.5 IEC8528 part 4. Control Systems for Generator Sets.

.6 IEC Std 801.2, 801.3, and 801.5 for susceptibility, conducted, and radiated electromagnetic emissions.

.7 IEEE446 - Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications.

.8 IEEE587 for voltage surge resistance.

.9 NEMA ICS10-1993 - AC Generator sets.

.10 NFPA70 - National Electrical Code. Equipment shall be suitable for use in systems in compliance to Article 700, 701 and 702.

.11 NFPA110 - Emergency and Standby Power Systems. The generator set shall meet all requirements for Level 1 systems. Level 1 prototype tests required by this standard shall have been performed on a complete and functional unit, component level type tests will not substitute for this requirement.

.12 NEMA MG1, Part 33. Alternator shall comply with the requirements of this standard.

.13 UL1236 - Battery Chargers.

.14 UL2200. The generator set shall be listed to UL2200 or submit to an independent third party certification process to verify compliance as installed.

.15 UL508. The entire control system of the generator set shall be UL508 listed and labeled.

.16 CSA C282:19 Emergency Electrical Power Supply for Buildings.

.17 CSA C282 Logbook:20 Emergency electrical power supply for buildings maintenance logbook.

.18 CSA B139:19 Installation code for oil-burning equipment

.2 The generator set manufacturer shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.

1.3 ACCEPTABLE MANUFACTURERS

.1 Only approved bidders listed below shall supply equipment provided under this contract. Equipment proposals must include a line by line compliance statement based on this specification.

.1 Caterpillar Toromont Power Systems Ltd.

.2 Cummins Inc.

.3 Generac Power Systems Inc.

.4 Sommers Generator Systems

1.4 SUBMITTALS

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

.2 Provide PDF copies of the following information for review.

.1 Manufacturer's product literature and performance data, sufficient to verify compliance to specification requirements.

.2 A paragraph by paragraph specification compliance statement, describing the differences between the specified and the proposed equipment.

.3 Manufacturer's certification of prototype testing.

.4 Manufacturer's published warranty documents.

.5 Shop drawings showing plan and elevation views with certified overall dimensions, as well as wiring interconnection details.

.6 Interconnection wiring diagrams showing all external connections required; with field wiring terminals marked in a consistent point-to-point manner.

.7 Manufacturer's installation instructions.

1.5 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for diesel generator for incorporation into manual specified in Section 01 78 00 – Closeout Submittals.

.2 Include in Operation and Maintenance Manual instructions for particular unit supplied and not general description of units manufactured by supplier and:

.1 Operation and maintenance instructions for engine, alternator, control panel, automatic transfer switch, manual bypass switch, battery charger, battery, fuel system, engine room ventilation system, exhaust system and accessories, to permit effective operation, maintenance and repair.

.2 Technical data:

.1 Illustrated parts lists with parts catalogue numbers.

.2 Schematic diagram of electrical controls.

.3 Flow diagrams for:

.1 Fuel system.

.2 Lubricating oil.

.3 Cooling system.

.4 Certified copy of factory test results.

.5 Maintenance and overhaul instructions and schedules.

.6 Precise details for adjustment and setting of time delay relays or sensing controls which require on site adjustment.

.3 Provide two copies of generator operation and maintenance data, in separate binders, per clause 11.2.1 of CSA C282:19.

.4 Provide an inspection, testing, and maintenance logbook, as described in Clause 11.1.2 of CSA C282:19. Logbook shall be CSA C282 Logbook:19.

Part 2 PRODUCTS

2.1 GENERATOR SET

.1 Ratings

.1 The generator set shall operate at 1800rpm.

.2 Voltage as indicated on contract drawings.

.3 The generator kW rating as indicated on contract drawings at 0.8 PF, standby rating, based on site conditions of: 200ft., ambient temperatures up to 40°C.

.4 The generator set rating shall be based on emergency/standby service.

.2 Performance

.1 Voltage regulation shall be plus or minus 0.5 percent for any constant load between no load and rated load for both parallel and non-parallel applications. Random voltage variation with any steady load form no load to full load shall not exceed plus or minus 0.5 percent.

.2 Frequency regulation shall be isochronous from steady state no load to steady state rated load. Random frequency variation with any steady load form no load to full load shall not exceed plus or minus 0.25%.

.3 The engine-generator set shall be capable of single step load pick up of 100% nameplate kW and power factor, less applicable derating factors, with the engine-generator set at operating temperature.

.4 The alternator shall produce a clean AC voltage waveform, with not more than 5% total harmonic distortion at full linear load, when measured from line to neutral, and with not more than 3% in any single harmonic. Telephone influence factor shall be less than 40.

.3 Construction

.1 The engine-generator set shall be mounted on a heavy-duty steel base to maintain alignment between components. The base shall incorporate a battery tray with hold-down clamps within the rails. For engine leak & blow-by containment, include suitably sized drip tray to mount beneath generator set. The gen-set shall be mounted on a dual wall sub-base diesel fuel tank sized for minimum 24hour runtime at 100% load. Containments leak checked as UL and ULC requirements.

.2 All switches, lamps, and meters in the control system shall be oil-tight and dust-tight, and the enclosure door shall be gasketed. There shall be no exposed points in the control (with the door open) that operate in excess of 50 volts.

.3 Weather Protective Sound Attenuation Enclosure:

.1 A level II sound-attenuated housing which allows the generator to operate a full rated load in the ambient conditions previously specified. The enclosure shall reduce the sound level of the generator set while operating at full rated load to an average of 75 dBA at 23' (7 meters) from the generator set in a free field environment. Housing configuration and materials used may be of any suitable design which meets application needs, except that acoustical materials used shall be oil and water resistant. No foam materials shall be used unless they can be demonstrated to have the same density and life as fiberglass.

.2 The enclosure shall include doors for access to both sides of the engine and alternator, and the control equipment. Key-locking and padlockable door latches shall be provided for all doors or access panels.

.3 The enclosure shall be provided with an exhaust silencer which is mounted inside of the enclosure, and allows the generator set package to meet specified sound level requirements. Silencer and exhaust shall include a raincap and rainshield.

.4 All sheetmetal shall be primed for corrosion protection and finish painted with the manufacturers standard colour. All surfaces of all metal parts shall be primed and painted.

.5 Painting of hoses, clamps, wiring harnesses, and other non-metallic service parts shall not be acceptable. Fasteners used shall be corrosion resistant and designed to minimize marring of the surface when removed for normal installation or service work.

.4 Connections

.1 The generator set load connections shall be composed of tin plated copper bus bars, drilled to accept compression terminations of the number and type as shown on the drawings. Sufficient lug space shall be provided for use with cables of the number and size as shown on the drawings.

.2 Power connections to auxiliary devices shall be made at the devices, with required protection located at a wall-mounted common distribution panel.

.3 Generator set control interfaces to other system components shall be made on a common, permanently labeled terminal block assembly.

2.2 ENGINE AND ENGINE EQUIPMENT

.1 The engine shall be diesel fueled, radiator and fan cooled. Minimum displacement shall be 3.3 litres with 4 cylinders. The horsepower rating of the engine at its minimum tolerance level shall be sufficient to drive the alternator and all connected accessories. Two cycle engines are not acceptable. Engine accessories and features shall include:

.1 Complete engine fuel system, including all pressure regulators, strainers, and control valves. The fuel system shall be plumbed to the generator set skid for ease of site connections to the generator set.

.2 An electronic governor system shall provide automatic isochronous frequency regulation. The governing system dynamic capabilities shall be controlled as a function of engine coolant temperature to provide fast, stable operation at varying engine operating temperature conditions. The control system shall actively control the fuel rate and excitation as appropriate to the state of the generator set. Fuel rate shall be regulated as a function of starting, accelerating to start disconnect speed, accelerating to rated speed, and operating in various isochronous or parallel states.

.3 Skid-mounted radiator and cooling system rated for full load operation in 40°C ambient as measured at the generator air inlet, based on 0.5 in H¨0 external static head. Radiator shall be sized based on a core temperature which is 20°F higher than the rated operation temperature, or prototype tested to verify cooling performance of the engine/radiator/fan operation in a controlled environment. Radiator shall be provided with a duct adapter flange. The cooling system shall be filled with a 50/50-ethylene glycol/water mixture by the equipment manufacturer. Rotating parts shall be guarded against accidental contact.

.4 Electric starter(s) capable of three complete cranking cycles without overheating.

.5 Positive displacement, mechanical, full pressure, lubrication oil pump.

.6 Full flow lubrication oil filters with replaceable spin-on canister elements and dipstick oil level indicator.

.7 Replaceable dry element air cleaner with restriction indicator.

.8 Flexible supply fuel line.

.9 Engine mounted battery charging alternator of, 40-ampere minimum, and solid-state voltage regulator.

.10 Coolant heater

.1 Engine mounted, thermostatically controlled, coolant heater(s) for each engine. Heater voltage shall be as shown on the project drawings. The coolant heater shall be rated 120V or 240V for full heating capacity.

.2 The coolant heater shall be installed on the engine with silicone hose connections. Steel tubing shall be used for connections into the engine coolant system wherever the length of pipe run exceeds 1 ft. The coolant heater installation shall be specifically designed to provide proper venting of the system. The coolant heaters shall be installed using quick disconnect couplers to isolate the heater for replacement of the heater element. The quick disconnect/automatic sealing couplers shall allow the heater element to be replaced without draining the engine cooling system or significant coolant loss.

.3 The coolant heater shall be provided with a 12VDC thermostat, installed at the engine thermostat housing. An AC power connection box shall be provided for a single AC power connection to the coolant heater system.

.4 The coolant heater(s) shall be sized as recommended by the engine manufacturer to warm the engine to a minimum of 100°F (40°C) in a 40°F ambient, in compliance with NFPA110 requirements, or the temperature required for starting and load pickup requirements of this specification.

.11 Provide vibration isolators, pad type, quantity as recommended by the generator set manufacturer.

.12 Starting and Control Batteries shall be calcium/lead antimony type, 12 volt DC, sized as recommended by the engine manufacturer, complete with battery cables and connectors.

.13 Provide exhaust silencer for the engine of size and type as recommended by the generator set manufacturer and approved by the engine manufacturer. The mufflers shall be as required to allow the generator set package to meet specified sound level requirements. Exhaust system shall be installed according to the engine manufacturer's recommendations and applicable codes and standards.

.14 A CSA certified 10 amp voltage regulated battery charger shall be provided. The charger shall be located in the generator enclosure. Input AC voltage and DC output voltage shall be as required. Charger shall be equipped with float, taper and equalize charge settings. Operational monitors shall

provide visual output along with individual form C contacts rated at 4 amps, 120VAC, 30VDC for remote indication of:

.1 Loss of AC power - red light

.2 Low battery voltage - red light.

.3 High battery voltage - red light.

.4 Power ON - green light (no relay contact) Charger shall include an Analog DC voltmeter and ammeter, 12 hour equalize charge timer, and AC and DC fuses.

.15 distribution panel, minimum 60A, 120/240V, single phase, c/w main disconnect/breaker, shall be provided within the enclosure. Heaters and battery charger shall be prewired to the distribution panel and fed from Building Normal Power.

2.3 AC GENERATOR

.1 The AC generator shall be; synchronous, four pole, 2/3 pitch, revolving field, drip-proof construction, single prelubricated sealed bearing, air cooled by a direct drive centrifugal blower fan, and directly connected to the engine with flexible drive disc. All insulation system components shall meet NEMA MG1 temperature limits for Class H insulation system. Actual temperature rise measured by resistance method at full load shall not exceed 80 degrees Centigrade.

.2 The generator shall be capable of delivering rated output (kVA) at rated frequency and power factor, at any voltage not more than 5 percent above or below rated voltage.

.3 A permanent magnet generator (PMG) shall be included to provide a reliable source of excitation power for optimum motor starting and short circuit performance. The PMG and controls shall be capable of sustaining and regulating current supplied to a single phase or three phase fault at approximately 300% of rated current for not more than 10 seconds.

.4 The subtransient reactance of the alternator shall not exceed 15 percent, based on the standby rating of the generator set.

.5 A generator space heater shall be provided along with thermostat and wired to the distribution panel within the enclosure.

.6 Provide warning sign at the generator connection box stating that the neutral is isolated from ground.

2.4 GENERATOR SET CONTROL

.1 The generator set shall be provided with a microprocessor-based control system that is designed to provide automatic starting, monitoring, and control functions for the generator set. The control system shall also be designed to allow local monitoring and control of the generator set, and remote monitoring and control as

described in this specification. The generator control panel shall be integral with the generator set. The control shall be vibration isolated and prototype tested to verify the durability of all components in the system under vibration conditions encountered. The integral control shall include the specified features and functions.

.2 Control Switches

.1 Mode Select Switch. The mode select switch shall initiate the following control modes. When in the RUN or MANUAL position the generator set shall start, and accelerate to rated speed and voltage as directed by the operator. In the OFF position the generator set shall immediately stop, bypassing at all time delays. In the AUTO position the generator set shall be ready to accept a signal from a remote device to start and accelerate to rated speed and voltage.

.2 Emergency Stop Switch. Switch shall be Red "mushroom-head" push-button. Depressing the emergency stop switch shall cause the generator set to immediately shut down, and be locked out from automatic restarting.

.3 Reset Switch. The reset switch shall be used to clear a fault and allow restarting the generator set after it has shut down for any fault condition.

.4 Panel Lamp Switch. Depressing the panel lamp switch shall cause the entire panel to be lighted with DC control power. The panel lamps shall automatically be switched off 10 minutes after the switch is depressed, or after the switch is depressed a second time.

.3 Generator Set AC Output Metering. The generator set shall be provided with a metering set including the following features and functions:

.1 Analog voltmeter, ammeter, frequency meter, and kilowatt (KW) meter. Voltmeter and ammeter shall display all three phases. Ammeter and KW meter scales shall be color coded in the following fashion; readings from 0-90% of generator set standby rating: green; readings from 90-100% of standby rating: amber; readings in excess of 100%: red.

.2 Digital metering set, 0.5% accuracy, to indicate generator RMS voltage and current, frequency, output current, output KW, KW-hours, and power factor. Generator output voltage shall be available in line-to-line and line-to-neutral voltages, and shall display all three phase voltages (line to neutral or line to line) simultaneously.

.3 Both analog and digital metering are required. The analog and digital metering equipment shall be driven by a single microprocessor, to provide consistent readings and performance.

.4 Generator Set Alarm and Status Display.

.1 The generator set shall be provided with alarm and status indicating lamps to indicate non-automatic generator status, and existing warning and shutdown conditions. The lamps shall be high-intensity LED type. The lamp condition shall be clearly apparent under bright room lighting conditions.

The generator set control shall indicate the existence of the following alarm and shutdown conditions on an alphanumeric digital display panel:

.1 low oil pressure (alarm)
.2 low oil pressure (shutdown)
.3 oil pressure sender failure (alarm)
.4 low coolant temperature (alarm)
.5 high coolant temperature (alarm)
.6 high coolant temperature (shutdown)
.7 engine temperature sender failure (alarm)
.8 low coolant level (alarm or shutdown-selectable)
.9 fail to crank (shutdown)
.10 fail to start/overcrank (shutdown)
.11 overspeed (shutdown)
.12 low DC voltage (alarm)
.13 high DC voltage (alarm)
.14 weak battery (alarm)
.15 high AC voltage (shutdown)
.16 low AC voltage (shutdown)
.17 under frequency (shutdown)
.18 over current (warning)
.19 over current (shutdown)
.20 short circuit (shutdown)
.21 over load (alarm)
.22 emergency stop (shutdown)
.23 Fuel valve closed (alarm)
.24 ATS - in bypass mode (warning)
.25 Main breaker open (warning)

.2 Provisions shall be made for indication of four customer-specified alarm or shutdown conditions. Labeling of the customer-specified alarm or shutdown conditions shall be of the same type and quality as the above specified conditions. The non-automatic indicating lamp shall be red, and shall flash to indicate that the generator set is not able to automatically respond to a command to start from a remote location.

.5 Engine Status Monitoring

.1 The following information shall be available from a digital status panel on the generator set control:

.1 engine oil pressure (psi or kPA)
.2 engine coolant temperature (degrees F or C)
.3 engine oil temperature (degrees F or C)
.4 engine speed (rpm)

.5 number of hours of operation (hours)

.6 number of start attempts

.7 battery voltage (DC volts)

.2 The control system shall also incorporate a data logging and display provision to allow logging of the last 10 warning or shutdown indications on the generator set, as well as total time of operation at various loads, as a percent of the standby rating of the generator set.

.6 Engine Control Functions

.1 The control system provided shall include a cycle cranking system, which allows for user selected crank time, rest time, and # of cycles. Initial settings shall be for 3 cranking periods of 15 seconds each, with 15-seconds rest period between cranking periods.

.2 The control system shall include an idle mode control, which allows the engine to run in idle mode in the RUN position only. In this mode, the alternator excitation system shall be disabled.

.3 The control system shall include an engine governor control, which functions to provide steady state frequency regulation as noted elsewhere in this specification. The governor control shall include adjustments for gain, damping, and a ramping function to control engine speed and limit exhaust smoke while the unit is starting. The governor control shall be suitable for use in paralleling applications without component changes.

.4 The control system shall include time delay start (adjustable 0-300 seconds) and time delay stop (adjustable 0-600 seconds) functions.

.5 The control system shall include sender failure monitoring logic for speed sensing, oil pressure, and engine temperature which is capable of discriminating between failed sender or wiring components, and an actual failure condition.

.7 Alternator Control Functions

.1 The generator set shall include an automatic digital voltage regulation system that is matched and prototype tested by the engine manufacturer with the governing system provided. It shall be immune from misoperation due to load-induced voltage waveform distortion and provide a pulse width modulated form misoperation due to load-induced voltage waveform distortion and provide a pulse width modulated output to the alternator exciter. The voltage regulation system shall be equipped with three-phase RMS sensing and shall control buildup of AC generator voltage to provide a linear rise and limit overshoot. The system shall include a torque-matching characteristic, which shall reduce output voltage in proportion to frequency below a threshold of 58HZ. The voltage regulator shall include adjustments for gain, damping, and frequency roll-off. Adjustments shall be broad range, and made via digital raise-lower switches, with an alphanumeric LED readout to indicate setting level. Rotary potentiometers for system adjustments are not acceptable.

.2 Controls shall be provided to monitor the output current of the generator set and initiate an alarm (over current warning) when load current exceeds 100% of the rated current of the generator set on any phase for more than 60 seconds. The controls shall shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator (over current shutdown). The protective functions provided shall be in compliance to the requirements of NFPA70 article 445.

.3 Controls shall be provided to individually monitor all three phases of the output current for short circuit conditions. The control/protection system shall monitor the current level and voltage. The controls shall shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator (short circuit shutdown). The protective functions provided shall be in compliance to the requirements of NFPA70 article 445.

.4 Controls shall be provided to monitor the KW load on the generator set, and initiate an alarm condition (over load) when total load on the generator set exceeds the generator set rating for in excess of 5 seconds. Controls shall include a load shed control, to operate a set of dry contacts (for use in shedding customer load devices) when the generator set is overloaded.

.5 An AC over/under voltage monitoring system that responds only to true RMS voltage conditions shall be provided. The system shall initiate shutdown of the generator set when alternator output voltage exceeds 110% of the operator-set voltage level for more than 10 seconds, or with no intentional delay when voltage exceeds 130%. Under voltage shutdown shall occur when the output voltage of the alternator is less than 85% for more than 10 seconds.

.8 Provide and install a 18-light LED type remote alarm annunciator panel with horn, located as shown on the drawings. The remote annunciator shall provide all the audible and visual alarms called for by NFPA Standard 110 for level 1 systems; and in addition shall provide indications for high battery voltage, low battery voltage, loss of normal power to the charger, ATS in Bypass Mode, Main Breaker Open. Spare lamps shall be provided to allow future addition of other alarm and status functions to the annunciator. Provisions for labeling of the annunciator in a fashion consistent with the specified functions shall be provided. Alarm silence and lamp test switch(es) shall be provided. LED lamps lamps shall be replaceable. Alarm horn shall be switchable for all annunciation points. Alarm horn (when switched on) shall sound for first fault, and all subsequent faults, regardless of whether first fault has been cleared, in compliance with NFPA110 3-5.6.2.

.9 The generator set shall be provided with a mounted, pad lockable, main line, circuit breaker, sized to carry the rated output current of the generator set on a continuous basis. The circuit breaker shall incorporate an electronic trip unit that operates to protect the alternator under all overcurrent conditions, or a thermal-magnetic trip with other overcurrent protection devices that positively protect the alternator under overcurrent conditions. The supplier shall submit time overcurrent characteristic curves and thermal damage curve for the alternator, demonstrating the effectiveness of the protection provided.

.10 A second circuit breaker shall be provided for Load Bank testing. This unit shall be supplied with a shunt trip, interlocked with the ATS starting contact.

.11 Control Interfaces for Remote Monitoring

.1 All control and interconnection points from the generator set to remote components shall be brought to a separate connection box. No field connections shall be made in the control enclosure or in the AC power output enclosure. Provide the following features in the control system:

.2 Form "C" dry common alarm contact set rated 2A @ 30VDC to indicate existence of any alarm or shutdown condition on the generator set.

.3 One set of contacts rated 2A @ 30VDC to indicate generator set is ready to load. The contacts shall operate when voltage and frequency are greater than 90% of rated condition.

.4 A fused 10 amp switched 12VDC power supply circuit shall be provided for customer use. DC power shall be available from this circuit whenever the generator set is running.

.5 Analogue output 4-20mA signal for generator output kw power.

.6 Analogue output 4-20mA signal for fuel tank level.

.7 Modbus communication interface for remote monitoring.

Part 3 EXECUTION

3.1 SEQUENCE OF OPERATION

.1 Generator set shall start on receipt of a start signal from the transfer switch. The start signal shall be via hardwired connection to the generator set control.

.2 The generator set shall complete a time delay start period as programmed into the control.

.3 The generator set control shall initiate the starting sequence for the generator set. The starting sequence shall include the following functions:

.1 The control system shall verify that the engine is rotating when the starter is signalled to operate. If the engine does not rotate after two attempts, the control system shall shut down and lock out the generator set, and indicate "fail to crank" shutdown.

.2 The engine shall fire and accelerate as quickly as practical to start disconnect speed. If the engine has not started, it shall complete a cycle cranking process as described elsewhere in this specification. If the engine has not started by the completion of the cycle cranking sequence, it shall be shut down and locked out, and the control system shall indicate "fail to start".

.3 The engine shall accelerate to rated speed and the alternator to rated voltage. Excitation shall be disabled until the engine has exceeded

programmed idle speed, and regulated to prevent over voltage conditions and oscillation as the engine accelerates and the alternator builds to rated voltage.

.4 On reaching rated speed and voltage, the generator set shall operate as dictated by the control system in isochronous, synchronize, load share, load demand, or load govern state.

.5 When all start signals have been removed from the generator set, it shall complete a time delay stop sequence. The duration of the time delay stop period shall be adjustable by the operator.

.6 On completion of the time delay stop period, the generator set control shall switch off the excitation system and shall shut down.

.1 Any start signal received after the time stop sequence has begun shall immediately terminate the stopping sequence and return the generator set to isochronous operation.

3.2 FACTORY TESTING

.1 The generator set manufacturer shall perform a complete operational test on the generator set prior to shipping form the factory. A certified test report shall be provided. Equipment supplied shall be fully tested at the factory for function and performance.

.2 Generator set factory tests on the equipment shall be performed at rated load and rated power factor. Generator sets that have not been factory tested at rated power factor will not be acceptable. Tests shall include: run at full load for 4 hours, maximum power, voltage regulation, transient and steady-state governing, single step load pickup, and function of safety shutdowns.

3.3 INSTALLATION

.1 Equipment shall be installed by the contractor in accordance with final submittals and contract documents. Installation shall comply with applicable state and local codes as required by the authority having jurisdiction. Install equipment in accordance with manufacturer's instructions and instructions included in the listing or labeling of UL listed products.

.2 Installation of equipment shall include furnishing and installing all interconnecting wiring between all major equipment provided for the on-site power system. The contractor shall also perform interconnecting wiring between equipment sections (when required), under the supervision of the equipment supplier.

.3 Equipment shall be installed on concrete housekeeping pads. Equipment shall be permanently fastened to the pad in accordance with manufacturer's instructions and seismic requirements of the site.

.4 Equipment shall be initially started and operated by representatives of the manufacturer.

.5 All equipment shall be physically inspected for damage. Scratches and other installation damage shall be thoroughly cleaned to remove all dirt and construction debris prior to initial operation and final testing of the system.

3.4 ON-SITE ACCEPTANCE TEST

.1 The complete installation shall be tested for compliance with the specification following completion of all site work. Testing shall be conducted by representatives of the manufacturer, who will supply the required diesel fuel. The Owner and Engineer shall be notified in advance (2 weeks notice) and shall have the option to witness the tests.

.2 Installation acceptance tests to be conducted on-site shall include a "cold start" test, a four hour full load test, and a one step rated load pickup test in accordance with NFPA 110. Provide a resistive load bank and make temporary connections for full load test.

.3 Perform a power failure test on the entire installed system. This test shall be conducted by opening the power supply from the utility service, and observing proper operation of the system for at least 2 hours. Coordinate timing and obtain approval for start of test with site personnel.

3.5 TRAINING

.1 The equipment supplier shall provide training for the facility operating personnel covering operation and maintenance of the equipment provided. The training program shall be not less than 1-4 hours in duration and the class size shall be limited to 5 persons. Training date shall be coordinated with the facility owner.

3.6 SERVICE AND SUPPORT

.1 The manufacturer of the generator set shall maintain service parts inventory at a central location which is accessible to the service location 24 hours per day, 365 days per year.

.2 The generator set shall be serviced by a local service organization that is trained and factory certified in generator set service. The supplier shall maintain an inventory of critical replacement parts at the local service organization, and in service vehicles. The service organization shall be on call 24 hours per day, 365 days per year.

.3 The manufacturer shall maintain model and serial number records of each generator set provided for at least 20 years.

3.7 WARRANTY

.1 The generator set and associated equipment shall be warranted for a period of not less than 5 years from the date of commissioning against defects in materials and workmanship.

.2 The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts cost, etc.

END OF SECTION

AUTOMATIC LOAD TRANSFER EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

.1 Materials and installation for automatic load transfer equipment which can monitor voltage on all phases of normal power supply, initiate cranking of standby generator unit, transfer loads and shut down standby unit.

1.2 RELATED SECTIONS

.1 Information For Tenderers.

.2 Section 26 05 00 - Common Work Results - Electrical.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN3-C13-M83(R1998), Instrument Transformers.

.2 CSA C22.2 No.5-02, Moulded-Case Circuit Breakers, Moulded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, tenth edition, and the second edition of NMX-J-266-ANCE).

.3 CSA C22.2 No.178-1978(R2001), Automatic Transfer Switches.

.2 American National Standards Institute (ANSI)/National Electrical Manufacturers Association (NEMA)

.1 ANSI/NEMA ICS 2-2000, Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC.

1.4 SYSTEM DESCRIPTION

.1 Automatic load transfer equipment to:

.1 Monitor voltage on phases of normal power supply.

.2 Initiate cranking of standby generator unit on normal power failure or abnormal voltage on any one phase below preset adjustable limits for adjustable period of time.

.3 Transfer load from normal supply to standby unit when standby unit reaches rated frequency and voltage pre-set adjustable limits.

.4 Transfer load from standby unit to normal power supply when normal power restored, confirmed by sensing of voltage on phases above adjustable pre-set limit for adjustable time period.

.5 Shut down standby unit after running unloaded to cool down using adjustable time delay relay.

1.5 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Information For Tenderers.

.2 Shop drawings shall include:

- .1 Make, model and type.
- .2 Load classification:
- .3 Single line diagram showing controls and relays.
- .4 Description of equipment operation including:
  - .1 Automatic starting and transfer to standby unit and back to normal power.
  - .2 Test control.
  - .3 Manual control.
  - .4 Automatic shutdown.

1.6 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for automatic load transfer equipment for incorporation into manual specified in Information For Tenderers.

.2 Detailed instructions to permit effective operation, maintenance, and repair.

.3 Technical data:

- .1 Schematic diagram of components, controls, and relays.
- .2 Illustrated parts lists with parts catalogue numbers.
- .3 Certified copy of factory test results.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Instrument transformers: to CAN3-C13.

.2 Contactors: to ANSI/NEMA ICS2.

2.2 CONTACTOR TYPE TRANSFER EQUIPMENT

.1 Contact Type Transfer Equipment: to CSA C22.2 No.178.

.2 Two - 3 phase contactors mounted on common frame, in double throw arrangement, mechanically and electrically interlocked, motor operated, open type mounted in switchboard. Transition mode: Open transition with adjustable time delay in open position.

.3 Rated: 347/600 V, 60Hz, 800amp rating, 3-phase, 4 wire, solid neutral. Duty service 347/600V.

.4 Main contacts: silver surfaced, protected by arc disruption means.

.5 Switch and relay contacts, coils, spring and control elements accessible for inspection and maintenance from front of panel without removal of switch panel or disconnection of drive linkages and power conductors.

.6 Auxiliary contact: silver plated, to initiate emergency generator start-up on failure of normal power.

.7 Fault withstand rating: 25kA symmetrical for 3 cycles with maximum peak value of 25 kA.

.8 Lever to operate switch manually when switch is isolated.

.9 Solid neutral bar, rated: capacity as shown on drawing.

2.3 CONTROLS

.1 Selector switch - four position "Test", "Auto", "Manual", "Engine start".

.1 Test position - Normal power failure simulated. Engine starts and transfer takes place. Return switch to "Auto" to stop engine.

.2 Auto position - Normal operation of transfer switch on failure of normal power; retransfers on return of normal voltage and shuts down engine.

.3 Manual position - Transfer switch may be operated by manual handle, but transfer switch will not operate automatically, and engine will not start.

.4 Engine start position - Engine starts but unit will not transfer unless normal power supply fails. Switch must be returned to "Auto" to stop engine.

.2 Control transformers: dry type with 120V secondary to isolate control circuits from:

.1 Normal power supply.

.2 Emergency power supply.

.3 Relays: continuous duty, industrial control type, with wiping action contacts rated 10 A minimum:

.1 Voltage sensing: 3-phase for normal power and on one phase only for emergency, solid state type, adjustable drop out and pick up, close differential, 2V minimum undervoltage and over voltage protection.

.2 Time delay: normal power to standby, adjustable solid state, 0 to 60s.

.3 Time delay on engine starting to override momentary power outages or dips, adjustable solid state, 0 to 60s delay.

.4 Time delay on re-transfer from standby to normal power, adjustable 0 to 60s.

.5 Time delay for engine cool-off to permit standby set to run unloaded after retransfer to normal power, adjustable solid state, 20s intervals to 10 min.

.6 Frequency sensing, to prevent transfer from normal power supply until frequency of standby unit reaches preset adjustable values.

.4 Solid state electronic in-phase monitor.

2.4 ACCESSORIES

.1 Pilot lights to indicate power availability normal and standby, switch position, green for normal, red for standby, mounted in switchboard.

.2 Plant exerciser: 168h timer to start standby unit once each week for selected interval transfers load to emergency supply and retransfers to normal supply on standby unit shutdown. Timer adjustable 0-168h in 15 min intervals.

.3 Auxiliary relay to provide 2 N.O. and 2 N.C. contacts for remote alarms.

.4 Manual by-pass isolation switch capable of by-pass to normal or by-pass to standby while in isolated position.

.5 NEMA 12 enclosure.

2.5 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - For Electrical.

2.6 SOURCE QUALITY CONTROL

.1 Complete equipment, including transfer mechanism, controls, relays and accessories factory assembled and tested in presence of Engineer.

.2 Notify Engineer 10 days in advance of date of factory test.

.3 Tests shall include:

.1 Operate equipment both mechanically and electrically to ensure proper performance.

.2 Check selector switch, in modes of operation Test, Auto, Manual, Engine Start and record results.

.3 Check voltage sensing and time delay relay settings.

.4 Check:

.1 Automatic starting and transfer of load on failure of normal power.

.2 Retransfer of load when normal power supply resumed.

.3 Automatic shutdown.

.4 In-phase monitor operation.

2.7 WARRANTY

.1 The transfer switch and associated equipment shall be warranted for a period of not less than 5 years from the date of commissioning against defects in materials and workmanship.

.2 The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts cost, etc.

2.8 ACCEPTABLE MANUFACTURER

.1 Asco 7000 Series.

.2 Onan/Cummins BTPC.

.3 Cutler Hammer contactor-based ATS c/w ATC-800 controller.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install on 4" (100mm) thick concrete pad, extending 2" (50 mm) beyond equipment. Exact dimensions to be confirmed after receipt of shop drawings.

.2 Locate, install, and connect transfer equipment.

.3 Check relays, solid state monitors and adjust as required.

.4 Install and connect battery.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 Energize transfer equipment from normal power supply.

.3 Set selector switch in "Test" position to ensure proper standby start, running, transfer, retransfer. Return selector switch to "Auto" position to ensure standby shuts down.

.4 Set selector switch in "Manual" position and check to ensure proper performance.

.5 Set selector switch in "Engine start" position and check to ensure proper performance. Return switch to "Auto" to stop engine.

.6 Set selector switch in "Auto" position and open normal power supply disconnect. Standby should start, come up to rated voltage and frequency, and then load should transfer to standby. Allow to operate for 10 min, then close main power supply disconnect. Load should transfer back to normal power supply and standby should shutdown.

.7 Commissioning to be performed by a factory trained technician representing the manufacturer. Commission report to be forwarded to Engineer without delay.

END OF SECTION

LIGHTING EQUIPMENT

PART 1 GENERAL

1.1 REFERENCES

.1 American National Standards Institute (ANSI)

.2 ANSI C82.11-1993, lamp current crest factor.

.3 ANSI C82.2 Input wattage.

1.2 RELATED SECTIONS

.1 Information For Tenderers.

.2 Refer to Section 26 05 00 Common Work Results - Electrical for related Sections applicable to this Project.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 26 05 00 Common Work Results - Electrical.

.2 Submit complete photometric data prepared by independent testing laboratory for luminaires.

.3 Submit list of replacement lamp data for each luminaire. Include lamp type, voltage, wattage, base type and order code. Include list in Maintenance Manual.

.4 Submit a luminaire and driver and lamp shop drawing for each luminaire type.

.5 Ensure that each of the specified driver features is specifically shown on the shop drawings.

.6 Provide test reports for LED modules and drivers.

1.4 CODE REQUIREMENTS

.1 Installation of lighting equipment to conform to Section 30, Canadian Electrical Code, Part I, and as amended or supplemented by Provincial, municipal, or other regulatory agencies having jurisdiction.

1.5 OPERATION AND MAINTENANCE DATA

.1 Provide operation and maintenance data for incorporation into manual specified in Section 26 05 00 Common Work Results – Electrical.

1.6 GUARANTEE

.1 Replace:

.1 Drivers that fail or exceed their labelled noise level rating within 12 months of substantial completion

.2 Luminaires which show evidence of corrosion, rough handling, scratching of finishes, etc., are to be replace with new luminaires at no additional cost.

1.7 OPERATIONAL TESTING

.1 Check wiring for agreement with design circuits.

.2 Test for short circuits and improper grounds.

.3 Test operation of luminaire and lamp with ballast.

.4 Allow for third party testing of all lighting controls.

1.8 LAMP USED FOR TEMPORARY LIGHTING

.1 Fluorescent lamps may be used for temporary lighting and lamps used for this purpose will be accepted when the project or portions of the work are turned over to the Owner Representative. Spot re-lamp faulty or burned out lamps prior to acceptance.

.2 Metal halide, incandescent and quartz lamps are not to be used for temporary lighting unless all lamps so used are replaced with new lamps immediately prior to completion.

PART 2 PRODUCTS

2.1 GENERAL

.1 Verify the Catalogue Number of all fixtures with the description prior to ordering and check for final ceiling finish in all areas where recessed fixtures are called for in order to purchase ceiling trim, flanges and mounting brackets to suit the particular construction used where the fixtures are installed.

.2 Different luminaires may be supplied by different manufacturers. Similar luminaires shall be supplied by the same manufacturer.

.3 Provide only luminaires which are structurally well designed and constructed and which use new parts and materials of highest commercial grade available.

.4 Use cadmium-plated chains for suspended luminaires in unfinished areas.

.5 Luminaires shall carry the CSA label.

.6 Provide supporting devices, plaster frames, junction boxes and outlet boxes where required.

.7 Provide lenses or diffusers of glass or acrylic material as indicated. Acrylic lenses shall be minimum 3mm thick.

.8 Include finishes to Section 26 05 00 Common Work Results - Electrical and as indicated.

.9 Where soffits or ceilings have thermal insulation, provide luminaires which are CSA approved for such use.

2.2 LAMPS

.1 Provide lamps as recommended by the luminaire manufacturer.

.2 LED sources to be high power, minimum rated 50,000 hour, white, 3500 K (+/-500 per full fixture), minimum 80 CRI, replaceable modules. Exterior LED sources shall have a high power, minimum rated 50,000 hour, white 4100 K.

.3 Lamps shall be installed one month before substantial completion of the building. Luminaires and lenses shall be thoroughly cleaned before installation of lamps upon completion of construction.

2.3 DRIVERS AND ACCESSORIES

.1 LED Drivers:

.1 120V 50/60 Hz, Class 1 LED drivers
.2 Power Factor: >90%
.3 Total Harmonic Distortion (THD): <10% of full load
.4 Complete with integral 9kV surge suppression protection

2.4 FINISHES

.1 Baked enamel finish:

.1 Conditioning of metal before painting:
.1 For corrosion resistance conversion coating to ASTM F 1137.
.2 For paint base, conversion coating to ASTM F 1137.
.2 Metal surfaces of luminaire housing and reflectors finished with high gloss baked enamel aluminum to give smooth, uniform appearance, free from pinholes or defects.
.3 Reflector and other inside surfaces finished as follows:
.1 White, minimum reflection factor 85%.
.2 Colour fastness: yellowness factor not above 0.02 and after 250 hours exposure in Atlas fade-ometer not to exceed 0.05.

.3 Film thickness, not less than 0.03 mm average and in no areas less than 0.025 mm.

.4 Gloss not less than 80 units as measured with Gardner 60 gloss meter.

.5 Flexibility: withstand bending over 12 mm mandrel without showing signs of cracking or flaking under 10 times magnification.

.6 Adhesion: 24 mm square lattice made of 3 mm squares cut through film to metal with sharp razor blade. Adhesive cellulose tape applied over lattice and pulled. Adhesion satisfactory if no coating removed.

.2 Alzak finish:

.1 Aluminium sheet fabricated from special aluminum alloys and chemically brightened, subsequently anodically treated to specifications established by Alcoa, to produce:

.1 Finish for mild commercial service, minimum density of coating 7.8 g/m , minimum reflectivity 83% for specular, 80.5% for semi-specular and 75% for diffuse.

.2 Finish for regular industrial service, minimum density of coating 14.8 g/m , minimum reflectivity 82% for specular and 73% for diffuse.

.3 Finish for heavy duty service, minimum density of coating 21.8 g/m , minimum reflectivity 85% for specular, 65% for diffuse.

2.5 LENSES

.1 Design K-12

.1 100% virgin acrylic, UV stabilized, clear.

.2 .113 overall thickness.

.3 Square base male conical per 625mm 64 prisms.

.4 Suitable for 1 x 4', nominal fixture dimensions.

.5 Meets or exceeds flame and smoke density rating.

.2 Design K-19

.1 100% virgin acrylic, UV stabilized, clear.

.2 .187 overall thickness.

.3 Square base male conical per 625mm 64 prisms.

.4 Suitable for 2 x 4', nominal fixture dimensions.

.5 Meets or exceeds flame and smoke density rating.

2.6 LIGHTING FIXTURES

.1 Type letters for each lighting fixture shown on the drawings are indicated on lighting fixture schedule and/or legend.

.2 Manufacturer's names and products listed in the luminaires schedule indicate the standard of acceptance for each lighting fixtures.

.3 Acceptable manufacturers:

.1 Interior fluorescent fixtures: CFI, Columbia, Cooper, Crouse-Hinds, Hubbell, Lithonia, Metalux, Peerless, Philips, Thomas,

.2 Exterior fixtures: Emco, Lithonia, Keene, Hubbell, Kim and Mcgraw Edison

.3 Other acceptable manufacturers may be indicated on the schedule for specified fixtures.

2.7 LUMINAIRES SCHEDULE

.1 Refer to Legend on Electrical drawings for Luminaire types.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Locate and install luminaires as indicated, complete with all wiring, connections, fittings, hangers, aligners, box covers and accessories, as required.

.2 Review all ceiling types, construction details and mounting arrangements before placing luminaire orders and ensure that all mounting assemblies, framing rings and similar features are included and match the required installation.

.3 Install luminaires and lens materials in architectural details.

.4 Install luminaires parallel with building lines. Wall-mounted luminaires shall be installed plumb.

.5 All luminaires and assemblies shall be properly secured and supported. Support luminaires independent of the ceiling construction, complete with all fasteners such as 'S' hooks, framing and hangars, as may be required. Do not secure luminaires to mechanical ductwork or other vibration producing apparatus, unless specifically detailed on the drawings.

.6 Where a luminaire is suspended from the ceiling using a self-aligning box cover, an additional ground wire from the outlet box to the luminaire shall be provided.

.7 Coordinate the installation of luminaires with the work of other trades, ensuring that the necessary depths and mounting spaces are provided. Luminaires which cannot be installed due to a conflict with structural members, pipes or ductwork shall be relocated to a more suitable location, as directed by Engineer.

3.2 WIRING

.1 Connect luminaires to lighting circuits:

.1 Directly for luminaire designs.

.2 Through rigid conduit for luminaire designs.

.3 By use of modular wiring system for luminaire design.

.2 Connect luminaires to lighting circuits rated to CEC.

.3 Ground lighting equipment to a separate grounding conductor.

3.3 LUMINAIRE ALIGNMENT

.1 Align luminaires mounted in continuous rows to form straight uninterrupted line.

.2 Support luminaire independently of ceiling. Using "S" hooks and chains to structural steel or suspended "U" channels and in accordance with Ontario Hydro Safety Code.

.3 Explosion fixture to be mounted to the underside of precast concrete roof slab unless noted otherwise on drawings.

.4 Support continuous row mounted fluorescent fixtures every 1M.

.5 Weatherproof fluorescent to be mounted to the underside of pre-cast concrete roof slab unless noted otherwise on drawings.

3.4 CO-ORDINATION OTHER DIVISIONS

.1 Fully co-ordinate with other divisions to avoid interference with ductwork and piping and other services.

3.5 TEST

.1 Perform tests in accordance with Section 26 08 01 - Electrical Testing Requirements.

.2 Check luminaires and replace defective lamps, ballasts, lenses, drivers, modules, and accessories.

3.6 3.6 CLEANING

.1 Prior to take-over of the project, clean the lenses and reflectors of all luminaires with damp cloth to remove dust, smudges and fingerprints.

END OF SECTION

COMMISSIONING OF ELECTRICAL SYSTEMS

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 coordinated by the General Contractor.

.3 Commissioning activities for the electrical systems must have available up to date as-built drawing information and accurate Operations and Maintenance Manuals. These documents shall be a major part of this activity.

.4 Contractor shall be responsible to update all documentation with information and any changes noted during the Commissioning exercise.

.5 Contractor shall arrange for all outside suppliers, equipment manufacturers, test agencies and others as identified in the commissioning sections of this specification. The cost associated with this requirement shall be included as part of the tender price.

1.7 SUBMITTALS

.1 A commissioning document shall be prepared by the Owner's Representative prior to conducting these activities for use by the Commissioning Team.

.2 The electrical sub-contractor shall be responsible for ensuring all activities are properly documented in this manual and coordinated through the General Contractor.

.3 As-built drawings and data books must be available two weeks prior to commissioning for review and use by the consultant and Commissioning Team prior to the start of the commissioning activities.

1.8 PREPARATION

.1 Provide test instruments required for all activities as defined in the commissioning documents.

.2 Verify all systems are in compliance with the requirements of the commissioning documents prior to the pre-commissioning check out operation.

.3 Confirm all scheduled activities have identified personnel available.

.4 Where systems or equipment do not operate as required, make the necessary corrections or modifications, re-test and re-commission.

1.9 SYSTEM DESCRIPTION

.1 Perform all start-up operations, control adjustment, trouble shooting, servicing and maintenance of each item of equipment as defined in the commissioning documentation.

.2 Owner will provide list of personnel to receive instructions and will co-ordinate their attendance at agreed upon times.

.3 Prepare and insert additional data in the operations and maintenance manuals and update as-built drawings when need for additional data becomes apparent during the commissioning exercise.

.4 Where instruction is specified in the commissioning manual, instruct personnel in all phases of operation and maintenance using operation and maintenance manuals as the basis of instruction.

.5 Conduct presentation on Owner's premises. Owner will provide space.

1.10 FINAL REPORT

.1 This trade shall assemble all testing data and commissioning reports and submit them to the Owner.

.2 Each form shall bear signature of recorder, and that of supervisor of reporting organizer.

1.11 SCHEDULE OF ACTIVITIES

.1 Commissioning activities shall be conducted based on pre-established schedule with all members of the commissioning team, refer to Section 01 91 13 – 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

WIRING OF EQUIPMENT SUPPLIED BY OTHERS

PART 1 GENERAL

1.1 GENERAL

.1 This section describes the extent of services to be provided for wiring of equipment supplied by others.

.2 Within the context of this section, Others means:

.1 Other divisions of this specification (i.e.: Division 25 – Integrated Automation).

.2 The Owner, as defined in the Contract.

.3 Other contractors supplying and installing equipment to the contract.

1.2 EXTENT OF SERVICES PROVIDED

.1 The work of this contract is to include all power and control wiring of equipment which is provided by Division 26.

.2 All power and control wiring for equipment supplied by all other divisions, including but not limited to, Division 22, 25, 27, 28 & 44 will be the responsibility of this contractor. Coordinate with Integrated Automation contractor for exact control wiring requirements.

.3 All power and control wiring associated with equipment supplied by Division 01 will be the responsibility of this contractor. Coordinate with general contractor for exact requirements. See Section 26 27 97 – Door Hardware Wiring for exceptions for wiring of door lock systems.

.4 Final connection of all wiring to equipment provided by Others will be by Division 26. Coordinate with the provider for connection instructions.

1.3 RESPONSIBILITY OF DIVISION 26

.1 It is the responsibility of the Division 26 contractor to verify final requirements for wiring of all equipment noted. Verification of wiring requirements to include:

.1 Confirmation of electrical characteristics.

.2 Location of connection point.

.3 Method of connection (i.e. direct or plug-in etc.)

.2 Obtain and become familiar with shop drawings for all relevant equipment.

.3 No claim for extra will be entertained for wiring equipment which has been indicated, or changes to installed wiring where installation proceeded prior to verification of electrical requirements.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

DIVISION 27 INDEX

TELECOMMUNICATIONS RACEWAY SYSTEM

PART 1 GENERAL

1.1 SYSTEM DESCRIPTION

.1 Empty telecommunications raceways system consisting of outlet boxes, cover plates, conduits, cabletroughs, pull boxes, sleeves and caps, fish wires, service poles, service fittings, concrete encased ducts.

.2 Cable tray and underground distribution system.

PART 2 PRODUCTS

2.1 MATERIAL

.1 Underground conduits: PVC type, in accordance with Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings.

.2 Junction boxes, pull boxes, cabinets type E: in accordance with Section 25 05 31 – Splitters, Junction, Pull Boxes and Cabinets.

.3 Outlet boxes, conduit boxes, and fittings: in accordance with Section 25 05 31 – Splitters, Junction, Pull Boxes and Cabinets.

.4 Fish wire: polypropylene type.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install empty raceway system, including overhead distribution system, fish wire, terminal cabinets, outlet boxes, floor boxes, pull boxes, cover plates, conduit, sleeves and caps, cabletroughs, service poles, miscellaneous and positioning material to constitute complete system.

END OF SECTION

COMMUNICATION CABLES - INSIDE BUILDINGS

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 27 11 19 – Terminals and Connectors for Building Communication Conductors

1.2 REFERENCES

.1 CAN/CSA-T530-M90, Building Facilities, Design Guidelines for Telecommunications.

.2 CAN/CSA-T529-M91, Design Guidelines for Telecommunications Wiring System in Commercial Buildings.

.3 CAN/CSA-C22.2 No. 214-M90, Communications Cables.

.4 CAN/CSA-C22.2 No. 182.4-M90, Plugs, Receptacles, and Connectors for Communication Systems.

.5 EIA/TIA Bulletin TSB-36, Technical Systems Bulletin Additional Cable Specifications for Unshielded Twisted Pair Cables, Electronic Industries Association (USA), November 1991.

1.3 SYSTEM DESCRIPTION

.1 Structured telecommunications wiring system consist of copper unshielded-twisted-pair and optical fibre cables, terminations, connectors, cross-connection hardware and related equipment installed inside buildings for occupant's telecommunications systems.

.2 Installed in physical star configuration with separate horizontal and backbone sub-systems.

.1 Horizontal cables link work areas to telecommunications closet located on same floor.

.2 Telecommunications closets linked to central equipment room by backbone cables.

PART 2 PRODUCTS

2.1 STATION WIRE (ZSW)

.1 4-pair, 24 AWG, 100 ohm cable with insulated copper conductor in separate outer jacket: to C22.2 No.214. FT-6 fire-rated jacket.

.2 Voice-grade electrical transmission requirements: to CAN/CSA T529 and TSB-36, Category 6.

.3 Data-grade electrical transmission requirements to: CAN/CSA T529 and TSB-36, Category 6. Process related data CAT 6 cables – Blue coloured jackets. Security related CAT 6 cables, including security cameras – Red coloured jackets.

2.2 COMMUNICATIONS BUILDING CABLE (CBC)

.1 Data Line Cable:

.1 Data-grade electrical transmission requirements to: CAN/CSA T529 and TSB-36, Category 6.

.2 Fiber Optic Cable

.1 6 pair, 12 fiber 62.5mm/125 LT Direct Burial PE Armoured, Grade 3.5/1.0 DB 200/500 Mhz-MM fiber.

PART 3 EXECUTION

3.1 INSTALLATION OF HORIZONTAL DISTRIBUTION CABLES

.1 Install ZSW horizontal cables, as indicated in conduits from telecommunications closet to outlets.

.2 Install ZSW cables, as indicated in equipment room.

.3 Terminate 2 ZSW cables per work station terminated in accordance with CAN/CSA C22.2 No.182.4.

.1 2 service outlet(s) terminated in accordance with C22.2 No.182.4 and CAN/CSA-T529.

.2 Wall termination unit interconnecting ZSW to CFC wiring transition.

3.2 INSTALLATION OF BACKBONE CABLES

.1 Install CBC cable, as indicated in conduit from termination in each telecommunications closet to equipment room. Termination: to CAN/CSA-T529.

.2 Terminate CBC ZSW cables in accordance with CAN/CSA-T529 on patch panel.

3.3 TERMINATION FOR FIBER OPTIC CABLES

.1 Terminate all fiber with SC connectors.

3.4 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Electrical General Requirements.

.2 Test UTP cable installations for:

.1 Continuity: including open/short, polarity, and pair transpositions.

.2 DC loop resistance.

.3 Test fiber optic cable after terminated. Test report to be forwarded to Engineer.

3.5 COORDINATION WITH BELL CANADA

.1 Coordinate and pay for connection of static IP fibre internet service.

END OF SECTION

TERMINALS AND CONNECTORS FOR BUILDING COMMUNICATION CONDUCTORS

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 27 10 05 – Communication Cables - Inside Buildings

.2 Section 27 05 28 – Telecommunications Raceway System

1.2 REFERENCES

.1 CAN/CSA-T530-M90, Building Facilities, Design Guidelines for Telecommunications.

.2 CAN/CSA C22.2 No. 182.4-M90, Plugs, Receptacles and Connectors for Communication Systems.

.3 CAN/CSA T529-91, Design Guidelines for Telecommunications Wiring Systems in Commercial Buildings.

.4 Canadian Open Systems Application Criteria (COSAC) Profile for the Telecommunications Wiring System in Government Owned and Leased Buildings, Treasury Board Information Technology Standards TBITS-6.9

1.3 SYSTEM DESCRIPTION

.1 Termination, patch cords, and cross-connection equipment installed inside buildings for voice and data telecommunications systems employing unshielded twisted pair (UTP) and fiber optic cables.

PART 2 PRODUCTS

2.1 TERMINATIONS AND CROSS-CONNECTION SYSTEM FOR UNSHIELDED-TWISTED-PAIR (UTP) CABLES

.1 Cross-connect patch panel mounted on wall: to CAN/CSA-T529

2.2 TERMINATIONS AND CROSS-CONNECTION SYSTEM FOR FIFTY OHM COAXIAL CABLES

.1 Patch panel employing type BNC connectors: to CAN/CSA-T529 to terminate horizontal cables, type N connectors: to CAN/CSA-T529 to terminate backbone cables.

2.3 BUILDING TELECOMMUNICATION AND CROSS-CONNECTION SYSTEM FOR OPTICAL FIBRE CABLES

.1 Panel mounted self-contained interconnect unit equipped with SC connectors

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install building communications terminating and cross-connecting systems in locations as shown in Contract Drawings, and in accordance with manufacturer's instructions.

3.2 INSTALLATION OF COMMUNICATION WIRES / CABLES

.1 Colour match conductors on terminal strip in accordance with C22.2 No. 214 and CAN/CSA-T529. For IDC-type connections, use tool with seating and cutting heads for connecting conductors to terminals

.2 Harness slack wire in cabinets, terminals and cross-connecting terminating systems.

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 – Electrical General Requirements.

END OF SECTION

DIVISION 28 INDEX

INTRUSION DETECTION

PART 1 GENERAL

1.1 REFERENCE STANDARDS

.1 System shall meet all required Underwriters' Laboratory of Canada (ULC) standards, including:

.1 ULC Commercial and Residential Fire/Burglar Alarm.

.2 CAN/ULC-S303 Local Burglar Alarm Units and Systems.

.3 CAN/ULC-S304 Central and Monitoring Station Burglar Alarm Units.

.2 System shall be installed in compliance with the Ontario Electrical Safety Code.

1.2 RELATED REQUIREMENTS

.1 Section 01 33 00 – Submittals

.2 Section 01 78 00 – Closeout Submittals

.3 Section 01 91 13 – Commissioning Requirements

.4 Section 26 05 00 – Common Work Requirements Electrical

.5 Section 26 90 00 – Wiring of Equipment Supplied by Others

1.3 SUBMITTALS

.1 Submit the following in accordance with 01 33 00 – Submittal Procedures:

.1 PDF shop drawings and product data.

.2 Descriptive System Document for all devices / wiring circuits to be installed in hazardous locations, in accordance with OESC rule 18-066 1) and Appendix F.

.3 Items as required in Section 26 05 00 – Common Work Requirements Electrical.

.2 Submit verification test report in accordance with 01 78 00 – Closeout Submittals.

1.4 SCOPE OF WORK

.1 Contractor shall solicit the services of the Township's Security System Maintenance Contractor:

Rangard Security & Electronic Systems Inc.
433 Tollgate Rd. West
Cornwall, ON
K6H 5R6

.2 Security System Contractor shall:

.1 Recommend and supply all security system components (system controller w/ panel, keypads, door contacts, etc.).

.3 Contractor shall supply all other materials required for the security system (wiring, relays, conduit, junction boxes, pull boxes, etc.).

.4 Contractor shall be responsible for all other aspects of providing a complete system, including but not limited to installation, configuration, & verification.

.5 Contractor shall be responsible for all coordination with Security System Contractor.

.6 All work performed under this specification by the Contractor will be completed to the satisfaction of the Security System Contractor and the Contract Administrator. Contractor shall redo any deficient work identified at no additional cost.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

.1 Contractor shall provide a complete electronically supervised, burglary and alarming system with rechargeable backup battery.

.2 System shall consist of:

.1 Non-volatile memory c/w integral static and lightning protection circuitry.

.2 Alarm communications complete with integrated digital communicator capable of being programmed to transmit up to three phone numbers or locations with 2 account numbers, capable of communicating in all major formats.

.3 Events transmitted shall be programmable to include: burglary alarms trouble alarms, supervisory conditions, alarm restoral codes, opening (disarming) and closing (arming) codes, partial closing codes and opening after alarm codes.

.4 Continuous system supervision of AC power failure, low battery, loss of internal clock, fail to communicate, module fault (supervisory or tamper), trouble by zone, telephone line trouble, bell output trouble, tamper by zone, and aux. power supply fault.

.5 Ability to page personnel on the occurrence of any of the events listed in 2.1.2.3 as selected.

.6 Ability to supervise the telephone line.

.7 Auxiliary power of up to 1.55 Amps (@12.5 VDC) for modules and alarm devices.

.8 Capacity for 9 low current (50mA) and 5 high current (300mA) programmable outputs.

.9 700mA PTC-protected, supervised bell/siren circuit that will drive a bell/siren until reset or silenced.

.10 Surface mounted hardwired keypad with 32 character LCD with zone indicators as required and with backlit keys and displays.

.11 Ability to allow 38 – 4 to 6 digit access codes.

.12 False alarm prevention features.

.13 Voice-assisted security & automation.

.14 Upload/Download capability.

.3 System shall be comprised of, but not be limited to, the following components, as shown on the Contract Drawings:

.1 Alarm controllers in NEMA 1 enclosure

.2 Alarm horns

.3 Keypads

.4 Door contacts

2.2 ALARM CONTROLLERS

.1 Alarm controllers shall be as recommended by Security System Contractor and have the following features, at a minimum:

.1 Minimum of 6 onboard, fully supervised programmable zones

.2 Integrated power supply

.3 Supervised digital alarm communicator

.4 Auxiliary power supply for powering security detection devices

.5 Two programmable outputs

.6 Configurability of expansion / functional modules

.2 The controller shall be complete with all the software required to implement every system feature and to allow for the addition of every expansion or functional module without changes to the basic software.

.3 The controller shall be fully programmable via the keypads, and also allows event buffer viewing via the alphanumeric LCD keypads.

.4 The controller shall have a separate PC-based upload/download software that provides the ability to fully program the system and to read all current system programming, including the event buffer.

2.3 SYSTEM KEYPADS:

.1 LED, alphanumeric LCD, or fixed ICON LCD type, as recommended by Security System Contractor.

.2 At a minimum, keypads shall include:

.1 “Armed” indication LED

.2 "Ready" indication LED
.3 "Trouble" indication LED
.4 "Power" indication LED
.5 5 programmable function keys
.6 3 keypad activated alarm buttons
.7 Power Save mode functionality in the event of a power failure

2.4 MANUFACTURER

.1 Manufacturer of security system components shall be DSC, or as recommended by the Security System Contractor.

.2 Manufacturer of door contacts shall be G.R.I. (George Rick Industries, Inc.), or as recommended by the Security System Contractor.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install the work of this section in accordance with manufacturer's printed instructions and reference standards, and as detailed on the drawings.

.2 Wiring for door contacts shall be concealed within masonry between door contact and nearest junction box.

.3 Install all intrinsically safe circuits in hazardous locations according to the Descriptive System Documents.

3.2 TESTING AND CERTIFICATION

.1 The system shall be tested in accordance with the manufacturer's recommendations, industry standard practices and in accordance with Section 01 91 13 – Commissioning Requirements.

.2 Submit a copy of the testing & verification report / certificate for review by the Contract Administrator.

.3 Include a copy of the testing & validation report / certification in the Operating and Maintenance manuals.

END OF SECTION

FIRE ALARM SYSTEM

PART 1 GENERAL

1.1 REGULATORY REQUIREMENTS

.1 All equipment shall be listed by Underwriters' Laboratory of Canada (ULC).

.2 All components of the system shall be the product of a single manufacturer.

.3 The system and installation shall conform to the latest edition of the Ontario Building Code (OBC) and the Ontario Electrical Safety Code (OESC).

.4 The system shall be installed in accordance with CAN/ULC-S524-14, and shall be subject to the approval of the local Authority Having Jurisdiction.

.5 Fire Alarm System to be verified to CAN/ULC-S537-13

1.2 RELATED REQUIREMENTS

.1 Section 01 33 00 – Submittals

.2 Section 01 78 00 – Closeout Submittals

.3 Section 01 91 13 – Commissioning Requirements

.4 Section 26 05 00 – Common Work Requirements Electrical

.5 Section 26 90 00 – Wiring of Equipment Supplied by Others

1.3 SUBMITTALS

.1 Submit pdf shop drawings in accordance with 01 33 00 – Submittal Procedures.

.2 Shop drawings must be submitted and approved by project Engineer before any equipment is shipped to site.

.3 Shop drawings to consist of the following:

.1 Project title page with project name, Engineer, contractor, and equipment manufacturers.

.2 Project detailed equipment list

.3 Project verification requirements

.4 System/device data sheets and typical wiring schematics

.5 Graphic annunciators detailed construction drawings.

.6 Main fire alarm control panel.

.7 Fire alarm transponder panel (if applicable).

.4 Provide 'as-built' drawings upon completion showing all devices c/w addresses including line isolator and conduit runs.

1.4 OPERATION AND MAINTENANCE MANUALS

.1 Operation and maintenance manuals to consist of the following:

.1 Operation and maintenance instructions for the complete fire alarm system to permit effective operation and maintenance.

.2 Recommended spare parts list with parts catalogue numbers.

.3 Copy of approved shop drawings.

1.5 MAINTENANCE

.1 Provide one year's free maintenance with two inspections by manufacturer during the year. Inspection tests to conform to CAN/ULC-S537-13.

1.6 TRAINING

.1 Provide on-site lectures and demonstrations by fire alarm equipment manufacturer, to train operational personnel in use and maintenance of the fire alarm system. Two separate lectures a minimum of 2 hours each. Coordinate training schedule with Owner.

1.7 QUALIFICATIONS OF MANUFACTURERS

.1 Manufacturers bidding this project must provide a Letter of Compliance, indicating they have met the specifications and system operation exactly.

1.8 SYSTEM DESCRIPTION

.1 Existing conventional fire alarm system to be replaced with new addressable system. New system to be extended to buildings on site, as per the contract drawings.

.2 Provide a supervised, micro-processor based, zoned, non-coded, single-stage, addressable fire alarm system, utilizing automatic/manual devices, wired in DCLA style 6 configuration, and operating at 24 VDC nominal voltage from a rectified 120 VAC power supply.

.3 Any circuit wiring leaving or entering a building shall be provided with a combination choke, MOV, and gas-discharge transient protector. Any circuit servicing a Class 1, Div. 2 area shall be isolated using intrinsically safe barriers.

.4 System shall notify the fire department of an alarm condition by way of a signal to a central monitoring station conforming to CAN/ULC-S561.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Equipment and devices: ULC listed and labelled; standard product of single manufacturer. Addressable type unless otherwise noted.

.2 Power supply: to CAN/ULC-S524 and OBC requirements.

.3 Audible signal devices: to ULC-S525.

.4 Control unit: to CAN/ULC-S527.

.5 Manual fire alarm stations: to ULC-S528.

.6 Smoke detectors: to CAN/ULC-S529.

.7 Thermal detectors: to ULC-S530.

2.2 SYSTEM OPERATION – SINGLE STAGE

.1 Single stage operation. Operation of any alarm initiating device:

.1 Cause on electronic latch to lock-in the alarm state at the control panel.

.2 Cause audible signal devices to sound throughout entire building.

.3 Transmit signal to remote monitoring station via telephone line to CAN/ULC S561.

.4 Cause zone of alarm signal to be indicated on fire alarm control panel and remote annunciator panel.

.5 Automatically record the time, date and zone of alarm at the control panel.

.6 Cause fire doors and smoke control doors if normally held open, to close automatically.

.7 Fire alarm system shall automatically shut down the A/C systems and fans which are fitted with duct smoke detectors or otherwise indicated. Provide relay as required.

.8 Fire alarm system shall recall elevator in the event of fire detection in the elevator machine room.

.2 Supervisory Device Activation

.1 Actuation of and supervisory device shall:

.1 Cause on electronic latch to lock-in the supervisory state at the control panel.

.2 Indicate the respective supervisory zone at the control panel.

.3 Automatically record the event by time and date at the control panel.

.4 Cause a distinctive audible signal at the control panel.

.5 Activate a common supervisory sequence.

.3 Resetting System:

.1 Resetting the alarm or supervisory device and the system shall:

.1 Be automatically recorded at the control panel.

.2 Return all other system indications/functions back to normal.

.4 Trouble Activation:

.1 The system shall continuously monitor the system devices and wiring. Any trouble on the system shall:

.1 Indicate the circuit/device in trouble on the control panel.

.2 Automatically record the time, date and device in trouble.

.3 Activate the “system trouble” indication, buzzer and the common trouble sequence. Acknowledging the trouble condition shall silence the audible indication, whereas the visual indication shall remain until the trouble is cleared and the system is back to normal.

2.3 CONTROL PANEL

.1 DCLA System style in accordance with CAN-ULC-S524. Minimum of one loop per floor and one spare loop capacity.

.2 Each device individually addressed unless otherwise noted.

.3 Non-coded.

.4 Enclosure: CSA Enclosure 1, c/w lockable concealed hinged door, full viewing window, flush lock and 2 keys, wall mounted, max. 750 mm width.

.5 Central Processing Unit (CPU):

.1 The CPU is to monitor and control the entire system and allow control of all systems components connected to the system. The CPU shall be of modular design.

.2 The Central Processing Unit (CPU) shall be complete with forty (40) character alphanumeric display and keypad. All components shall be fully operational while the system is operating on the standby batteries.

.3 Basically all events are to be logged automatically in the system for future review.

.4 The CPU electronics shall be microprocessor-based. Basic life safety software shall be retained in erasable programmable read only memory (EPROM) and executed from random access memory (RAM) to allow password protected field editing. The CPU shall have the capacity to monitor the number of addressable points required for this project plus 25% spare capacity.

.5 The CPU must incorporate circuitry to continuously monitor the communications and data processing cycles of the microprocessor. On

CPU failure, an audible and visual trouble signal shall initiate and provide a remote trouble at Fire Department Control panel.

.6 The CPU shall be equipped with software routines to provide event initiated programs (EIP) whereby the receipt of an alarm or supervisory trouble condition may be programmed to operate any or all of the system's control points. EIP actions for life safety functions shall be retained in the non-volatile PROM memory for reliability. The CPU shall also be retained in the non-volatile PROM memory for reliability. The CPU shall also be capable of reprogramming these EIP functions in the field and retaining the changes in the RAM memory until a new set of PROM are programmed.

.7 The control unit shall be able to process and evaluate incoming signals from addressable devices such as automatic detectors, manual pull station, supervisory valves, etc., via DCLA style link.

.8 The control unit shall be able to handle the following maximum number of addressable links and field-programmable zones:

.1 Up to four addressable links per control unit.

.2 Up to 100 detection devices per line. Maximum initial loading to be no more than 80.

.9 Provide operating power for the detection devices through a regular two-wire line.

.10 Each addressable line module is to have its own microprocessor based circuit, working independently from the central processor board located in the control unit and independently from each other.

.11 All addressable circuits shall be monitored against open circuits and ground faults. Should a malfunction occur in any circuit, this must result in an indication of a trouble condition of this address location at the Control Panel while all other addresses continue operating normally.

.12 Should a detection device respond with either an alarm or trouble condition, its location must be displayed along with its user text of 40 characters. For maintenance purposes. The panel shall have the ability to display the address information of the device in alarm/trouble condition.

.13 Auxiliary relays: plug-in type, dust cover, supervised against unauthorized removal by common trouble circuit and c/w individual bypass switch.

.1 Contacts: 2 A, 120 V ac, for functions such as release of door holders or initiation of fan shut down. Provide also 2 N.O. and 2 N.C. contacts for security system monitoring of 'trouble' and 'alarm' connections to Control panel.

.2 Contact terminal size capable of accepting 22-12 AWG wire.

.14 The system shall be capable of logging and storing 300 events in an alarm log and300 events in a trouble log. These events shall be stored in a battery protected random access memory. Each recorded event shall include the time and date of that event's occurrence.

.1 The following Historical Alarm log events shall be stored:

.1 Alarms.

.2 Alarm acknowledgement.

.3 Trouble acknowledgement.

.4 Supervisory acknowledgement.

.5 Alarm verification tallies.

.6 Trouble Historical log cleared.

.15 Provide a general evacuation switch in the control panel to provide the fire department the option of causing a general alarm.

.6 General System Operation:

.1 Reset of the alarm system and return of the control panel to normal operation will be accomplished as follows:

.1 Resetting the fire alarm system shall not be possible until all the alarm zones have been reset or properly cleared after the Code required time delay.

.2 A supervisory input signal initiated by the actuation of a standpipe supervised valve shall cause:

.1 An audible trouble signal shall sound only at the control panel until acknowledged by authorized personnel.

.2 A latched-type visual indication of the location of the supervisory zone on the control panel.

.3 Print out of the time, date and the trouble zone on the printers.

.4 An open circuit fault on a supervisory circuit shall result in a specific trouble indication.

.5 Manual pull station, heat detectors, or flow switches will immediately cause the system to activate and report an alarm condition without verification requirement.

.3 The system will be programmable on site as outlined below:

.1 The fire alarm system shall allow for on-site loading or editing of the fire alarm programs as required to accommodate and facilitate expandability, building parameter changes or changes as required by the authority having jurisdiction.

.2 Fire alarm programs shall be written in an equation format comparable to ladder logic equations. The equations shall consist of input and output statements providing selective input/output control functions based on binary logic (and, or, not, timing) and other specially coded operational commands.

.3 Programming or editing a forty (40) character description label shall be made possible for any system monitor or control point. Extension of messages for any system point or group of points shall be field programmable.

.4 Assigning the same control point more than one level of control priority indifferent equations shall be possible to allow for automatic and/or manual override functions.

.5 The following conditions shall exist when disabling any part of the system.

.1 When a point has been disabled from the system it shall not disable the supervisory circuit for that zone. Tampering with the wiring of the disabled circuit shall initiate a point trouble condition at the Control Panel CPU.

.2 For an alarm received from any other monitor circuit which has not been disabled, the system shall operate as programmed.

.3 Whenever an initiating circuit has been disabled or disconnected a trouble condition shall be initiated and its location displayed at the main CPU and the monitoring control centre.

.6 All on-site programming or editing changes to the fire alarm system shall be password protected.

2.4 POWER SUPPLY

.1 The Control Panel is to contain the power supply for the entire system. 120 VAC, 60 Hz input, 24 VDC output from rectifier to operate alarm and signal circuits, with standby power of gel cell battery minimum expected life of four years, sized in accordance with OBC.

.2 The power supply unit must contain suitable over-voltage protection to prevent any malfunction or damage which might occur from line power surges.

.3 Upon loss of mains power, the power supply unit must contain suitable over-voltage protection to prevent any malfunction or damage which might occur from line power surges.

.4 When battery voltage drops below 22V, a fault indication is to be provided to indicate a battery fault condition.

.5 A visible and audible signal is to be generated to indicate that the control unit is operating under emergency power.

.6 The master fault indicator on the control unit is to be illuminated until power has been returned.

.7 When the AC power is restored, the control unit must automatically revert to normal operation without requiring any manual restarting procedures.

.8 Battery Charger shall be designed to suit the characteristics of the battery providing automatic boost charge facility when the battery bank potential falls below acceptable voltage for maintaining a working system and return to float charge when the battery bank reaches maximum acceptable voltage.

.9 Automatic equalizing type battery charger must be rated to recharge to at least 70% within 12 hours, and to operate from 120V, 60 Hz, single phase input.

2.5 MANUAL PULL STATIONS

.1 All manual stations shall be addressable.

.2 Manual alarm stations: pull lever, break glass, wall mounted flush type, non-coded single pole normally open contact for single stage.

2.6 AUTOMATIC ALARM INITIATING DEVICES

.1 All automatic initiating devices to be addressable.

.2 Heat detectors, combination fixed temperature and rate of rise, non-restorable fixed temperature element, self-restoring rate of rise, fixed temperature 57°C, rate of rise 8.3°C per minute. Low profile type.

.3 Heat detector base to be compatible with smoke detectors.

.4 Smoke detector: ionization type

.1 Plug-in type.

.2 Wire-in base assembly with integral continuously lit red LED, when in alarm mode. Flashing or alarm pulsating is not acceptable.

.3 Base compatible with heat detectors.

.4 Low profile type.

.5 Duct type smoke detectors; ionization type addressable c/w remote indicating lamp.

.6 All devices to be low profile type.

2.7 ADDRESSIBLE INTERFACE MODULES

.1 Provide addressable interface modules to interface non-addressable devices to the addressable loop including kitchen fire suppression system.

.2 Actuated as a distinct and separate address for each supervisory device.

2.8 AUDIBLE/VISUAL SIGNAL DEVICES

.1 Red Flush Mount Housing

.2 Horns and Horn/Strobes with field adjustable Hi/Lo dB setting.

.3 Strobes and Horn/Strobes with field adjustable 15/30/75/110cd strobe output.

.4 Equivalent to Edwards Genesis Series Horns and Strobes.

.5 Provide protective wire cages in arena setting.

2.9 GRAPHIC ZONE MAP

.1 Provide a graphic zone map indicating the name and extents of each zone for installation adjacent to the main control panel and remote annunciator panel.

.2 Floor plan, graphic style at: 1:200 scale, include:

- .1 Building Outline
- .2 Entrance and exit locations.
- .3 “You are here” indications.
- .4 Zone Boundaries.
- .5 North Arrow.
- .6 Stairwells
- .7 Elevators

.3 Construct graphic in black on white non-fade medium. (Do not use ink as it will fade).

.4 Address (Zone) wording to correspond to panel annunciator wording.

.5 Upper case mechanically printed lettering. Sized for each reading.

.6 Building orientation to suit exact building layout when viewed from front.

.7 Building outline and zone boundaries to be distinguished by line thicknesses, line types, etc.

.8 Set in polished metallic frame with mark resistant Lexan overall cover.

.9 Suitable for screw fixing to wall.

.10 Submit PDF copy of graphic drawing for Engineer's approval prior to manufacturing.

2.10 SPARE PARTS

.1 Provide the following spare parts:

- .1 5 glass rods for pull stations

2.11 SYSTEM MANUFACTURES

.1 Acceptable manufacturers:

- .1 Edwards
- .2 Simplex

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install systems in accordance with CAN-ULC-S524.

.2 Install main control panel and connect to ac power supply, ac dc standby power. Install unit so that alphanumeric display is between 1500 mm and 1700 mm A.F.F.

.3 Locate and install manual alarm stations and connect to the addressable loop.

.4 Locate and install detectors and connect them to the addressable loop. Do not mount detectors within 1 m of air outlets. Maintain at least 600 mm radius clear space on ceiling, below and around detectors.

.5 Connect addressable loops to main control panel.

.6 Locate and install horns and strobes and connect to signaling circuits.

.7 Connect signaling circuits to main control panel. Alternate signal circuits within floor space (i.e. circuit 'A' device adjacent to circuit 'B' device)

.8 Locate and wire door releasing devices.

.9 Install all wiring for fire alarm system monitoring, control and communication circuits in conduit. Minimum conduit size shall be 21 mm. All wiring must be clear of shorts, opens and grounds on completion of installation. All wires must be clearly identified at all termination points.

.10 Ensure wire and cable are copper conductors with insulation rated at 300 V minimum, as follows:

.1 Fire alarm addressable circuits shall be #18 AWG twisted shielded pair. Maximum allowable length of run (wire distance) must not exceed 762 m.

.2 Signal circuit: 300 V 105°C PVC insulated copper conductors. Minimum conductor size #12 AWG. Voltage drop must not exceed the maximum permissible value recommended by the manufacturer.

.3 All wiring to be in conduit, unless otherwise specified on Contract Drawings.

.11 Ground panel and conduits.

.12 Provide connection to security system for remote monitoring of 'alarm' and 'trouble'.

.13 All Fire Alarm devices shall have both the device and its base labelled with p-touch to indicate building (if in a campus), floor, column line, device type. i.e. device labelled as T2-5-G3-SD would indicate tower 2, floor 5, column G3, smoke detector. This description should also be indicated at the annunciator and control panel.

.14 All fire alarm work is to be logged in at the main security station by the contractor, and shall indicate the location of the work, a description of the work, and the name of the contractor performing the work.

.15 The installation contractor shall notify the building owner of verification times, so the owner can include their maintenance contractor in review.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical and CAN/ULC S536.

.2 Fire alarm system:

.1 Test each device and alarm circuit to ensure manual stations, thermal and smoke detectors transmit alarm to control panel and actuate general alarm ancillary devices.

.2 Test to demonstrate correct operation of each interlock device, auxiliary device, and by-pass switches.

.3 Check annunciator panels to ensure zones are shown correctly.

.4 Simulate grounds and breaks on alarm and signaling circuits to ensure proper operation of trouble signals and the capability for providing a subsequent alarm during any imposed single circuit fault condition (open, ground).

.5 Perform the system verification and certification per Clause 3.3 "Verification and Certification".

3.3 CERTIFICATION AND VERIFICATION

.1 Verify system to "CAN-ULC-S537".

.2 Verification is the responsibility of the manufacturer for testing the wiring in relation to field devices operation.

.3 To avoid unnecessary alarms during testing, the system's program shall be capable of being temporarily disabled to disconnect only the audible signals that are being tested. Re-enable the zones after the testing is performed at the end of the day.

.4 Inspect and test wiring to every device to verify the removal of the device or breaking the wire will cause a trouble condition at the Control Panel.

.5 Inspect all equipment installed as part of the system for visible damage or tampering which may be a potential problem with its intended operation.

.6 Activate each manual initiating device to verify and ensure their proper operation.

.7 Test each self-restoring heat detector utilizing a heat source to test the device operation.

.8 Test each ionization smoke detector. Detector operation shall be tested by introducing "smoke" into the detector head.

.9 Test all audible signals for proper operation. Tests shall be made to determine that the signal is audible throughout the area and above the normal ambient noise level.

.10 Verify all field wiring and terminate on a single conductor per terminals basis.

.11 Test system annunciators to ensure proper operation correct zoning and visibility of window inscriptions. All lamps and indicators shall be tested for proper operation.

.12 Test all control equipment for proper operation. Inspect and test all cable terminals, plug connectors, plug-in modules circuitry, lamp sockets and controls to confirm that their mechanical and electrical connections and mounting are acceptable to confirm their electrical supervision.

.13 Test ancillary equipment connections. Inspect such equipment to ensure that faults and malfunctions will not interfere with the alarm system.

.14 Test the following control functions for proper supervision, operation and annunciation.

.1 The Central station connection.

.15 Only make changes to the system program or zone identifications as approved by authorized personnel.

.16 Notify and demonstrate the complete system to Owner's representative and Building Inspection's representatives only after testing and verification performances has been completed and all deficiencies rectified. In their presence, demonstrate the proper functioning of the system. Have system manufacturer's certified technician present.

.17 Upon completion of the inspection and when all of the above conditions have been performed and complied with, the manufacturer shall issue to the Owner's representative the following:

.1 A copy of the inspection report identifying the location of each device and certifying the test results of each device.

.2 A certificate of verification confirming that the inspection has been completed and outlining the conditions upon which such an inspection and certification have been rendered.

.3 Proof of liability insurance for the inspection.

.18 All costs involved in this inspection for both the manufacturer's and the Contractor's work shall be included in the overall tender price.

3.4 VERIFICATION RECORDS

.1 Complete accurate records of the verification shall be maintained with the following requirements but not limited to:

.1 Show the date on which each device and equipment has been verified.

.2 Show the date of all deficiencies encountered in the control system equipment, wiring and field devices.

.3 Show the date when the deficiencies have been corrected and re-verified.

.4 Show dB levels measured during verification.

3.5 MONITORING COMPANY

.1 Arrange and pay for remote monitoring by an authorized (ULC listed) firm (approved by the Owner) for transmission of signals over leased line. Include one year of monitoring. Owner to pay for leased line.

3.6 INTEGRATED SYSTEMS TESTING

.1 Following are tests required to show system integration with other systems. Initiate a fire alarm via a manual pull station verify the following:

.1 Alarm initiated.

.2 Elevators return to ground level.

.3 Signal sent to central alarm facility.

.4 Signal sent to security system.

.5 Alarm annunciates at fire control panel.

.6 Fire shutters release & close.

.7 Audible devices are operating.

.2 Verify connections to elevators. Coordinate all wiring and functionality with elevator system provider.

.1 Simulate activate of ground floor lobby smoke detector and verify that elevator returns to alternate floor.

END OF SECTION

GAS DETECTION SYSTEM

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 – Submittals

.2 Section 01 78 00 – Closeout Submittals

.3 Section 01 91 13 – Commissioning Requirements

.4 Section 26 05 00 – Common Work Requirements Electrical

.5 Section 26 90 00 – Wiring of Equipment Supplied by Others

1.2 SUBMITTALS

.1 Submit the following in accordance with 01 33 00 – Submittal Procedures:

.1 PDF shop drawings and product data.

.2 Descriptive System Document for all devices / wiring circuits to be installed in hazardous locations, in accordance with OESC rule 18-066 1) and Appendix F.

.3 Items as required in Section 26 05 00 – Common Work Requirements Electrical.

.2 Submit verification test report in accordance with 01 78 00 – Closeout Submittals.

1.3 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into Operating and Maintenance manual.

1.4 SCOPE OF WORK

.1 Supply, install MSA Gas Detectors or approved alternative, for the monitoring of Oxygen, Methane, Hydrogen Sulphide, Carbon Monoxide gas concentration.

.2 Supply and install horn/strobe units to annunciate zone and main gas detection alarms.

.3 Gas sensors units will initiate a horn/strobe combination in locally effected zones. Materials and installation for industrial control devices including pushbutton stations, control and relay panels.

PART 2 PRODUCTS

2.1 GAS DETECTION SENSORS

.1 Supply and install MSA Ultima X5000 sensor/transmitters or acceptable alternative for Oxygen, Methane, Hydrogen Sulphide, Carbon Monoxide detection as shown in Contract Drawings.

- .1 Certified to UL and CSA requirements for Class 1, Div. 1 Group B, C, and D.
- .2 Ranges to be 0-500 ppm of CO, 0-100ppm of H2S, 0-25% of O2, and 0-100% LEL of combustibles.
- .3 Two alarm Levels
- .4 Time Delays
- .5 Integrated LCD Display
- .6 LCD Display and keypad
- .7 Audible and Visual Indicator
- .8 Explosion-Proof Housings for devices installed in hazardous locations
- .9 Microprocessor-based operating system
- .10 Electrochemical Cell for CO concentration and H2S, battery type for O2, and catalytic for combustibles.

2.2 HORN/STROBE (EXPLOSION PROOF)

.1 Supply and install Horn/Strobe unit or combination as shown in Contract Drawings.

- .1 Operates with 24VAC
- .2 Minimum 80dB, Max 100 dB
- .3 80 flashes/min.
- .4 Adjustable 15/75 candela
- .5 Rated for Class 1, Div 2, Group D
- .6 Wall mounted
- .7 Amber strobe lens
- .8 Strobe and horn to be distinguishable from fire alarm.

2.3 HORN/STROBE

.1 Supply and install Horn/Strobe unit or combination as shown in Contract Drawings.

- .1 Operates with 24VAC
- .2 Minimum 80dB, Max 100 dB
- .3 80 flashes/min.
- .4 Adjustable 15/75 candela
- .5 Rated for unclassified areas
- .6 Wall mounted
- .7 Amber strobe lens

.8 Strobe and horn to be distinguishable from fire alarm.

2.4 120/24V AC TRANSFORMER

.1 Supply and install 120/24VAC, 300VA transformer to be used for power supply as show in Contract Drawings.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Follow manufacturers installation directions/requirements and drawings.

.2 Commissioning to be performed by authorized technician.

.3 Provide calibration sheets and technicians inspection report to engineer.

3.2 OPERATING SEQUENCE

.1 Activate external, zone horn/strobe units with contacts from each individual sensor, in the event of a low alarm, according to logic and levels found in Contract Drawings. Groups of sensors in a common zone will activate a single, external horn/strobe unit within the zone.

END OF SECTION

DIVISION 31 INDEX

AGGREGATE MATERIALS

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 31 23 33 – Excavating, Trenching and Backfilling.

.3 Section 32 11 16 – Granular Sub-Base

.4 Section 32 11 23 – Aggregate Base Courses.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM International).

.1 ASTM D4791, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.

.2 Ontario Provincial Standard Specifications (OPSS):

.1 OPSS MUNI 1002 – Material Specification for Aggregates – Concrete

.2 OPSS MUNI 1004 – Material Specification for Aggregates – Miscellaneous

.3 OPSS MUNI 1010 – Material Specification for Aggregates – Base, Subbase, Select Subgrade, and Backfill Material

1.3 SOURCE QUALITY CONTROL

.1 Source of materials to be incorporated into work or stockpiles requires approval.

.2 Inform Contract Administrator of proposed source of aggregates and provide access for sampling at least 4 weeks prior to commencing production.

.3 If, in opinion of Contract Administrator, materials from proposed source do not meet, or cannot reasonably be processed to meet, specified requirements, locate an alternative source or demonstrate that material from source in question can be processed to meet specified requirements.

.4 Should a change of material source be proposed, advise Contract Administrator 4 weeks in advance of proposed change to allow sampling and testing.

.5 Acceptance of material at source does not preclude future rejection if it is subsequently found to lack uniformity, or if its field performance is found to be satisfactory.

1.4 SAMPLES

.1 Aggregate will be subject to continual sampling by Contract Administrator during production.

.2 Provide Contract Administrator with access to source and processed material for sampling and testing.

.3 Bear the cost of sampling and testing of aggregates which fail to meet specified requirements.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Aggregate quality: sound, hard, durable material free from soft, thin, elongated or laminated particles, organic material, clay lumps or minerals, or other substances that would act in deleterious manner for use intended.

.2 Flat and elongated particles of coarse aggregate: to ASTM D4791.

.1 Greatest dimension to exceed five times least dimension.

.3 Fine aggregates satisfying requirements of applicable section to be one, or blend of following:

.1 Natural sand.

.2 Manufactured sand.

.3 Screenings produced in crushing of quarried rock, boulders, gravel or slag.

.4 Coarse aggregates satisfying requirements of applicable section to be one of or blend of following:

.1 Crushed rock or slag.

.2 Gravel and crushed gravel composed of naturally formed particles of stone.

.5 Granular ‘A’ as per OPSS MUNI 1010.

.6 Granular ‘B’ Type II as per OPSS MUNI 1010.

.7 19mm Clear Stone Type II to OPSS MUNI 1004.

.8 Rip Rap as per OPSS MUNI 1004

PART 3 EXECUTION

3.1 DEVELOPMENT OF AGGREGATE SOURCE

.1 Contractor to produce aggregates off site.

.2 Contractor to develop aggregate source to prevent contamination of aggregates stockpiled.

3.2 PROCESSING

.1 Process aggregate uniformly using methods that prevent contamination, segregation and degradation.

.2 Blend aggregates, if required, to obtain gradation requirements, percentage of crushed particles, or particle shapes, as specified. Use methods and equipment approved by Contract Administrator.

.3 Wash aggregates, if required to meet specifications. Use only equipment approved by Contract Administrator.

.4 When operating in stratified deposits use excavation equipment and methods that produce uniform, homogeneous aggregate.

3.3 HANDLING

.1 Handle and transport aggregates to avoid segregation, contamination and degradation.

3.4 STOCKPILING

.1 Stockpile aggregates on site in locations as indicated unless directed otherwise by Contract Administrator. Do not stockpile on completed pavement surfaces.

.2 Stockpile aggregates in sufficient quantities to meet Project schedules.

.3 Stockpiling sites to be level, well drained, and of adequate bearing capacity and stability to support stockpiled materials and handling equipment.

.4 Except where stockpiled on acceptably stabilized areas, provide compacted sand base not less than 300 mm in depth to prevent contamination of aggregate. Stockpile aggregates on ground but do not incorporate bottom 300 mm of pile into work.

.5 Separate different aggregates by strong, full depth bulkheads, or stockpile far enough apart to prevent intermixing.

.6 Do not use intermixed or contaminated materials. Remove and dispose of rejected materials as directed by Contract Administrator within two (2) working days of rejection.

.7 Stockpile materials in uniform layers of thickness as follows:

- .1 Max 1.0 m for coarse aggregate and base course materials.
- .2 Max 2.0 m for fine aggregate and sub-base materials.
- .3 Max 1.5 m for other materials.

.8 Complete each layer over entire stockpile area before beginning next layer.

.9 Uniformly spot-dump aggregates delivered to stockpile in trucks and build up stockpile as specified.

.10 Do not cone piles or spill material over edges of piles.

.11 Do not use conveying stackers.

.12 During winter operations, prevent ice and snow from becoming mixed into stockpile or in material being removed from stockpile.

3.5 CLEANING

.1 Leave aggregate stockpile site in tidy, well drained condition, free of standing surface water.

.2 Leave any unused aggregates in neat compact stockpiles as directed by Contract Administrator.

END OF SECTION

CLEARING AND GRUBBING

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 35 43 - Environmental Procedures.

.2 Section 31 23 16.26 - Rock Removal.

.3 Section 31 23 33.01 - Excavation, Trenching and Backfilling.

.4 Section 8 – Natural Heritage Report

1.2 DEFINITIONS

.1 Clearing consists of cutting off trees and brush vegetative growth to not more than a specified height above ground and disposing of felled trees, previously uprooted trees and stumps, and surface debris.

.2 Close-cut clearing consists of cutting off standing trees, brush, scrub, roots, stumps and embedded logs, removing at, or close to, existing grade and disposing of fallen timber and surface debris.

.3 Clearing isolated trees consists of cutting off to not more than specified height above ground of designated trees, and disposing of felled trees and debris.

.4 Underbrush clearing consists of removal from treed areas of undergrowth, deadwood, and trees smaller than 50 mm trunk diameter and disposing of all fallen timber and surface debris.

.5 Grubbing consists of excavation and disposal of stumps and roots boulders and rock fragments of specified size to not less than a specified depth below existing ground surface.

1.3 QUALITY ASSURANCE

.1 Safety Requirements: worker protection.

.1 Workers must wear gloves, dust masks, eye protection, protective clothing, when applying herbicide materials.

.2 Workers must not eat, drink or smoke while applying herbicide material.

.3 Clean up spills of preservative materials immediately with absorbent material and safely discard to landfill.

1.4 STORAGE AND PROTECTION

.1 Prevent damage to fencing, trees, landscaping, natural features, bench marks, existing buildings, existing pavement, utility lines, site appurtenances, water courses, root systems of trees which are to remain.

.2 Repair any damaged items to approval of Contract Administrator. Replace any trees designated to remain, if damaged, as directed by Engineer /Architect.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Consider felled timber from which saw logs, pulpwood, posts, poles, ties, or fuel wood can be produced as saleable timber.

.2 Trim limbs and tops, and saw into saleable lengths. Stockpile adjacent to site.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 PREPARATION

.1 Inspect site and verify with Contract Administrator, items designated to remain.

.2 Locate and protect utility lines. Preserve in operating condition active utilities traversing site:

.1 Notify Contract Administrator immediately of damage to or when unknown existing utility lines are encountered.

.2 When utility lines which are to be removed are encountered within area of operations, notify Contract Administrator in ample time to minimize interruption of service.

.3 Notify utility authorities before starting clearing and grubbing.

.4 Keep roads and walks free of dirt and debris.

3.2 CLEARING

.1 Clearing includes felling, trimming and cutting of trees into sections and satisfactory disposal of trees and other vegetation designated for removal, including downed timber, snags brush and rubbish occurring within cleared areas.

.2 Clear as directed by Contract Administrator, by cutting at a height of not more than 300 mm above ground. In areas to be subsequently grubbed, height of stumps left from clearing operations to be not more than 1000 mm above ground surface.

.3 Cut off branches and cut down trees overhanging area cleared as directed by Contract Administrator.

.4 Cut off unsound branches on trees designated to remain as directed by Contract Administrator.

3.3 CLOSE CUT CLEARING

.1 Close cut clearing to ground level.

.2 Cut off branches down trees overhanging area cleared as directed by Contract Administrator.

.3 Cut off unsound branches on trees designated to remain as directed by Contract Administrator.

3.4 ISOLATED TREES

.1 Cut off isolated trees as directed by Contract Administrator at height of not more than 300mm above ground surface.

.2 Grub out isolated tree stumps.

.3 Prune individual trees as indicated.

.4 Cut limbs and branches to be trimmed close to bole of tree and main branches.

.5 Paint cuts more than 3 cm in diameter with approved tree wound paint.

3.5 UNDERBRUSH CLEARING

.1 Clear underbrush from areas as indicated at ground level.

3.6 GRUBBING

.1 Remove and dispose of roots larger than 7.5 cm in diameter, matted roots and designated stumps from indicated grubbing area.

.2 Grub out stumps and roots to not less than 200 mm below ground surface.

.3 Grub out visible rock fragments and boulders, greater than 300 mm in greatest dimension, but less than 0.25 m^3.

.4 Fill depressions made by grubbing with suitable material and to make new surface conform with existing adjacent surface of ground.

3.7 REMOVAL AND DISPOSAL

.1 Remove cleared and grubbed materials off site.

.2 Cut timber greater than 125 mm diameter to 3000mm lengths and stockpile as indicated. Unless otherwise notified, stockpiled timber becomes property of the Owner.

.3 Dispose of cleared and grubbed materials off site.

.4 Remove diseased trees identified by Contract Administrator and dispose of this material to approval of Contract Administrator.

3.8 FINISHED SURFACE

.1 Leave ground surface in condition suitable for immediate grading operations stripping of topsoil to approval of Contract Administrator.

3.9 CLEANING

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

END OF SECTION

ROUGH GRADING

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 31 11 00 - Clearing and Grubbing.

.2 Section 31 23 16 - Rock Removal.

.3 Section 31 23 33 - Excavation, Trenching and Backfilling.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM D698, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (600kN-m/m^3),

1.3 EXISTING CONDITIONS

.1 Examine subsurface investigation report which is available for inspection from Contract Administrator.

.2 Known underground and surface utility lines and buried objects are as indicated on site plan. Contractor to verify all utilities prior to commencing construction.

.3 Refer to dewatering in Section 31 23 33.01 - Excavating Trenching and Backfilling.

1.4 PROTECTION

.1 Protect and/or transplant existing fencing trees, landscaping, natural features, bench marks, buildings, pavement, surface or underground utility lines which are to remain as directed by Contract Administrator. If damaged, restore to original or better condition unless directed otherwise.

.2 Maintain access roads to prevent accumulation of construction related debris on roads.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Fill material: Select subgrade material or granular material as per Type 3 in accordance with of Section 31 23 33 - Excavating, Trenching and Backfilling.

.2 Excavated or graded material existing on site may be suitable to use as fill for grading work if approved by Contract Administrator.

PART 3 EXECUTION

3.1 STRIPPING OF TOPSOIL

.1 Do not handle topsoil while in wet or frozen condition or in any manner in which soil structure is adversely affected as determined by Contract Administrator.

.2 Commence topsoil stripping of areas as indicated after area has been cleared of brush, weeds and grasses and removed from site.

.3 Strip topsoil to depths as indicated. Avoid mixing topsoil with subsoil.

.4 Stockpile in locations as directed by Contract Administrator. Stockpile height not to exceed 2 m.

.5 Dispose of unused topsoil as directed by Contract Administrator.

.6 Contain all soil piles with erosion control measures, mitigate all soil erosion.

3.2 GRADING

.1 Rough grade to levels, profiles, and contours allowing for surface treatment as indicated.

.2 Rough grade to following depths below finish grades:

.1 250mm for concrete slabs and walks precast paving units.

.3 Slope rough grade away from building 1:50 minimum.

.4 Grade ditches to depth as indicated.

.5 Prior to placing fill over existing ground, scarify surface to depth of 150 mm. Maintain fill and existing surface at approximately same moisture content to facilitate bonding.

.6 Compact filled and disturbed areas to corrected maximum dry density to ASTM D698, as follows:

.1 95% SPD under landscaped areas.

.2 100% SPD under paved and walk areas.

.7 Do not disturb soil within branch spread of trees or shrubs to remain.

3.3 TESTING

.1 Inspection and testing of soil compaction will be carried out by testing laboratory designated by Contract Administrator. Refer to Sections 01 29 83 - Payment Procedures for Testing Laboratory Services and 01 45 00 – Quality Control.

.2 Submit testing procedure, frequency of tests, to Contract Administrator for approval.

3.4 SURPLUS MATERIAL

.1 Contractor shall manage excess materials in accordance with On-Site and Excess Soil Management, O.Reg. 406/19. Remove surplus material and material unsuitable for fill, grading or landscaping off site.

END OF SECTION

ROCK REMOVAL

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedure.

.2 Section 01 35 43 – Environmental Protection

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

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

.5 Section 02 23 40 – Vibration Monitoring.

.6 Section 31 23 33.01 - Excavating, Trenching and Backfilling.

1.2 DEFINITION

.1 Rock: any solid material in excess of 2.0m^3 and which cannot be removed by means of mechanical excavating equipment having 1.95m^3 bucket. Frozen material not classified as rock.

1.3 MEASUREMENT PROCEDURES

.1 Rock removal quantities for building excavation, trench excavation, etc. will be considered inclusive to the work and will not be measured for any other purpose other than documenting as-built conditions.

.1 Contractors shall provide all survey equipment needed and provide assistance to Owner's Representative in taking cross sections. Sections shall be taken at 5 m intervals for mass and trench rock excavation. Sections will be submitted to contractor's site representative for verification. Additional sections shall be taken at points or significant change in elevation or at any other locations as determined by Owner's Representative. Contractor to schedule work to allow sufficient time for Owner's Representative to take necessary sections.

1.4 SUBMITTALS

.1 Submit to Owner's Representative and local authorities having jurisdiction for approval, written proposal of operations for removal of rock by mechanical means, blasting will not be accepted.

1.5 VIBRATION CONTROL

.1 Reduce ground vibrations to avoid damage to structures or remaining rock mass.

.2 Vibration monitoring shall be as per Specification 02 23 40.

PART 2 PRODUCTS [NOT USED]

PART 3 EXECUTION

3.1 PROTECTION

.1 Prevent damage to surroundings and injury to persons in accordance with Section 01 56 00 - Temporary Barriers and Enclosures. Sound warnings and display signs when blasting to take place.

.2 Monitor and repair any/all damage to surrounding infrastructure. Monitoring impacts as indicated in Vibration Monitoring section 01 35 43.

3.2 ROCK REMOVAL

.1 Co-ordinate this Section with Section 01 35 29.06 - Health and Safety Requirements.

.2 Remove rock to alignments, profiles, and cross sections in order to install work as indicated.

.3 Explosive blasting is not permitted.

.4 Use rock removal procedures to produce uniform and stable excavation surfaces. Minimize overbreak, and to avoid damage to adjacent structures.

.5 Excavate rock to horizontal surfaces.

.6 Scale, pressure wash and broom clean rock surfaces which are to bond to concrete.

.7 Excavate trenches to lines and grades to minimum of 300 mm below pipe invert indicated. Provide recesses for bell and spigot pipe to ensure bearing will occur uniformly along barrel of pipe.

.8 Cut trenches to widths as indicated.

.9 Remove boulders and fragments which may slide or roll into excavated areas.

.10 Correct unauthorized rock removal at no extra cost, in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

3.3 DAMAGE

.1 Upon completion of blasting or immediately following the receipt of a complaint, a site condition survey shall be performed to determine if any damage has resulted. The Contractor shall record all incidents of any damage or injury, which shall be reported immediately in writing to the Contract Administrator. All other complaints shall be reported to the Contract Administrator in writing within 24

hours of receipt. Each complaint report shall include the name and address of the complainant, time received, and description of the circumstances that led to the complaint.

.2 The contractor shall be responsible for any and all damage caused by their choice of rock removal.

3.4 ROCK DISPOSAL

.1 Dispose of surplus removed rock off site. Dispose in locations acceptable to authorities having jurisdiction and Contract Administrator. The Contractor may be permitted to crush rock on site for use as Granular A or Granular B material if crushed material conforms to Section 31 05 16.

.2 Do not dispose removed rock into landfill. Material must be sent to appropriate location as approved by the Contract Administrator.

END OF SECTION

DEWATERING

PART 1 GENERAL

1.1 SUMMARY

.1 Comply with Division 1 – General Requirements.

.2 Section Includes:

.1 Control of groundwater and surface water.

.2 Monitoring of groundwater levels at the site.

.3 Monitoring water levels in existing neighbouring domestic water wells located within one kilometre of the site. Where required, supply water to affected wells at the City's expense.

.4 Monitoring for movement of existing structures.

.5 Discharge of drainage water from the site.

.6 Coordinating dewatering work with requirements of other trades and units of work affected by dewatering operations.

1.2 DESCRIPTION

.1 This section specifies requirements for dewatering procedures to stabilize ground and/or keep excavations dry during the construction of the works.

1.3 RELATED SECTIONS

.1 Section 01 33 00 - Submittals

.2 Section 31 23 33 – Excavating, Trenching and Backfilling

.3 Section 31 32 25 – Erosion and Sedimentation Control

.4 Section 31 62 16 – Shoring

.5 Section 33 05 13 – Manholes, Catchbasins, and Precast Structures

.6 Section 33 31 13 – Sanitary Sewers and Forcemains

1.4 DEFINITIONS

.1 Subgrade: Surface to which excavations are made for the purpose of construction of the Work in accordance with the Contract Documents. Subgrade as defined does not include additional depths of excavation that may be required or ordered to obtain suitable foundation conditions.

.2 Dewatering: Removal of water, groundwater as well as surface water, to facilitate construction of the specified works under dry conditions on a stable subgrade.

1.5 REFERENCES

.1 Geotechnical Design Report – Revision 1, Napanee Water Pollution Control Plant Expansion & Upgrade, 300 Water Street West, Napanee, ON, Thurber Engineering Ltd., June 5, 2024

.2 Draft Hydrogeological Report – Revision 1, Napanee Water Pollution Control Plant Expansion & Upgrade, 300 Water Street West, Napanee, ON, Thurber Engineering Ltd., July 24, 2024

.3 Draft Preliminary Geotechnical Design Report, Napanee Water Pollution Control Plant Expansion & Upgrade, Napanee, ON, Thurber Engineering Ltd., July 16, 2021

.4 Interim Draft, Hydrogeological Report, Napanee Water Pollution Control Plant Upgrades, Napanee, ON, Thurber Engineering Ltd., August 18, 2021

.5 Geotechnical Investigation, Upgrades to Wastewater Treatment Plant, 300 Water Street West, Napanee, ON, GHD, June 21, 2018

.6 Stage 2 Contract Soil Investigation, Town of Napanee Water Pollution Control Plant, J.D. Lee Engineering Ltd., October 1977

1.6 DEFINITIONS

.1 Dewatering: Removal of water, groundwater as well as surface water, to facilitate construction of the specified works under dry conditions on a stable subgrade.

1.7 PERMITS

.1 An application for a Permit To Take Water (PTTW) from the Ministry of the Environment, Conservation and Parks (MECP) has been submitted. The anticipated groundwater conditions and pumping rates are identified in the Hydrogeological Report (2025) the volumes are expected to exceed 400,000 L/day.

.2 The submitted Permit to Take Water application has been included in the Appendix to the Contract Documents for reference.

1.8 SUBMITTALS

.1 Submit detailed shop drawings of the proposed primary dewatering system in accordance with Section 01300, including but not limited to the locations and depths of the primary dewatering units, location and depth of piezometers (observation wells), details of pumping, discharge points, chemical analysis of the water as it pertains to:

.1 Relationship between dewatering equipment, new and existing structures, the excavation plan and excavation shoring systems.

.2 Location and dimensions of siltation ponds.

.3 Details of screens and filter media.

.4 Details of the recharge system.

.5 Location of monitoring points, frequency, data to be recorded, volumes pumped, etc.

.6 Shop drawings are to bear the seal and signature of a professional engineer licensed in the Province of Ontario.

.2 The Contractor cannot change the proposed dewatering system without the approval of the Contract Administrator.

.3 All design and shop drawings shall bear the signature and stamp of a Licensed Professional Engineer in the Province of Ontario with a demonstrated competence in this type of work.

1.9 PROTECTION AND DAMAGES

.1 Geotechnical investigations have been completed for the site and are attached to the Contract Documents. The Owner and Contract Administrator accept no responsibility for the accuracy of this information. Claims arising from the interpretation of available information will not be considered.

.2 The Contractor shall take full responsibility for the interpretation of available soils information for planning and execution of the dewatering work.

.3 Prevent damage to pipes, maintenance holes, other structures, ground cover and grades within and in the immediate vicinity of the area of work. Make good any damage.

.4 Rectify any and all damage caused to the excavated base and/or pipe bedding and other adjacent structures and slopes due to improper and/or inadequate dewatering to the satisfaction of the Contract Administrator and at no cost to the Owner.

.5 Prior to commencing the Work, the Contractor shall provide a precondition survey report using a specialized firm to checking adjacent structures and basements of residents, and provide a chemical analysis of nearby private wells. A report shall be submitted in accordance with Submittals 01 33 00.

.6 The Contractor shall submit a Dewatering contingency plan, which includes the supply of nearby residents with water wells potentially impacted by the Work with water, as well as any other mitigation measures.

1.10 QUALITY ASSURANCE

.1 Qualifications

.1 Due to the quantity of dewatering on site, the Contractor shall engage the services of a specialist dewatering subcontractor who has a minimum of 10 years experience in the design and construction of dewatering systems for projects of similar size and complexity.

1.11 SYSTEM DESCRIPTION

.1 Design and Performance Requirements

.1 The Contractor shall review the recommendations of the hydrogeologist’s report and Permit to Take Water application in the Appendix to the Contract Documents for developing the Work of this Section.

.2 Engage a professional engineer with demonstrated competence to design, and to supervise construction, operation and maintenance of a dewatering system.

.3 Design, construct, operate, and maintain a dewatering system, to control groundwater. Consider also the lateral tracking of groundwater underneath existing structures.

.4 Co-ordinate with design and construction of excavation shoring systems, excavation and backfilling operations.

.5 Prevent surface run-off from entering excavations. Construct ditches, berms, and similar items as required to lead water away from excavation as shown on the drawings or as necessary. Do not allow silt laden run-off water to enter watercourses. Direct run-off flows to existing storm sewers, siltation ponds or catchment areas.

.6 Maintain groundwater level a minimum of 300 mm below subgrade level, or lower as may be required to permit placing geotextiles, subdrains, granular construction working surface, concrete, underground services and similar items on a firm dry undisturbed subgrade.

.7 Maintain groundwater at required level until:

.1 Structure/pipes are completely built where designed self-weight of structure resists the buoyancy forces.

.2 Backfilling to final grade is complete.

.8 Prevent destabilization, heaving, or shear failure of the sides and bottom of excavation.

.9 Prevent damage to, or displacement of, structures from groundwater pressures.

.10 Obtain the Contract Administrator's written consent prior to allowing a rise in groundwater level or prior to shutting down the dewatering operation.

.11 Repair or replace any structure or Works damaged due to dewatering at no expense to the Owner.

.2 Dewatering Discharge Requirements

.1 Provide appropriate filter screens so that no soil or foundation material is removed, and solids concentration of less than 5 ppm in the discharge water is achieved. Do not exceed solids concentration of 10 ppm at any time.

.2 Provide siltation controls at discharge locations to prevent excess sediment from leaving the construction site.

.3 Maintain siltation controls during construction period by removing silt build up from time to time to keep siltation controls functional.

.4 The Owner will carry out physical analysis of drainage water to establish conformance with local by-laws and provincial regulations. If directed by

the Contract Administrator, treat the drainage water before discharging into existing storm sewer systems or watercourses.

.5 Provide discharge siltation ponds of the required size to allow for sufficient detention time so that the decanted water will meet all applicable Provincial regulations. Discharge all water from surface water collection and dewatering operations to the siltation ponds as required. This shall include all trench sump pump discharge water.

.6 Maintain the siltation ponds including the removal of sediment during the construction period, as necessary.

.7 Discharge drainage water to existing drainage outlet(s)/swale(s). Prevent erosion of existing outlets/swales by energy absorption devices, such as rock check dams.

1.12 SYSTEM REQUIREMENTS

.1 The Contractor is to determine, based on the geotechnical/hydrogeological report, the design of a primary dewatering system (wellpoints or eductors). The primary dewatering system must maintain the groundwater level at least 300 mm below the invert of the excavation or trench so that the excavation, pipe laying, construction of foundations, placement and compaction of bedding and backfill, etc. can be performed in the dry and in such a way as not to disturb or soften the foundation, native soils or fills already placed, and prevent uplift of any structure or underground service during, and after, construction.

.2 Maintain dewatering systems of sufficient capacity to keep the bottom of the excavation or trench dry and free of water at all times until the installation of the services has been completed.

.3 Install a secondary dewatering system consisting of perimeter ditches and/or ground contouring to prevent flow of surface runoff water into the excavation. As part of secondary dewatering system, provide also for pumping from sumps located within excavations to handle any surface run off or subsurface water entering the excavation, in spite of the primary and secondary dewatering systems in place.

.4 In all cases maintain a duplicate system of equal or greater capacity as emergency equipment, in case of breakdown of the dewatering systems in place.

.5 The dewatering system design will be the responsibility of the Contractor based on the soil information contained in their geotechnical/hydrogeological reports as well as the results of test pits.

PART 2 PRODUCTS

2.1 DEWATERING EQUIPMENT

.1 Pipes, wells, deep wells, well-points, pumps, electrical generators and other equipment as required.

.2 Standby pumps and generator with effective muffling devices to keep noise levels at or below background noise levels. In any event, do not exceed a noise level of 55 dB at adjacent structures at property lines.

PART 3 EXECUTION

3.1 FIELD PUMP TEST

.1 Perform a field pumping test prior to any excavation to ensure the adequacy of the primary dewatering system as proposed and as installed, to establish the rate of pumping to be used during various construction activities, and the rate of recharge when the primary dewatering system is shut off.

3.2 INSTALLATION AND MAINTENANCE

.1 Install and maintain the primary and secondary dewatering systems, and piezometers (observation wells).

.2 Install dewatering equipment and continuously dewater to the required level before proceeding to excavate.

.3 Take corrective measures as required to maintain groundwater at a sufficiently low level to meet the performance requirements.

.4 Flotation of Structures

.1 Maintain groundwater at a sufficiently low level to prevent damage to, or displacement of, structures by groundwater pressures.

.2 Protect completed structures or parts of completed structures that could suffer displacement or other damage as a result of dewatering equipment failure by providing:

.1 Standby dewatering equipment, connected directly to electrical generators, engaging automatically in the case of a power failure.
.2 A positive means by which the structures may be flooded with water to neutralize exterior hydraulic pressures.
.3 A combination of the two alternatives above.

.5 Design and Operate Dewatering Systems:

.1 To prevent the loss of ground as water is removed.
.2 To avoid inducing settlement or damage to existing facilities, completed Work, or adjacent property.
.3 To relieve artesian pressures and any resultant uplift of the bottom of the excavation.

.6 Standby power and equipment:

.1 Provide sufficient redundancy in each system to keep excavations free of water in the event of component failure.

.2 Provide 100 percent emergency power backup with automatic start-up and switchover in the event of electrical power failure.

.7 Maintain the dewatering systems in operation until a written authorization is given by the Engineer that the dewatering systems could be shut off.

.8 During the entire work, observe and record the elevation of the water levels in all observation wells daily. Submit the water level records to the Engineer each day.

.9 Do not remove any observation well except on written permission of the Engineer. Replace observation wells, which were damaged or destroyed within 24 hours.

.10 Conduct an assessment of the potential for dewatering induced settlement. Provide and operate devices or systems, including, but not limited to, reinjection wells, infiltration trenches and cut-off walls, as necessary in order to prevent damage to existing facilities, completed Work, and adjacent property.

.11 Securely support existing facilities, completed Work, and adjacent property which may be vulnerable to settlement due to dewatering operations. Support shall include, but not be limited to, bracing, underpinning, or compaction grouting.

.12 Install dewatering equipment and continuously dewater to allow for work.

.13 Take corrective measures as required to maintain groundwater at a sufficiently low level to allow for work.

3.3 DISPOSAL OF WATER

.1 Dispose of water from the excavation into a temporary sediment trap either in portable container and/or as per OPSD 219.180.

.2 Dispose of water removed from the excavation in such a way so that it will not be injurious to public health, private property or to any operation of the work completed or under construction under this contract or by others.

.3 Water from the dewatering system is not to be discharged to the sanitary sewer.

.4 Flow of water shall not be directed across or over pavements or sidewalks, except through approved pipes or properly designed and constructed methods.

.5 Water from the dewatering system may also be discharged directly to the existing Napanee WPCP provided all measures indicated in the Permit to take Water application have been implemented, and approval from the Owner has been received.

3.4 REMOVAL OF PRIMARY DEWATERING SYSTEM

.1 Maintain the primary dewatering system until the excavation has been completely backfilled and compacted. Remove the primary dewatering system only on receipt of written authorization from the Contract Administrator to do so.

.2 Remove the primary dewatering system in stages to allow the groundwater level to rise at a controlled rate.

3.5 FIELD QUALITY CONTROL

.1 Monitor Groundwater Level

.1 Take readings of groundwater level twice a day for the duration of the dewatering period. Keep a written record of groundwater levels.

.2 Dewatering Discharge Volumes

.3 Take readings of daily flow rates due to dewatering for the duration of the dewatering period. Keep a written record of flow rates on site. Provide recorded flow rates to the Contract Administrator on a weekly basis.

.2 The Contractor shall be responsible to maintain all records as required by the Permit to Take Water.

END OF SECTION

EXCAVATION, TRENCHING AND BACKFILLING

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 31 05 16 – Aggregate Materials

.2 Section 31 23 19 – Dewatering

.3 Section 31 32 25 – Erosion and Sedimentation Control

.4 Section 33 05 13 – Precast Structures

.5 Section 33 31 13 – Sanitary Sewers and Forcemains

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM).

.1 ASTM C117, Standard Test Method for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.

.2 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.3 ASTM D422, Standard Test Method for Particle-Size Analysis of Soils.

.4 ASTM D698, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3) (600 kN-m/m3).

.5 ASTM D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3) (2,700 kN-m/m3).

.6 ASTM D4318, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

.2 Canadian General Standards Board (CGSB).

.1 CA/CGSB-8.2, Sieves, Testing, Woven Wire, Metric

.3 Canadian Standards Association (CSA)

.1 CAN/CSA-A3000, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

.1 CSA-A3001, Cementitious Materials for Use in Concrete.

.2 CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/ Methods of Test and Standard Practices for Concrete.

.4 Ontario Provincial Standard Specifications (OPSS) and Drawings (OPSD)

.5 O. Reg. 406/19: On-Site and Excess Soil Management made under the Environmental Protection Act, R.S.O. 1990, c. E.19

.6 Geotechnical Investigation – Refer to Section 7 of Tender Documents

1.3 DEFINITIONS

.1 Excavation classes: two classes of excavation will be recognized; common excavation and rock excavation.

.1 Rock excavation: excavation of material from solid masses of igneous, sedimentary or metamorphic rock which, prior to its removal, was integral with its parent mass, and boulders or rock fragments having individual volume in excess of 2 m^3. Frozen material not classified as rock. There shall be no compensation for boulder removal for boulders which can be removed by mechanical means with a 1.95 m^3 bucket.

.2 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation.

.2 Unclassified excavation: excavation of deposits of whatever character encountered in work.

.3 Topsoil: material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.

.4 Waste material: excavated material unsuitable for use in work or surplus to requirements.

.5 Borrow material: material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of work.

.6 Unsuitable materials:

.1 Weak and compressible materials under excavated areas.

.2 Frost susceptible materials under excavated areas.

.3 Frost susceptible materials:

.1 Fine grained soils with plasticity index less than 10 when tested to ASTM D4318, and gradation within limits specified when tested to ASTM D422 and ASTM C136: Sieve sizes to CAN/CGSB-8.1.

Sieve Designation	%Passing
2.00 mm	100
0.10 mm	45-100
0.02 mm	10-80
0.005 mm	0-45

.2 Coarse grained soils containing more than 20% by mass passing 0.075 mm sieve.

1.4 SUBMITTALS

.1 Inform Contract Administrator at least 4 weeks prior to commencing work, of proposed source of fill materials and provide access for sampling.

.2 Submit 70 kg samples of type of fill specified including representative samples of excavated material.

.3 Ship samples as directed by Contract Administrator in tightly closed containers to prevent contamination.

1.5 QUALITY ASSURANCE

.1 Submit design and supporting data at least 2 weeks prior to commencing work.

.2 Design and supporting data submitted to bear stamp and signature of qualified professional engineer registered or licensed in the Province of Ontario.

.3 Keep design and supporting data on site.

.4 Do not use soil material until written report of soil test results are reviewed and approved by Contract Administrator.

1.6 EXISTING CONDITIONS

.1 Buried services:

.1 Before commencing work verify location of buried services on and adjacent to site.

.2 Arrange with appropriate authority for relocation of buried services that interfere with execution of work: pay costs of relocating services.

.3 Remove obsolete buried services within 2 m of foundations: cap cut-offs.

.4 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.

.5 Prior to commencing excavation work, notify applicable Owner or authorities having jurisdiction, establish location and state of use of buried utilities and structures. Owners or authorities having jurisdiction to clearly mark such locations to prevent disturbance during work.

.6 Confirm locations of buried utilities by careful test excavations.

.7 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered as indicated.

.8 Where utility lines or structures exist in area of excavation, obtain direction of Contract Administrator before removing or re-routing.

.9 Record location of maintained, re-routed and abandoned underground lines.

.10 Confirm locations of recent excavations adjacent to area of excavation.

.2 Existing buildings and surface features:

.1 Conduct, with Contract Administrator condition survey of existing buildings, trees and other plants, lawns, fencing, service poles, wires, rail tracks, pavement, survey benchmarks and monuments which may be affected by work.

.2 Protect existing buildings and surface features from damage while work is in progress. In event of damage, immediately make repair to approval of Contract Administrator.

.3 Where required for excavation, cut roots or branches as approved by Contract Administrator.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Type 1 fill: Granular 'A' as per OPSS 1010 and Section 31 05 16 - Aggregate Materials.

.2 Type 2 fill: Granular 'B' Type II as per OPSS.MUNI 1010 and Section 31 05 16 – Aggregate Materials.

.3 Type 3 fill: select subgrade material as per OPSS.MUNI 1010 from excavation or other sources, approved by Contract Administrator for use intended, unfrozen and free from rocks larger than 75 mm, cinders, ashes, sods, refuse or other deleterious materials.

.4 Geotextile: Type II Non-woven as per OPSS 1860.

.5 Clear stone per OPSS.MUNI 1010.

.6 Sand: Mortar sand or uniformly graded sand as per OPSS 1004.

.7 Unshrinkable fill: proportioned and mixed to provide:

.1 Maximum compressive strength of 0.4 MPa at 28 days.

.2 Maximum Portland cement content of 25 kg/m 3.

.3 Minimum strength of 0.07 MPa at 24 h.

.4 Concrete aggregates: to CSA-A23.1/A23.2,

.5 Cement: to CSA A3000, Type GU.

.6 Slump: 160 to 200 mm.

PART 3 EXECUTION

3.1 SITE PREPARATION

.1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.

3.2 PREPARATION/PROTECTION

.1 Keep excavations clean, free of standing water, and loose soil.

.2 Where soil is subject to significant volume change due to change in moisture content, cover and protect to Contract Administrator's approval.

.3 Protect natural and man-made features required to remain undisturbed. Unless otherwise indicated or located in an area to be occupied by new construction, protect existing trees from damage. Protect buried services that are required to remain undisturbed.

.4 Protect buried services that are required to remain undisturbed.

3.3 EROSION AND SEDIMENT CONTROL

.1 As per the requirements of Specification 31 32 25.

3.4 STRIPPING OF TOPSOIL

.1 Commence topsoil stripping of areas as indicated by Contract Administrator after area has been cleared of brush, weeds and grasses and removed from site.

.2 Strip topsoil to depths as indicated by Contract Administrator. Do not mix topsoil with subsoil.

.3 Stockpile in locations as directed by Contract Administrator. Stockpile height not to exceed 2 m.

.4 Dispose of unused topsoil off-site or as directed by Contract Administrator.

3.5 STOCKPILING

.1 Stockpile fill materials in areas designated by Contract Administrator. Stockpile granular materials in manner to prevent segregation.

.2 Protect fill materials from contamination.

3.6 COFFERDAMS, SHORING, BRACING AND UNDERPINNING

.1 Maintain side and slopes of excavations in safe condition by appropriate methods and in accordance with Occupational Health and Safety Act for the Province of Ontario.

.2 Design and construct temporary works to depths, heights and locations as required for new work.

.3 During backfill operation:

.1 Unless otherwise as indicated or as directed by Contract Administrator remove sheeting and shoring from excavations.

.2 Do not remove bracing until backfilling has reached respective levels of such bracing.

.3 Pull sheeting in increments that will ensure compacted backfill is maintained at an elevation at least 500 mm above toe of sheeting.

.4 When sheeting is required to remain in place, cut off tops at elevations as indicated.

.5 Upon completion of substructure construction:

.1 Remove cofferdams, shoring and bracing.

.2 Remove excess materials from site as indicated and as directed from Contract Administrator.

3.7 DEWATERING AND HEAVE PREVENTION

.1 Keep excavations free of water while work is in progress.

.2 Submit for Contract Administrator's review details of proposed dewatering or heave prevention methods, such as dikes, well points, and sheet pile cut-offs.

.3 Avoid excavation below groundwater table if quick condition or heave is likely to occur. Prevent piping or bottom heave of excavations by groundwater lowering, sheet pile cut-offs, or other means.

.4 Protect open excavations against flooding and damage due to surface run-off.

.5 Dispose of water in accordance with Section 01 35 43 - Environmental Procedures and in manner not detrimental to public and private property, or any portion of work completed or under construction.

.6 Provide flocculation tanks, settling basins, or other treatment facilities to remove suspended solids or other materials before discharging to storm sewers, water courses or drainage areas. Maximum allowable concentration of suspended solids in discharge shall be 25 mg/L TSS.

3.8 EXCAVATION

.1 Excavate to lines, grades, elevations and dimensions as indicated by Contract Administrator.

.2 Remove concrete, masonry, paving, walks, demolished foundations and rubble and other obstructions encountered during excavation. Dispose of material off site.

.3 Excavation must not interfere with bearing capacity of adjacent foundations.

.4 Do not disturb soil within branch spread of trees or shrubs that are to remain. If excavating through roots, excavate by hand and cut roots with sharp axe or saw.

.5 For trench excavation, unless otherwise authorized by Contract Administrator in writing, do not excavate more than 30 m of trench in advance of installation operations and do not leave open more than 15 m at end of day's operation.

.6 Keep excavated and stockpiled materials a safe distance away from edge of trench as directed by Contract Administrator.

.7 Restrict vehicle operations directly adjacent to open trenches.

.8 Dispose of surplus and unsuitable excavated material off site.

.9 Do not obstruct flow of surface drainage or natural watercourses.

.10 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.

.11 Notify Contract Administrator when bottom of excavation is reached.

.12 Obtain Contract Administrator approval of completed excavation.

.13 Remove unsuitable material from trench bottom to extent and depth as directed by Contract Administrator.

.14 Correct unauthorized over-excavation as follows:

.1 Fill under bearing surfaces and footings with concrete specified for footings.

.2 Fill under other areas with Type 2 fill compacted to not less than 95% of corrected maximum dry density.

.15 Hand trim, make firm and remove loose material and debris from excavations. Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil. Clean out rock seams and fill with concrete mortar or grout to approval of Contract Administrator.

.16 Division 31 will complete all required trenching and backfilling required for work of Division 20, 26 and 44.

3.9 BUILDING SUBEXCAVATION

.1 Sub-excavate within entire footprint of the new building and beyond the footprint of the new building to a minimum geodetic elevation as shown on the drawings.

.2 Beyond the building footprint, sub-excavation shall extend a minimum of 500mm horizontally from the edge of the footing, and outwards as required to reach the existing grade at a slope as indicated in the geotechnical reports (Refer to Section 7).

3.10 FILL TYPES AND COMPACTION

.1 Use fill of types as indicated or specified below. Compaction densities are percentages of Standard Proctor Maximum Dry Densities (SPMDD) obtained from ASTM D698.

.1 Open excavation (basement) from demolition work or building sub-excavation:

.1 Type 2 fill, thickness as required, compacted to minimum 98% SPMDD, in maximum 300 mm thick lifts.

.2 New building sub excavation areas:

.1 Type 2 fill, thickness as required, compacted to minimum 98% SPMDD, in maximum 300 mm thick lifts.

.3 Slabs-on-grade for new structures:

.1 Type 2 fill, thickness as required to raise the floor subgrade, compacted to minimum 98% SPMDD, in maximum 300 mm thick lifts.

.2 Type 1 fill to underside of slab, minimum compacted thickness of 150 mm, compacted to minimum 98% SMPDD, in maximum 300 mm thick lifts.

.4 Footings founded on structural fill for new structures:

.1 Type 2 fill placed over undisturbed native soil, thickness as required to achieve design footing subgrade elevation (minimum compacted thickness of 200 mm), compacted to minimum 100% SPMDD, in maximum 300 mm thick lifts.

.2 Type 1 fill to underside of footing, minimum compacted thickness of 150 mm, compacted to minimum of 100% SPMDD, in maximum 300 mm thick lifts.

.5 Exterior side of perimeter walls for new structures:

.1 Type 2 fill for 1.0m beyond face of foundation wall, thickness as required to reach subgrade level, compacted to 95% SPMDD.

.2 Type 3 fill for other areas, thickness as required to reach subgrade level, compacted to 95% SPMDD.

.6 Subgrade:

.1 Compact existing subgrade under walkways, paving, and sidewalks to same compaction as fill above.

.7 Under grassed areas:

.1 Type 3 fill, thickness as required to reach underside of topsoil, compacted to 95% SPMDD.

.8 To correct over excavation in trenches:

.1 Type 2 fill to underside of Granular “A” bedding, compacted to 95% SPMDD.

3.11 BEDDING AND SURROUND OF UNDERGROUND SERVICES

.1 Place and compact granular material for bedding and surround of underground services as indicated.

.2 Place bedding and surround material in unfrozen condition.

3.12 BACKFILLING

.1 Vibratory compaction equipment: approved by Contract Administrator.

.2 Do not proceed with backfilling operations until Contract Administrator has inspected and approved installations.

.1 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.

.3 Do not use backfill material which is frozen or contains ice, snow or debris.

.4 Place backfill material in uniform layers not exceeding 150 mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer.

.5 Backfill around installations.

.1 Place bedding and surround material as specified elsewhere.

.2 Do not backfill around or over cast-in-place concrete within 24 hours after placing of concrete.

.3 Place layers simultaneously on both sides of installed work to equalize loading. Difference not to exceed 600 mm.

.4 Where temporary unbalanced earth pressures are liable to develop on walls or other structures.

.1 Permit concrete to cure for minimum 14 days or until it has sufficient strength to withstand earth and compaction pressure, and approval obtained from Contract Administrator, or

.2 If approved by Contract Administrator, erect bracing or shoring to counteract unbalance, and leave in place until removal is approved by Contract Administrator.

.6 Division 31 will perform required excavation, trenching and backfilling required for all Divisions. General Contractor to coordinate details of all Divisions to determine the extent of work to be provided.

3.13 RESTORATION

.1 Upon completion of work, remove waste materials and debris, trim slopes, and correct defects as directed by Contract Administrator.

.2 Replace topsoil as indicated by Contract Administrator.

.3 Reinstate lawns to elevation which existed before excavation.

.4 Reinstate pavement and sidewalks distributed by excavation to thickness, structure, and elevation which existed before excavation.

.5 Clean and reinstate areas affected by work as directed by Contract Administrator.

.6 Use temporary plating to support traffic loads over unshrinkable fill for initial 24 h.

.7 Protect newly graded areas from traffic and erosion and maintain free of trash and debris.

.8 Dispose of surplus material and material unsuitable for fill grading or landscaping off site.

3.14 FIELD QUALITY CONTROL

.1 Testing of materials and compaction of backfill and fill will be carried out by testing laboratory designated by Owner.

.2 Do not begin backfilling or filling operations until material has been approved for use by Contract Administrator.

.3 Not later than 48 hours before backfilling or filling with approved material, notify Contract Administrator to allow compaction tests to be carried out by testing agency designated by Owner.

3.15 SOIL MANAGEMENT AND EXCESS SOIL QUALITY

.1 Contractor shall manage excess materials in accordance with On-Site and Excess Soil Management, O. Reg. 406/19. All excess materials (including bituminous pavement, concrete, fabricated metal and plastic products, wood, masonry, pipes surplus or unsuitable excavated earth and rock, and other wastes not otherwise designated for salvage or Reuse by the Owner) shall be removed from the project area and properly transported and re-used or disposed of offsite.

.2 The contractor shall retain the services of a Qualified Person (QP) to complete in-situ or ex-situ soil characterization for the proposed excavation area by means of stock piling, and sampling to generate a soil characterization report in accordance with O. Reg. 406/19.

.3 Sampling shall include field screening of the soil samples for visual and olfactory evidence of impacts and for the presence of petroleum/volatile organic compound (VOC) – derived vapours using a combustible gas indicator (CGI) calibrated to hexane and a photo-ionization detector (PID) calibrated to isobutylene or equivalent. Use a combination of visual and olfactory observations and CGI/PID organic vapour readings to identify the most apparent worst-case samples for lab analysis.

.4 Submit apparent “worst-case” soil samples from each stockpile for bulk chemical analysis of petroleum hydrocarbons (PHCs) in the F1 to F4 fraction ranges, metals (including Hydrides), electrical conductivity (EC) and sodium adsorption ratio (SAR). Samples to be sent to a laboratory accredited by the Standards of Council of Canada and the Canadian Association for Laboratory Accreditation.

.5 Submit two representative soil samples for laboratory analysis of pH;

.6 The Contractor shall be responsible for the On-Site and Off-Site deposit of Excess Soils from the Project Area and will be responsible for executing the requirements of the Reuse Site in relation to import of Excess Soils originating from another site. This shall include all necessary sampling, documentation, and reporting to support placement of material at the Reuse Site(s) including the identified submittals. If required, the Contractor will be responsible to supply the necessary planning documents for a notice on the Registry as identified in O.Reg. 406/19, to be prepared by the contractor’s Qualified Person (QP).

.7 All excess material shall be transported to the Reuse Site(s) to be identified by the Contractor and approved by the QP. The contract administrator shall review and accept the proposed Reuse Site(s) in advance of any excavation work. The Contractor shall obtain written consent from the operator/owner of the Off-Site Reuse Site(s) at which the Excess Soils will be deposited prior to the initiation of construction operations.

.8 The Contractor shall develop and submit a plan for the transportation, disposal and tracking of Excess Soils. The plan shall list all carriers who will haul the soil to the Reuse Site(s) to be identified by the Contractor and approved by the QP. The contract administrator shall review the plan and list of carriers in advance of any excavation work. The plan shall also include details to meet the tracking requirements identified under O.Reg. 406/19.

.9 The Contractor shall comply with the requirements outlined in a Fill Management Plan, should it exist for the Reuse Site, Excess Soil Destination Assessment Report and/or site-specific Instrument of the Reuse Site where Excess Soil will be placed, as applicable.

.10 The Contractor shall determine the consistency, quality, and quantity of excavated material generated as a result of construction activities. Unless otherwise designated, the QP shall undertake any required additional sampling and testing of the excavated materials supplemental to the previous environmental sampling

and to evaluate the suitability for Reuse either within the Project Area or at an Off-Site Reuse Site.

END OF SECTION

PART 1 GENERAL

1.1 SCOPE

.1 This specification covers the requirements for the design, supply, placement, maintenance, and removal or abandonment of temporary support systems required to permit the excavation and backfilling of trenches or excavations for the installation of underground utilities and any other specified subsurface construction.

.2 This specification also covers the requirements for the design, placement, maintenance, and removal or abandonment of temporary support systems required to permit the construction of below grade structures and/or foundations for building structures.

.3 Shoring is mandatory where indicated and, in all areas, where excavation will potentially undermine existing structures, pipes, conduits, utilities or roadways.

.4 Subject to paragraph 1.1.3, it will be the Contractor's decision whether to carry out general excavation in open cut or to use shoring system to conserve space and/or control groundwater infiltration.

1.2 RELATED SECTIONS

.1 Division 1 – General Requirements

.2 Section 02 23 40 – Vibration Monitoring

.3 Section 03 30 00 – Cast-in Place Concrete

.4 Section 31 23 19 – Dewatering

.5 Section 31 23 33 – Excavating, Trenching and Backfilling

1.3 REFERENCES

.1 Occupational Health and Safety Act, R.S.O. 1990, c.O.1, as amended.

.2 Ontario Regulation 213/91 – Regulations for Construction Projects, as amended.

.3 OPSS 404 – Construction Specification for Support Systems.

.4 OPSS 539 – Construction Specification for Temporary Protection Systems.

.5 CSA G30.18-21 - Carbon Steel Bars for Concrete Reinforcement -

.6 CSA G40.20-13/G40.21-13 (R2018) - General requirements for rolled or welded structural quality steel / Structural quality steel.

.7 CSA A23.1/A32.2-19 - Concrete Materials and Methods of Concrete Construction / Test Methods and Standard Practices for Concrete

.8 CSA W59-18 – Welded Steel Construction (Metal Arc Welding)

1.4 RESPONSIBILITY FOR SHORING SYSTEM

.1 Engage a professional engineer, registered in the Province of Ontario, who has demonstrated competence in shoring and underpinning work, to design and supervise construction of temporary structures required to execute construction of permanent Works.

.2 Take full responsibility for design, supply, placement, installation, maintenance and where applicable removal of shoring system.

.3 Comply with all safety requirements of The Occupational Health and Safety Regulations and Ontario Building Code.

1.5 DESIGN OF SHORING SYSTEM

.1 Design excavation shoring and/or underpinning systems based on recognized geotechnical and structural theories and principles and site conditions encountered. Undertake additional geotechnical site investigation for design of the shoring system and/or underpinning at no extra cost to the Owner.

.2 Design shoring system for all applicable lateral pressures from soil and groundwater, including unsymmetrical surcharge loads from construction operations and frost action on retained soil.

.3 Design shoring system such that intermediate bracing members, walers or struts will not interfere with permanent structure. All below grade structures are to be complete with ground level slabs, and other bracing elements prior to backfill.

.4 Design bracing to be fully effective at all stages of construction. Pre-stress bracing, if required, to control deflection.

.5 Design underpinning and temporary supports for existing structures and/or utilities to safely resist all loads including loads which may be imposed as a result of construction operations.

.6 Where shoring system retains materials which provides support for foundations at a higher level, design to limit deflections so that foundation materials are not disturbed or weakened. Design lateral pressures to be determined based on at-rest soil pressures. Limit total deflection to 20 mm horizontally.

.7 Co-ordinate design of shoring system with design of dewatering system to meet performance requirements specified herein.

.8 Locate all yard piping, services, conduit, structures, etc., in the area of the excavation. Assume all items found are live and are to be kept live unless specifically noted otherwise. Take precautions necessary to ensure that there is no damage to existing buried services, piping, conduit, structure, etc., during the shoring and excavation work.

1.6 METHOD STATEMENT

.1 Submit method statements for the construction sequence and duration of all main activities including any ground treatment that may be required to construct without the use of active dewatering at least fifteen (15) days prior to the commencement of the Works.

1.7 COORDINATION

.1 Coordinate design of temporary shoring system with the design of dewatering system in Section 31 23 19 – Dewatering.

1.8 SHORING PERFORMANCE REQUIREMENTS

.1 General Requirements

.1 Construct substantially watertight excavation shoring systems suitable for geotechnical conditions encountered and which will meet all requirements of these performance specifications. Prevent destabilization of subgrade, migration of soil fines, damage to any structure and/or works. Prevent disturbance, displacement or damage, to sides and bottom of excavation, to new and existing structures, pipelines, utilities, roads, embankments, etc. at any stage of construction of works. Prevent destabilization or failure of bottom of excavation from shear, heave, piping and boiling, groundwater pressure or any other cause.

.2 Review Utilities drawings and Site Survey, available from the Engineer showing site information and configuration of existing buildings and services.

.3 Prior to beginning work on the site, confirm location of all underground services and structures, and arrange work to prevent damage to any services or structures.

.4 Provide adequate space for access for installation of formwork and inspection.

.2 Watertightness

.1 Shoring system to be watertight to the extent that any dewatering required inside the excavation shall not lower the water table on outer side of the shoring system.

.3 Tolerances

.1 Install shoring so that, exclusive of temporary walers or bracings, no part of temporary structure to be left in place above the bottom of the

excavation in its deflected position will reduce the concrete wall thicknesses to below the dimensions indicated.

.2 If the shoring installation does not satisfy these requirements, alter it, at no extra cost to Owner, until it meets the requirements.

.3 The maximum permitted deviation of the finished pile from the vertical at any level is 1 in 200.

.4 Lateral deflection limit

.1 Performance of temporary shoring systems shall be performance level 1a as described in OPSS 539.

.5 Monitoring Deflection

.1 The contractor shall hire a monitoring contractor with at least five years' experience in precision survey monitoring that can demonstrate having performed at least 10 projects of similar scope, magnitude and complexity to develop and execute a precision survey program for monitoring movement at the top of the shoring wall. The system shall achieve an accuracy of plus/minus 2 mm at each measurement point.

.2 The monitoring contractor is responsible for developing the system to meet 2 mm accuracy but the system at a minimum meet the following criteria:

.1 Monitoring points are to be spaced no more than 3 m apart and at all critical locations.

.2 Movement in the x, y and z direction must be measured at each point.

.3 The surveying instrument shall be a Leica TCA 1800 or equal. The manufacturer's published accuracy must be at least one second angular resolution with plus minus 1 mm electronic distance measurement at 100 m distance.

.3 Readings shall be recorded twice weekly until the excavation is no longer open.

.4 Reports shall show movement in both at a tabulated and graphical format. The owner's representative to approve the reporting format prior to start of the work.

.5 Data is to be reported weekly, but immediately if any unusual movements occur.

1.9 SUBMITTALS

.1 Submit shop drawings at least fifteen (15) days before commencement of shoring Works for temporary structures including both shoring and bracing systems. Shop drawing to bear seal and signature of a Professional Engineer, registered in the Province of Ontario, who has carried out the design and who will provide construction supervision of temporary structures.

.2 Indicate on shop drawings the following:

.1 Dimensions and elevations

.2 Relationship to new and existing structures and utilities

.3 Material designations, grades, sizes, mix design, etc.

.4 Temporary struts and walers etc., their relationship to permanent structure and schedule for removal3

.5 Permanent tie backs locations, size and embedment.

.6 Deflections of shoring members when deflection limitations have been specified in this Section.

.7 Design loads, design assumptions, surcharge loads and all loading restrictions.

.8 Identification of Shoring Engineer of record who will be responsible for design calculations, checking of shop drawings, inspection and supervision of fabrication and installation, and filing of reports with the appropriate authorities and the Owner.

.9 Complete field instructions required during installation and any other pertinent information.

.10 Schedule for removal of temporary struts and walers.

.3 Submittal of shop drawings for such temporary structures is for record purposes. The Engineer will not review or check such shop drawings for structural adequacy. Take the full responsibility for design, supplying, placing installation and maintenance.

1.10 QUALITY CONTROL

.1 Provide a system of quality control to ensure that the minimum standards specified herein are attained.

.2 Bring to the attention of Engineer any defects in the work or departures from the Contract Documents which may occur during construction. The Engineer will decide upon corrective action and state recommendations in writing.

.3 The Engineer’s general review during construction and inspection and testing by Independent Inspection and Testing Companies reporting to the Engineer are both undertaken to inform the Owner of the Contractor’s performance and shall in no way augment the Contractor’s quality control or relieve him of contractual responsibility.

1.11 QUALITY ASSURANCE

.1 Engage a Professional Engineer, licensed in Ontario, to design, supervise installation of, and inspect all temporary structures for the duration of construction.

.2 Utilize only personnel with demonstrated competence and experience to install temporary structures.

.3 Welder: CSA W47.1 certified.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Concrete Mixes and materials

.1 CSA A23.1/A23.2

.2 Reinforcing Steel

.1 CSA G30.18

.3 Steel Liner Plates

.1 Corrugated proprietary steel liner plates with bolted joints and grouting nipples supplied on a sufficient number of plates to provide grouting connections at 3 m maximum around the circumference and every second ring of plates.

.4 Steel Casings

.1 Temporary casings shall be thin-walled mild steel cylindrical casing, spirally welded or other similar construction. The dimensions and quality of the casing shall be adequate to withstand without damage or distortion all handling, construction and ground stresses to which they will be subjected, including preventing concrete from within the pile from displacing soft soil or soil squeezing in and displacing fresh concrete.

.5 Structural Steel Members

.1 CSA G40.20/G40.21 Grade 300W for walers, bracing and soldiers piles.

.6 Welding

.1 CSA W59 Welded Steel Construction

.7 Steel Sheet Piling:

.1 Per CAN/CSA G40.20/G40.21 interlocking type. Selection properties to suit design.

.8 Lumber

.1 Graded lumber, sound, straight, free from cracks, shakes, large or loose knots. Use planks for sheeting, tongued and grooved, or grooved and splined as required.

.9 Drypack Concrete Fill Behind Lagging

.1 Concrete in accordance with Section 03 30 00 – Cast-in Place Concrete suitable for filling all voids behind lagging with a 28-day compressive strength of 20 MPa.

PART 3 EXECUTION

3.1 GENERAL

.1 Before work begins, inspect conditions upon which work depends. Inform the Engineer, in writing, of conditions not identified.

.2 Protect adjacent structures, utilities, pipelines, or other foundations on or below grade from damage and/or displacement.

.3 Monitor and control vibration of existing structures in accordance with Section 02 23 40 – Vibration Monitoring.

.4 Monitor settlements of existing structures.

3.2 COLD WEATHER PROTECTION

.1 Between the 15th of October of any year and the 15th of April of the following year, provide on hand and ready for use all equipment necessary for adequate cold weather protection.

.2 Provide sufficient insulation, and heat as necessary, to prevent freezing of frost susceptible soil behind temporary shoring works.

.3 When providing heat, do not dry out sensitive soils such as clays.

3.3 PLACEMENT - GENERAL

.1 Retain Professional Engineer responsible for design and supervision of construction of temporary/permanent retaining structures to verify that Work is carried out in conformance with the design. Retained engineer to provide written acceptance of “As Constructed” shoring before excavation is occupied.

.2 Prior to commencing excavation in any area protected by temporary shoring, the shoring engineer shall provide written certification that the shoring has been constructed in accordance with the approved drawings as amended by field instruction. This requirement will not apply to trench boxes.

.3 Do not place any part of shoring and bracing systems until permission by the Engineer has been given to proceed.

.4 Have shoring systems installed by personnel with demonstrated competence and experience in this type of work.

.5 Provide and set all excavation, shoring and bracing necessary to prevent cave-in of banks and excavations.

.6 For installation of sheets, select driving hammer equipment suitable for the soil conditions. The driving equipment shall not exceed the vibration limits transmitted to adjacent structures established in Section 02 23 40 – Vibration Monitoring.

.7 Install shoring so that there is no loose material or voids between shoring and sound undisturbed soil.

.8 Set all shoring to a true vertical and to dimensions and elevations indicated on shop drawings.

.9 Do not encase any part of temporary structure in the structural concrete of the permanent structure without written permission from the Engineer.

.10 If bracing members, such as walers, etc., are to be removed during construction, timing and procedure for removal shall not induce stresses in permanent structures. Submit removals plan to Engineer for review.

3.4 SECANT PILE WALLS

.1 Excavation and construction methods shall result in minimum disturbance of surrounding material. The Contractor shall be required to drill through any boulders and rock encountered in the excavation boring.

.2 The sides of all borehole shall be kept intact and no loose material shall be permitted to fall into the bottom of the boreholes. The Contractor's boring equipment shall be able to sink a steel casing to support the sides of all boring.

.3 The Contractor shall be responsible for the program and sequence of construction which is dependent on the rate of gain of strength of primary piles affects the time within which secondary piles can be formed. The concrete mix may include additives to control the rate of gain of strength, particularly the primary piles. Where the Contractor considers that alternative proposals for the concrete mix are required then evidence of trial mixes should be provided.

.4 Concrete to be placed under high groundwater table shall be using a tremie method of concreting in accordance with CSA A23.1/A23.2.

.5 The caissons shall be socketed with a minimum of 1000mm below the sound bedrock elevation.

3.5 SOLDIER PILES AND LAGGING

.1 Install soldier piles to dimensions and elevations indicated on shop drawings. If soldier piles are installed in predrilled holes, fill void around piles with a lean concrete mix before commencing excavation.

.2 Install walers and/or ringwalers, struts and bracing for soldier piles as excavation proceeds and follow behind as closely as possible with lagging installation. Install lagging to bottom of excavation at the end of each day's work.

.3 Wedge lagging tightly against firm soil at all points. Prevent migration of soil particles through joints in lagging.

.4 If soil has been loosened, remove it and fill void with dry pack concrete rammed tightly between the lagging and firm soil.

.5 Fill all voids between lagging and firm soil with dry pack rammed tightly in place.

.6 If bracing members, such as walers, etc., are to be removed during construction, timing and procedure for removal shall not induce stresses in permanent structures or bracing members in excess of those allowed by applicable codes.

3.6 LINER PLATES

.1 Excavate to depth of one (1) ring and place liner plates, set first ring true to circle and vertical position.

.2 Excavate for next ring and place liner plates. Do not excavate further ahead of liner in place than the width of one ring.

.3 Grout voids between liner plates and ground, by means of a grout pump. Frequency of grouting to suit conditions but not less frequent than after every second ring has been placed. Do not leave any ring ungrouted overnight.

.4 Do not leave the sides of the excavation exposed below the liner plates at the end of the day's work.

.5 Provide reinforcing at openings as required by the design.

3.7 STEEL SHEET PILING

.1 Provide temporary guide frames and bracing to hold sheet piles in proper alignment during setting and driving. Install piling to dimensions and elevations indicated on shop drawings.

.2 Install walers and bracings so not to interfere with reinforcing bars or other parts of permanent structures.

.3 Splices in walers shall develop full strength of member in bending, shear and axial compression.

.4 If bracing members, such as walers, etc., are to be removed during construction, timing and procedure for removal shall not induce stresses in permanent structures or in steel sheet piling or bracing members in excess of those allowed by applicable codes.

.5 Leave sheeting in place unless otherwise specified.

3.8 CLOSED SHEETING FOR TRENCHES

.1 Provide and install braced closed sheeting where required for trench construction.

.2 Sheeting system shall be adequate for all loading and pressures and for surcharge effects due to construction equipment and materials in accordance with the provision of The Occupational Health and Safety Act, and The Ontario Building Code.

.3 Where sheeting is to be left in place, the top shall be cut off 1.2 m below grade or as directed.

3.9 MONITORING DEFLECTION/SETTLEMENT OF EXISTING INFRASTRUCTURE

.1 Monitor deflection of shoring systems that retain materials providing support for adjacent foundations at higher levels at least daily. Verify that measured deflections are within design tolerances.

.2 Monitor deflection/settlements at each corner and center of existing structures daily. Report to the Engineer immediately if specified settlement limits are exceeded. Monitor and control vibration.

.3 Monitor the following structures:

.1 Existing Digester Complex

.4 Submit written records of settlement and deflection result to the Engineer weekly.

3.10 SHORING REMOVALS

.1 When footings, walls, slabs and other foundations are in place and backfilling near completion to existing grade, cut down and remove the tops of piles and lagging to a minimum of 1200 mm below finished grade.

.2 Remove shoring as shown on the drawings where necessary to construct new foundation.

3.11 NOTIFICATION

.1 Give the Engineer advance notice of shop fabrication, field installation and other phases of the work to allow the Engineer reasonable opportunity to inspect the work for compliance with contract requirements. Failure to meet this requirement may be a cause for the Engineer to classify the work as defective.

3.12 DEFECTIVE MATERIALS AND WORK

.1 Where factual evidence exists that defective work has occurred or that work has been carried out incorporating defective materials, the Engineer may have tests, inspections or surveys performed, analytical calculations of structural strength made, and the like, in order to help determine whether the work must be replaced. Tests, inspections or surveys or calculations carried out under these circumstances will be made at the Contractor’s expense, regardless of their

results, which may be such that, in the Engineer's opinion, the work may be acceptable.

.2 All testing shall be conducted in accordance with the requirements of the Ontario Building Code and in accordance with the standards given by the Engineer.

.3 Materials or work which fail to meet specified requirements may be rejected by the Engineer whenever found at any time prior to final acceptance of the work regardless of previous inspection. If rejected, defective materials or work incorporating defective materials or work shall be promptly removed and replaced or repaired to the satisfaction of the Engineer, at no expense to the Owner.

END OF SECTION

GEOTEXTILES

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 31 05 16 – Aggregate Materials

.2 Section 31 23 19 – Dewatering

.3 Section 31 32 25 – Erosion and Sedimentation Control

1.2 SECTION INCLUDES

.1 Supply and placement of geotextile fabric to be used for rip-rap, subdrains, slope protection and silt fences as required.

.2 All geotextiles are to conform to Ontario Provincial Standard Specification (OPSS) 1860.

1.3 REFERENCE STANDARDS

.1 CAN/CSA-G40.21-04, Structural Quality Steel.

.2 CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.

.3 CAN/CGSB-4.2 No. 11.1-94, Textile Test Methods - Bursting Strength - Diaphragm Pressure Test

.4 CAN/CGSB-4.2 No. 14-2005, Textile Test Methods - Quantitative Analysis of Fibre Mixtures

.5 CAN/CGSB-148.1-M (Complete Set), Methods of Testing Geosynthetics.

.6 OPSS 577-2006, Construction Specification for Temporary Erosion and Sediment Control Measures.

.7 OPSS 1860-2004, Material Specification for Geotextiles.

.8 ASTM D4491-99a(2004)e1, Standard Test Methods for Water Permeability of Geotextiles by Permittivity.

.9 ASTM D4595-05, Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method

.10 ASTM D4751-04, Standard Test Method for Determining Apparent Opening Size of a Geotextile.

1.4 DELIVERY AND STORAGE

.1 Protect geotextiles during delivery and storage at the site from direct sunlight, ultraviolet rays, excessive heat, mud, dirt, dust, debris and rodents at all times.

PART 2 PRODUCTS

2.1 MATERIAL

GEOTEXTILES

.1 Geotextile: synthetic fibre fabric, supplied in rolls.

.1 Composed of: minimum 85% by mass of polypropylene, polyester, or polyethylene with inhibitors added to base plastic to resist deterioration by ultra-violet and heat exposure.

.2 Meet Owner requirements and Engineer approval.

.2 Geotextile for use with rip-rap

.1 Non-woven Type II.

.2 Thickness: to CAN/CGSB-148.1, No. 3, minimum 2.3 mm.

.3 Mass per unit area: to CAN/CGSB-148.1 No. 2, minimum 180 g/m².

.4 Grab tensile strength and elongation: to CAN/CGSB-148.1, No. 7.3.

.1 Breaking force: minimum 660 N, wet condition.
.2 Elongation at failure: minimum 15%.

.5 Bursting strength: to CAN/CGSB-148.1, No. 6.1 minimum 2.2 MPa, dry condition.

.6 Apparent opening size (AOS): to ASTM D4751, 50 to 100 micrometers.

.7 Permeability: to CAN/CGSB-4.2, No. 11.1, 2.7 x 10 cm/s.

.3 Geotextile for use in subdrains:

.1 Non-woven Type II.

.2 Mass per unit area: to CAN/CGSB-148.1 No. 2, minimum 180 g/m².

.3 Tensile strength and elongation (in any principal direction):

.1 Grab tensile strength; to CAN/CGSB-148.1 No. 7.3-92; minimum 440 N, wet condition.
.2 Elongation at break; minimum 70%.
.3 Seam strength; equal to or greater than tensile strength of fabric.
.4 Mullen burst strength: to CAN/CGSB-4.2 No. 11.1; minimum 1.4 MPa
.5 Filtration opening size (FOS); to ASTM D4751, 50-150 micrometers.
.6 Permeability; to CAN/CGSB - 4.2 No. 11.1: 2.0 x 10 cm/s.

.4 Geotextile for use in silt fences:

.1 Physical properties; to OPSS 577 and 1860, Class I, woven, FOS 105-210 micrometers.

.2 Bursting strength; to CAN/CGSB-148.1, No. 6.1, minimum 1.8 MPa.

.3 Slurry flow rate; maximum 25 L/min/m².

.4 Sediment retention efficiency; 75% minimum.

.5 Geotextile for slope protection:

.1 Open web; non-woven type polymer web.

.2 Cell area; 1000 cm².

.3 Cell height; 100 mm

.4 Weight; 350 g/m² minimum.

.5 Thickness; 1.9 mm minimum.

.6 Tensile strength; to ASTM D4595, 1.9 kN/100 mm minimum.

.7 Elongation break; to ASTM D4595, 30% minimum.

.8 Color; green or black, ultraviolet resistant.

.6 Securing pins and washers: to CAN/CSA-G40.21, Grade 300W, hot-dipped galvanized with minimum zinc coating of 600g/m² to CAN/CSA-G164.

.7 Wood posts for light duty Silt Fences: spruce, size 50 mm x 100 mm x 2200 mm long, pointed on one end for driving into ground.

.8 Staples for wood posts of Silt Fences:

.1 Crown width; 25 mm.

.2 Leg; 25 mm.

.3 Gauge; 1.25 mm.

.9 Steel posts for heavy duty Silt Fences: light weight galvanized steel T-Bar section not less than 37.5 mm x 37.5 mm x 2200 mm long.

.10 Tie Wire Fasteners for steel posts: vinyl coated, single strand, aluminum coated on galvanized steel wire, 5 mm diameter or other tie wire or strap approved by Engineer.

.11 Stretching wire for Silt Fences: not less than 3.4 mm diameter (9 gauge), galvanized wire.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Place geotextile material by unrolling onto graded surface in orientation, manner and at locations required in accordance with manufacturers instructions.

.2 Place geotextile material smooth and free of tension, stress, folds, wrinkles and creases.

.3 Place geotextile material on sloping surfaces in one continuous length from toe of slope to upper extent of geotextile.

.4 Overlap each successive strip of geotextile 500 mm over previously laid strip.

.5 For use with rip-rap, pin successive strips of geotextile with securing pins at 300 mm interval at mid-point of lap.

.6 Protect installed geotextile material from displacement, damage or deterioration before, during, and after placement of material layers.

.7 After installation, cover with overlying layer within four (4) hours of placement.

.8 Replace damaged or deteriorated geotextile to Contact Administrator's approval.

3.2 PROTECTION

.1 No vehicles permitted directly on geotextile.

3.3 INSTALLATION OF SILT FENCES/EXCLUSION FENCING

.1 Install silt fences to manufacturer's installation instructions and in accordance with OPSD 219.130 or as directed.

.2 Fences are to fully surround construction area to prevent silt migration to adjacent areas, or as directed.

.3 Fence posts:

.1 Install wood posts for fences for use in construction to be completed during one year or season after which fence is intended to be removed, as directed.

.2 Install steel posts for fences for use in construction to be completed over multiple seasons or years and where fences are required to remain in place during this extended period.

.4 Drive wood or steel posts into ground to a depth of 1200 mm as shown. Provide adequate protection in order that wood posts do not splinter during driving and that steel posts do not warp or get damaged.

.5 Spacing for fence stakes or posts:

.1 Intermediate stakes: Not more than 1500 mm on center.

.2 End Stakes and stakes at curves: Not more than 750 mm on center.

.6 Install geotextile fabric on side facing the flow and staple well taut to wood posts. Staples, not less than 4 per stake. Use not less than 4 tie wires for steel posts. Fabric to be embedded under ground and anchored in trench as shown. Trench to be well backfilled and compacted.

.7 Return the ends of the erosion control fencing with a J-Turn as indicated to complete the exclusionary function of the fence as indicated.

.8 Install stretch wire at the top of posts for the full length of fence and ensure that wire is well set in place to provide stability for fence. Wrap fabric around wire and tie at two points between posts.

.9 Construct an open silt collection swale, not less than 600 mm wide and 300 mm deep, on the side facing the flow and adjacent to the full extent of silt fence, as shown. Swale to be not less than 800 mm away from fence to permit removal of silt without disturbing or damaging fence.

.10 Silt fences are to be maintained for the full duration of the project and shall not be removed until all construction is completed on site.

.11 Maintain silt fences as specified in the Erosion and Sediment Control specification, Section 02370.

3.4 REMOVAL

.1 Remove silt fences including geotexiles and dispose of off-site when the project is complete and after receipt of approval from the Engineer.

END OF SECTION

EROSION AND SEDIMENTATION CONTROL

PART 1 GENERAL

1.1 OBJECTIVES

.1 Prevent the loss of soil from construction site resulting from storm water runoff, wind erosion and construction activities.

.2 Prevent the sedimentation of storm sewers and receiving waters.

.3 Prevent air pollution caused by dust and particulate matter.

.4 Prevent negative impacts on the Napanee River. The Napanee River is fish habitat and is not to be negatively impacted by construction operations.

1.2 DESCRIPTION OF WORK

.1 Implement the Erosion and Sedimentation Control (ESC) measures shown on the project drawings and described in these specifications.

.2 Install ESC products in accordance with contract drawings.

.3 Inspect ESC measures on a weekly basis and following all significant storm events. If deficiencies are found, make repairs within 24 hours of detection.

.4 Maintain an ESC inspection log to document observations, deficiencies and corrective actions.

1.3 RELATED REQUIREMENTS

.1 Section 31 05 16 – Aggregate Materials

.2 Section 31 23 19 – Dewatering

.3 Section 31 32 19 – Geotextiles

1.4 REFERENCES

.1 Contract Section 8: Natural Heritage Assessment Report provides requirements for the erosion and sediment control measures as well as the avoidance and mitigation measures to prevent contravention of the Endangered Species Act which shall be followed by the Contractor in execution of the Contract.

.2 MECP – Exclusion Fencing https://www.ontario.ca/page/reptile-and-amphibian-exclusion-fencing#:%7E:text=Concrete%2C%20metal%20or%20vinyl%20exclusion,concrete%20wall%20for%20complete%20exclusion

.3 U.S. Environmental Protection Agency, Office of Water. “Chapter 3: Sediment and Erosion Control” and Chapter 4: Other Controls”. Document No. EPA 832-R-92-005 Storm Water Management for Construction Activities.

.4 Canada Green Building Council. “Sustainable Sites Prerequisite 1: Erosion and Sedimentation Control”. Leadership in Energy and Environmental Design Reference Package for New Construction and Major Renovations (LEED® Canada-NC) Version 1.0.

.5 Ontario Provincial Standard Specifications/Drawings (OPSS/D)

1.5 SUBMITTALS

.1 Inspection Checklist – Schedule A procedures

.1 Prepare the checklist to include all measures shown on the drawings and described in the specifications.

.2 Complete a new checklist with each inspection and keep completed checklists with the weekly inspection log documentation.

.2 Weekly Inspection Log – Schedule B

.1 Complete the log on a weekly basis and keep all documentation on-site and available for review by the Owner's Representative.

.2 The inspection log shall be completed for each inspection, and must document deficiencies for all measures indicated as "Not OK" on the inspection checklist.

.3 Each deficiency must be initialled and each log signed, only after all corrective measures have been completed and documented.

.4 Submit all ESC documentation (e.g.: inspection checklists and inspection log) to the Owner's Representative after final landscaping is completely installed.

.3 Photographs:

.1 A minimum of three (3) digital photographs shall be taken (from various viewpoints) of each ESC measure implemented on-site immediately following installation.

.2 A minimum of three (3) digital photographs shall be taken (from various viewpoints) of ESC measure implemented on-site at the end of construction or prior to dismantling, whichever comes first.

.3 Submit all digital photographs to Contract Administrator for documentation within seven (7) days of being taken.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Geotextile: Type II Non-woven as per OPSS 1860

.2 Straw Bales and Silt Fencing as per OPSD 219.180 and 219.130.

.3 Rock Check Dams as per OPSD 219.210.

PART 3 EXECUTION

.1 General Practices:

.1 Stabilized Construction Entrance (SCE)

.1 Construct an SCE before construction begins at every point where traffic leaves the site and enters onto a public road and/or any unpaved entrance/exit location where there is a risk of transporting mud or sediment onto paved roads.

.2 The SCE must be at least 3.65 m wide, with room for two vehicles to pass at high traffic areas, and constructed from 50 mm diameter clear stone, 150 mm diamater rip rap, and filter fabric with the following characteristics:

.1	Grab Tensile Strength:	100 kgs
.2	Elongation Failure:	60%
.3	Mullen Burst Strength:	195 kgs
.4	Puncture Strength:	57 kgs
.5	Equivalent Opening:	Size 40-80 (US std sieve)

.2 Site Arrangement

.1 All construction trailers and equipment shall be positioned to reduce the disturbance of site. They shall be located close to the current phase of construction to minimize traffic damage to the site.

.3 Material Stockpiling

.1 If material in stockpile will not be used within 14 days, it must be stabilized using one of the following measures:

.1 Temporary Seeding
.2 Tarps
.3 Compaction
.4 Surface Roughening

.4 Install ESC products in accordance with manufacturer instructions and the prescribed installation procedures in the referenced EPA document.

.2 Stabilization Practices

.1 Preservation of Natural Vegetation

.1 Establish construction boundaries to limit site disturbance to 12m beyond the building perimeter, 1.5 m beyond primary roadway curbs, walkways and main utility branches and 7.6 m beyond parking areas. Refer the to attached Natural Heritage Report for separation distances to the natural environment along the southern property boundary.

.2 Stakes shall be used to indicate limits of construction, grading and disturbance. Trees shall be clearly marked to be preserved and protected from the ground disturbances around the base.

.2 Buffer Zones

.1 Incorporate vegetated strips of land on floodplains, next to wetlands, along stream banks and on steep, unstable slopes to decrease the velocity of storm water runoff, preventing soil erosion.

.2 May be an area of vegetation left undisturbed during construction, or it can be newly planted. New strips require establishment of permanent seeding and planting.

.3 Soil Retaining Measures

.1 Use skeleton sheeting, continuous sheeting or permanent retaining walls to hold in place loose or unstable soil where other soil retaining methods are not practical.

.4 Permanent Seeding

.1 Shall be applied to any graded or cleared area as specified on landscaping plan.
.2 Plant native species of grass, trees and shrubs during favourable growth conditions; for areas outside of construction activity preferably within 3 weeks of construction start.
.3 Species shall not require permanent irrigation after the first two years or fertilizers containing phosphorus. Species must not be invasive.
.4 Use topsoil on areas where topsoil has been removed, where soil is dense or impermeable, or where mulching and fertilizers alone cannot improve soil quality. Make topsoil layers at least 150 mm deep or similar to the existing topsoil depth.

.3 Structural Practices

.1 Silt Fence/ Exclusion Fencing

.1 Construct posts with filter fabric media to remove sediment from storm water volumes flowing through the fence as well as to create an exclusionary fence to isolated the work areas from amphibians.
.2 Provide J-returns at all terminal ends of the fencing.
.3 The lower edge of the fence is to be vertically trenched and covered by backfill.
.4 Filter fabric should be a pervious sheet of polypropylene, nylon, polyester, polyethylene or equivalent and have the following characteristics:

.1	Filtering Efficiency:	75%-85% (minimum)
.2	Tensile Strength at 20% kg/mm (max) Elongation kg/mm	Standard Strength – 0.54 Extra Strength – 0.89
.3	Slurry Flow Rate	15.0 L/m2/min (min)

.2 Outlet Protection

.1 Install stone, riprap, concrete aprons, paved sections or settling basins at all pipe, interceptor dike, swale or channel outlets where the velocity of flow may cause erosion or pools at the outlets of an ESC measure.

.3 Inlet Protection

.1 Install stone, concrete masonry units and stone, filter fabric or slit fences around catch basins and manhole covers to prevent silting of inlets, storm drainage systems or receiving channels.

.4 Check Dams

.1 Install check dams in steeply sloped swales or in swales where adequate vegetation cannot be established, and only in small open channels which will not overflow once dams are constructed.

.2 Construct small, temporary or permanent dam of stone, straw bales, logs or pea gravel-filled sandbags across a drainage ditch, swale of channel to slow water flow and allow suspended sediment to settle.

.5 Drainage Swale

.1 Construct a channel with a lining of vegetation, riprap, asphalt, concrete or other material to convey runoff from the bottom or top of a slope.

.2 Intercepted runoff shall be diverted to an appropriate outlet with sediment trap if required; swale shall have a positive grade with no dips to collect water.

.3 Swale shall be lined using geotextiles, grass, sod, riprap, asphalt or concrete – based on the volume and velocity of the runoff.

.6 Gravel or Stone Filter Berm

.1 Construct a temporary ridge of loose gravel, stone or crushed rock to slow filter flow and divert it from exposed traffic in areas with gentle slopes and traffic.

.7 Sediment Trap

.1 Excavate a pond area or construct earthen embankments to allow for settling of sediment from storm water volumes.

.2 Incorporate temporary seeding, mulching and/or earth dike per installation procedures to reduce erosion of banks.

.3 Use a sediment trap for small drainage areas, no more than 2 hectares (5 acres).

.8 Temporary Sediment Basin

.1 Use sediment basins for areas larger than 2 hectares (5 acres).

.2 Construct a pond with a controlled water release structure to allow for settling of sediment from water volumes.

.3 Construction shall occur before any clearing and grading occurs, and must not be built on an embankment in an active stream.

.4 Incorporate temporary seeding, mulching and/or earth dike per installation procedures to reduce erosion of banks.

.5 Outlet pipe and spill way shall be designed by Owner's Representative based on an analysis of the expected runoff flow rates from the site.

.9 Subsurface Drains

.1 Place a perforated pipe or conduit beneath the surface of the ground at a designed depth and grade to drain an area with high water table.
.2 Use relief drains in a gridiron, herringbone or random pattern to dewater an area where the water table is high.
.3 Place interceptor drains, as single pipes, to remove water where sloping soils are excessively wet or subject to slippage.
.4 Backfill with open granular, highly permeable soil immediately after pipe is placed.
.5 Stabilize outlet and ensure sediment-laden storm water runoff is directed to a sediment trapping measure.

3.2 INSPECTIONS AND MAINTENANCE

.1 Inspection procedures specified below summarize the EPA document and shall be followed in conjunction with details, drawings and manufacturer requirements.

.2 Inspect all control measures at least once each week (unless otherwise noted) and following any significant storm (13 mm of precipitation or greater). Complete the inspection log for each inspection, and keep in an accessible location on site until all corrective measures have been documented. Submit each completed log to the Owner's Representative for review.

.3 Maintain all measures in good working order. If a repair is necessary, initiate within 24 hours of report.

.4 Stabilized Construction Entrance: Apply additional gravel as required, remove sediments and other materials from all areas to minimize clogging. Keep adjacent public roadway(s) free from sediment.

.5 Site Arrangement: Verify that movement of construction equipment to appropriate area occurs at the same time as movement of construction activities.

.6 Material Stockpile: Inspect for effective prevention of runoff and erosion. Remove built-up sediment from silt fence when it has reached 1/3 the height of the filter fabric.

.7 Preservation of Natural Vegetation: Routine maintenance shall include mowing, fertilizing, liming, irrigating, pruning and weed and pest control, depending on the specific species and environmental conditions. Remove any debris and ensure area is protected from traffic.

.8 Buffer Zones: Routine maintenance shall include mowing, fertilizing, liming, irrigating, pruning and weed and pest control, depending on the specific species and environmental conditions. Remove any debris and ensure area is protected from traffic.

.9 Soil Retaining Measures: Inspect for structural damage and repair as required.

.10 Permanent Seeding: Inspect for sufficient growth and water conditions. Replant areas if cover does not provide erosion control.

.11 Silt Fence: Silt fence to be inspected for depth of sediment, tears, loose fabric attachment at fence posts, channel erosion beneath fence, sagging or collapse,

and to ensure the fence posts are firmly in the ground. Built-up sediment is to be removed from silt fence when it has reached 1/3 the height of the fence. Repair such that fence is in original installation condition.

.12 Outlet Protection: Inspect for erosion and pooling of water. Necessary repairs to be made as required to reduce exit velocity of runoff. If a riprap apron is used, inspect for riprap displacement and damage to filter fabric.

.13 Inlet Protection: Inspect that measures are in original installed condition. Ensure measures are effectively trapping sediment. Remove accumulated sediment and debris when it reaches ½ the design depth of the trap. Repair protection measures as required.

.14 Check Dams: Inspect for sediment and debris accumulation and erosion of sides. Sediment should be removed when it reaches ½ the original dam height. Repair dam as required.

.15 Drainage Swale: Inspect for dips or low points along the swale where water is pooling and ensure that runoff is being directed to sediment-trapping measure used onsite.

.16 Gravel or Stone Filter Berm: Inspect for breach in structure caused by vehicles, and accumulated sediment. Replace filter material if needed and remove and properly dispose of accumulated sediment.

.17 Temporary Sediment Basin/ Sediment Trap: Remove sediment when it reaches 300 mm in depth. If outlet becomes clogged with sediment it must be cleaned to restore flow capacity. Maintain until site area is permanently stabilized and/or permanent structures are in place. Ensure bank is sufficiently compacted and stabilized such that erosion into basin does not occur.

.18 Subsurface Drains: Inspect pipe for breaks or clogging by sediment or debris. Remove blockage immediately, replace any broken sections and restabilize the surface. Check inlets and outlets for sediment or debris, and remove and dispose of these materials properly.

3.3 REMOVAL OF PRODUCTS

.1 ESC measures shall not be removed and shall be fully inspected and maintained until final landscaping is complete.

Inspection Checklist – Schedule A

Project Name: _____

Completed By: _____

Date: _____

During Construction: Contractor to complete this Inspection Checklist ***once a week*** as per the ESC Specification. For each measure, check the "OK" box if there are no repairs or maintenance required; check the "Not OK" box if attention is required as per the inspection/maintenance procedures in the ESC specification.

For all measures marked as "Not OK", the Inspection Log must be completed. List the measures that are deficient in the "Deficiencies" column on the Inspection Log, and record the maintenance performed. Submit both the Inspection Checklist and Inspection Log to the Contract Administrator after all maintenance activities have been completed and recorded.

OK	Not OK	Location on Site	Measure

Inspection Log – Schedule B

Erosion & Sedimentation Control Weekly Inspection Log

Log Start Date: _____

Log End Date: _____

Log Completed By: _____

Company: _____

Telephone No.: _____

Inspection Date	General Observations (ie: seasonal conditions)	Location & Deficiency of ESC Measure	Corrective Measures	Initials

I hereby certify that the information provided is complete, correct and complies with the requirements of EPA Best Management Practices.

Signature	Title	Date

END OF SECTION

RIGID INCLUSION COLUMN GROUND IMPROVEMENT

PART 1 GENERAL

1.1 SCOPE OF WORK

.1 Provide all labour, equipment, material, and supervision to design and install a Rigid Inclusion Column (RIC) Ground Improvement System to support the raft slab foundation of the proposed structures presented in the Contract Drawings.

.2 Design shall rely on subsurface information presented in the project geotechnical and hydrogeological reports.

.3 RIC designer is responsible for designing an engineered pad system referred to as Load Transfer Platform (LTP) necessary to transfer loads between the improved soil and the underside of the raft foundation and/or any other structural elements requiring support.

.4 General contractor is responsible for site layout of control points and elevation benchmarks, construction and maintenance of LTP, footing excavation, subgrade preparation and disposal of spoils generated from the installation of the Rigid Inclusion Column Ground Improvement System.

1.2 RELATED SECTIONS

.1 DIVISION 1 – GENERAL REQUIREMENTS

.2 31 05 16 – Aggregate Materials

.3 Section 31 23 33 - Excavating, Trenching and Backfilling

.4 Section 02 23 40 – Vibration Monitoring

1.3 REFERENCES

.1 ASTM D422-63 (2007) – Standard Test Method for Particle-size Analysis of Soils

.2 ASTM D1143/D1143M-20 - Standard Test Methods for Deep Foundations Under Static Axial Compressive Load

.3 ASTM D1241-15, - Standard Specification for Materials for Soil-Aggregate Subbase, Base, and Surface Courses.

.4 Canadian Foundation Engineering Manual, 5th Edition, 2023.

.5 CSA A23.1/A23.2-19 - Concrete Materials and Methods of Concrete Construction / Test Methods and Standard Practices for Concrete.

.6 Ontario Building Code 2012 w/ latest amendments.

1.4 PAYMENT PROCEDURES

.1 This is a lump sum Contract, and payment will be made for work completed during the payment period.

1.5 GEOTECHNICAL AND HYDROGEOLOGICAL INVESTIGATIONS

.1 Geotechnical and Hydrogeological investigations of the site have been made and is provided as part of the Bid Documents.

.2 This information is given solely as a guide. No responsibility is accepted by the Owner or Consultant for its correctness, nor shall its accuracy affect the provisions of the contract.

1.6 SUBMITTALS

.1 Submit the following documentation for review at least three (3) weeks prior to the beginning of RIC construction.

.1 Reference projects as required in clause **Error! Reference source not found.**.

.2 installer's and designer's qualifications as required in clause **Error! Reference source not found.**.

.3 Drawings: General arrangement and detail drawings showing layout, location and number of each RIC element including corresponding depths below cut grade. These shall be prepared and sealed by a Professional Engineer, licensed in the Province of Ontario.

.4 Calculations: All computer-generated calculations and hand calculations shall be prepared and sealed by a Professional Engineer, licensed in the Province of Ontario.

.5 Concrete and Grout: Submit the concrete and grout mix design selected by the RIC Designer.

.6 Installation Work Plan: Complete description of the methods to install the RIC system including excavation procedures, sequence, liners, working elevations, concrete placement, improvement techniques, equipment to be used and spoils disposal. Do not proceed with work until methods have been reviewed by the Consultant.

.7 Quality Control Plan: The quality control test program for the RIC system, meeting the design requirements.

.8 Load Transfer Platform / Drill Rig Work Platform Engineering Report: Engineering report with drawings stating where the drill rig will travel and sit, its weight, the soils it sits on are stable and the requirements and construction of working pads under the drill rig. The report shall be by a Professional Engineer, licensed in the Province of Ontario.

.2 Submit the following during RIC construction:

.1 Daily RIC Progress Reports: The General Contractor shall have available a complete and accurate record of RIC installation prepared by the RIC

installer. The record shall indicate the location, length and volume of concrete used during installation, and final elevations or depths of the base and top of elements. The record shall also indicate the type and size of the installation equipment used, and the type of concrete used. The installer shall immediately report any unusual conditions encountered during installation to the RIC Designer, Owner, General Contractor and Consultant.

.2 Certification that the RIC system has been designed and installed in general conformance with the Contract Documents. All submitted certification and letters shall be stamped by a Professional Engineer, licensed in the Province of Ontario.

.3 Sacrificial load test reports.

.4 Concrete testing results.

.3 As-built drawings: As-built drawings showing the final locations and depth of the rigid inclusion elements geolocated with northings and eastings sealed by a Professional Engineer licensed in the Province of Ontario.

1.7 QUALIFICATIONS REQUIREMENTS

.1 The RIC Installer shall have at least 10 years' experience with the rigid inclusion column ground improvement being employed and shall have completed at least thirty (30) rigid inclusion projects in Canada and shall be able to demonstrate having completed projects in Ontario of similar scope in similar soil types using Ground Improvement.

.2 The RIC Designer shall have experience designing rigid inclusion column ground improvement for minimum of 10 years.

.3 Installers should have successfully completed a minimum of ten (10) WTP/WWTP Ground Improvement projects in Canada and have successfully completed on ground improvement projects in the Napanee Region. References to be provided at time of tender.

.4 The ground improvement Contractor shall provide three (3) references for projects for the method being employed, having a minimum total construction value of $5,000,000. The projects shall have the following:

.1 Similar types of soil conditions. Geotechnical reports to be included.

.2 Similar types of ground improvement systems supporting raft slab foundation.

.3 At least one example project that have been constructed in the Napanee Region.

1.8 QUALITY ASSURANCE

.1 The RIC installer shall have a full-time, on-site Quality Control Technician to verify and report all installation procedures. The Installer shall immediately report

any unusual conditions encountered during installation to the RIC Designer and to the General Contractor.

.2 Independent Inspection and Testing

.1 The Consultant will appoint the independent inspection and Testing Firm to make inspections or perform tests as the Consultant directs. The independent inspection and testing firm shall be responsible only to the Consultant and shall make only such inspections or tests as the Consultant may direct.

.2 When defects are revealed, the Owner is entitled to be provided with additional inspection or testing to ascertain the full extent of the defect, at the Contractor's expense.

.3 Load Test Requirements:

.1 A static load test(s) is performed on a sacrificial RIC element(s) to verify the design assumptions. The RIC designer shall provide a description of the installation equipment, installation records, complete test data, analysis of the test data and verification of the design parameter values. Static Load Test Procedures shall utilize appropriate sections of ASTM D1143-Quick Test. The report shall be prepared under direction of a Registered Professional Engineer in the Province of Ontario.

.2 In the event of unsuccessful tests, the RIC designer shall re-design the rigid inclusion foundation system and perform additional sacrificial tests until the design assumptions are verified. Re-design of the rigid inclusion column ground improvement system and additional load tests shall be included in the lump sum price of this section.

.4 Concrete Sampling and Testing:

.1 Concrete shall be sampled and tested. The sampling and testing are typically performed by an external certified technician retained by the Contractor. Each concrete truck load shall be tested for slump. For compressive strength testing, 4 cylinders shall be made per 115 cubic metres or once per day, whichever is more frequent. For every 250 RIC elements, a minimum of one set of 4 cylinders shall be tested to obtain 4, 7, 14, and 28 day strengths. For projects requiring less than 250 RIC elements, one set of 4 cylinders shall still be tested for 4, 7, 14, and 28 day strengths. The four-day break may be omitted at the RIC designer's discretion.

.2 Compressive test results shall be shared with the Consultant and the Owner.

1.9 DELIVERY, STORAGE, AND HANDLING

.1 Deliver and store materials on Site in accordance with CSA A23.1/A23.2

PART 2 PRODUCTS

2.1 DESIGN AND PERFORMANCE REQUIREMENTS

.1 Rigid Inclusion Column Design:

.1 The construction methods by which the ground improvement is achieved is the responsibility of the RIC Designer and is summarized in, but not limited to, the following points:

.1 The design of the rigid inclusion system shall be based on the service loads, and the allowable total and differential settlement criteria of all structural elements in accordance with generally accepted engineering practice and the methods.

.2 The RIC system shall be designed in accordance with engineering standards and the methods described in these Specifications. The design life of the structure shall be eighty (80) years.

.3 Design of an engineered granular pad, also referred to as Load Transfer Platform (LTP) for the equipment rig is to be included as part of the overall design of the ground improvement system. The LTP must extend at least 3.0 m from the extents of the foundation footprint.

.4 Design for the LTP shall consider point loads from vehicles, lifts, cranes, etc. and simplifying the point loads as uniformly distributed load is not acceptable.

.2 The design shall meet the following criteria:

Design Bearing Pressure for raft slab supported by RIC System	
Serviceability Limit States (SLS)	150 kPa
Ultimate Limit States (ULS)	225 kPa
Soil Subgrade Modulus	6,000 kPa/m
Estimated Total Long-Term Settlement	≤ 25 mm
Estimated Long-Term Differential Settlement:	≤ 12 mm
Loads from vehicles, lifts, cranes other construction equipment	Refer to Manufacturer's Literature

.3 The RIC elements shall be designed and installed so that they terminate on sound bedrock and do not terminate in any existing fill materials.

2.2 CONCRETE

.1 Concrete shall meet the requirements of CSA A23.1/A23.2.

.2 The mix design for concrete used by the RIC Installer for column construction shall be pre-approved by the RIC Designer.

2.3 ACCEPTABLE DESIGN AND INSTALLATION VENDORS FOR THESE WORKS ARE:

.1 Menard Canada

.2 GeoSolv Design/Build, Inc.

PART 3 EXECUTION

3.1 GENERAL

.1 Should any obstruction be encountered during RIC installation, the element shall be relocated or abandoned as determined by the RIC Designer at no additional expense to the Owner. Obstructions include, but are not limited to, boulders, timbers, concrete, bricks, utility lines, etc., which prevent placing the elements to the required depth, or shall cause the elements to drift from the required location.

.2 Dense natural rock or weathered rock layers or very dense natural soil shall not be deemed obstructions as determined by the RIC Designer, and piers may be terminated short of design lengths on such materials.

3.2 INSTALLATION PROCEDURES

.1 The following sections provide general criteria for the construction of the RIC elements. Unless otherwise approved by the RIC Designer, the installation method used for RIC construction shall be used in the construction of the successful load test.

.2 The RIC system is to be installed using displacement methods.

.3 The RIC system is to be installed using a method generating no vibrations.

3.3 PLAN LOCATION AND ELEVATION OF RIC ELEMENTS

.1 The as-built center of each pier shall be within 150 mm of the locations indicated on the plans. Piers installed outside of the above tolerances are deemed not acceptable, shall be rebuilt at no additional expense to the Owner.

3.4 REJECTED RIGID INCLUSION COLUMNS

.1 RIC elements installed beyond the maximum allowable tolerances shall be abandoned and replaced with new columns, unless the RIC Designer approves the condition or provides other remedial measures. All material and labour required to replace rejected piers shall be provided at no additional cost to the Owner, unless the cause of rejection is due to an obstruction or mis-location and has been approved by the Owner.

3.5 RESPONSIBLITIES OF THE GENERAL CONTRACTOR

.1 Examination and Protection

.1 The General Contractor is responsible for any field visits necessary to familiarize with the site conditions. The Owner will not accept any claims for items the Contractor is deemed to have considered in submission of their bid.

.2 The General Contractor shall locate and protect underground and aboveground utilities and other structures from damage during installation of the RIC elements.

.3 The General Contractor shall provide site access to the Installer, after earthwork in the area has been completed. A suitable working surface shall be established and maintained by the General Contractor to provide positive drainage and wet weather protection of the subgrade and to provide access and stability for efficient operation of the rigid inclusion column installation.

.4 A firm, stable and free draining working surface, as required, shall be included for the installation of the RIC system at no additional cost to the Owner.

.5 Protect installed RIC from freezing temperatures.

.6 Do not disturb RIC surface by construction traffic.

.7 The management and removal of any spoils generated through the installation of the RIC system, is to be completed at no additional cost to the Owner. The General Contractor shall removal spoil from the rigid inclusion column work area in a timely manner to prevent interruption of rigid inclusion column installation.

.8 The General Contractor shall coordinate all excavations made post-RIC installations so that excavations do not encroach on the elements as shown in the RIC construction drawings. Protection of completed elements is the responsibility of the General Contractor. In case that utility excavations are required in close proximity to the installed RIC elements, the General Contractor must contact the RIC Designer immediately to develop construction solutions to minimize impacts on the installed elements.

.9 Site grades for rigid inclusion column installation shall be within 300 mm of the top of footing elevation or finished grade elevation to minimize rigid inclusion column installation depths or as agreed upon between the general contractor and installer. Ground elevations and bottom of footing elevations shall be provided to the rigid inclusion column Installer in sufficient detail to estimate installation depth elevations to within 75 mm.

.2 Load Transfer Platform

.1 The Load Transfer Platform (LTP), as designed by the RIC designer shall be placed by the General Contractor between the tops of the rigid inclusion columns and the bottom of raft slab. A minimum thickness of

300 mm shall be used unless otherwise specified by the designer to be thicker.

.2 The LTP should be constructed as specified by the RIC Designer, and may include geogrid reinforcement, Cement Treated Aggregate, or other special construction techniques.

.3 The LTP material shall consist of a well-graded, crushed aggregate base material. If compaction of this material is problematic, open-graded, 19 mm diameter crushed stone may be substituted provided it is approved by the designer. Geofabrics and geogrids may be used at the discretion of the Geotechnical Engineer of Record (GER) as a compaction aid so that the gravel pad is compacted to a minimum dry density of 98% of the Standard Proctor Maximum Dry Density (SPMDD) value.

.3 Excavation of Footing Bottom

.1 Excavation and surface compaction of all footings is required.

.2 Foundation excavations to expose the tops of RIC elements shall be made in a workman-like manner, and shall be protected until concrete placement, with procedures and equipment best suited to:

.1 Avoid exposure to water,

.2 Prevent softening of the matrix soil between and around the RIC elements before pouring structural concrete, and

.3 Achieve direct and firm contact between the dense, undisturbed RIC elements and the concrete footing.

.3 All excavations for footing bottoms supported by RIC foundations shall be prepared in the following manner. Recommended procedures for achieving these goals are to:

.1 Limit over-excavation below the bottom of the footing to 75 mm (smooth-bucket recommended).

.2 Compaction of surface soil prior to construction of the granular pad shall be prepared using a motorized impact compactor "Jumping Jack," or similar (plate tampers shall only be used in granular soils and when approved by the RIC Designer). Loose or soft surficial soil over the entire footing bottom shall be recompacted or removed, respectively. If excessively soft subgrade soil is present (peat, organic silt) and preventing adequate compaction of the granular layer, a geogrid or other means of stabilizing the subgrade should be used as per direction of the RIC Designer prior to granular pad construction.

.3 Construct granular pad immediately after footing excavation is made and approved, preferably the same day as the excavation. If same day placement of the granular pad is not possible, open excavations shall be protected from surface water accumulation by means of a lean concrete mud-mat. Other methods must be pre-approved by the RIC Designer.

.4 The following criteria shall apply, and a written inspection report sealed by the Independent Testing Agency shall be furnished to the Installer to confirm:

.1 Water (which may soften the unconfined matrix soil between and around the RIC elements and may have detrimental effects on the supporting capability of the RIC reinforced subgrade) has not been allowed to pond in the footing excavation at any time.

.2 All RIC elements designed for each structural element have been exposed in the excavation.

.3 No excavations or drilled shafts have been made after installation of RIC elements within the excavation limits described in the RIC construction drawings, without the written consent of the Installer or RIC Designer.

END OF SECTION

DIVISION 32 INDEX

GRANULAR SUB-BASE

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 31 05 16 - Aggregate Materials.

.2 Section 32 11 16 – Granular Sub-Base

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM).

.1 ASTM C117, Standard Test Method for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing.

.2 ASTM C136, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

.3 ASTM D136, Standard Test Method for Sieve Analysis of Fine and Course Aggregated.

.4 ASTM D698, Stand Test Methods for Laboratory Compaction Characteristics of Soil Using standard Effort (12,400 ft-lbf/ft3)(600 N m/m3).

.5 ASTM D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3) (2,700 kN-m/m3).

.6 ASTM D4318, Standard Test Methods for Liquid Unit, Plastic Unit and Plasticity Index of Soils.

.7 Ontario Provincial Standard Specifications (OPSS) Division 10.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-8.2-, Sieves, Testing, Woven Wire, Metric.

.3 Ontario Provincial Standard Specifications (OPSS)

.1 OPSS MUNI 1010 – Material Specifications for Aggregates – Base, Subbase, Select Subgrade, and Backfill Material

1.3 DELIVERY, STORAGE, AND HANDLING

.1 Deliver and stockpile aggregates in accordance with Section 31 05 16 – Aggregate Materials.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Granular base: material to Section 31 05 16- Aggregate Materials and the following requirements:

.1 Granular ‘B’ Type II to OPSS MUNI 1010

.2 Granular ‘A’ Type II to OPSS.MUNI 1010

2.2 SEQUENCE OF OPERATION

.1 Place granular base after granular sub-base surface is inspected and approved by Contract Administrator.

.1 Construct granular base to depth and grade in areas indicated.

.2 Ensure no frozen material is placed.

.3 Place material only on clean unfrozen surface, free from snow and ice.

.4 Place material using methods which do not lead to segregation or degradation of aggregate.

.5 Place material to full width in uniform layers not exceeding 150 mm compacted thickness.

.6 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.

.7 Remove and replace that portion of layer in which material becomes segregated during spreading.

.2 Compaction Equipment

.1 Compaction equipment to be capable of obtaining required material densities.

.3 Compacting

.1 Compact to no less than 100% of standard proctor maximum dry density (SPMDD).

.2 Shape and roll alternately to obtain smooth, even and uniformly compacted base.

.3 Apply water as necessary during compacting to obtain specified density.

.4 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved by Contract Administrator.

.5 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

2.3 SITE TOLERANCES

.1 Finished base surface to be within plus or minus 10 mm of established grade and cross section but not uniformly high or low.

2.4 PROTECTION

.1 Maintain finished base in condition conforming to this section until succeeding material is applied or until acceptance by Contract Administrator.

END OF SECTION

AGGREGATE BASE COURSE

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 31 05 16 - Aggregate Materials.

.2 Section 32 11 16 – Granular Sub-Base

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM).

.1 ASTM C117, Standard Test Method for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing.

.2 ASTM C136, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

.3 ASTM D136, Standard Test Method for Sieve Analysis of Fine and Course Aggregated.

.4 ASTM D698, Stand Test Methods for Laboratory Compaction Characteristics of Soil Using standard Effort (12,400 ft-lbf/ft3)(600 N m/m3).

.5 ASTM D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3) (2,700 kN-m/m3).

.6 ASTM D4318, Standard Test Methods for Liquid Unit, Plastic Unit and Plasticity Index of Soils.

.7 Ontario Provincial Standard Specifications (OPSS) Division 10.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-8.2-, Sieves, Testing, Woven Wire, Metric.

.3 Ontario Provincial Standard Specifications (OPSS)

.1 OPSS MUNI 1010 – Material Specifications for Aggregates – Base, Subbase, Select Subgrade, and Backfill Material

1.3 DELIVERY, STORAGE, AND HANDLING

.1 Deliver and stockpile aggregates in accordance with Section 31 05 16 – Aggregate Materials.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Granular base: material to Section 31 05 16- Aggregate Materials and the following requirements:

.1 Granular ‘A’ to OPSS.MUNI 1010

2.2 SEQUENCE OF OPERATION

.1 Place granular base after granular sub-base surface is inspected and approved by Contract Administrator.

.1 Construct granular base to depth and grade in areas indicated.

.2 Ensure no frozen material is placed.

.3 Place material only on clean unfrozen surface, free from snow and ice.

.4 Place material using methods which do not lead to segregation or degradation of aggregate.

.5 Place material to full width in uniform layers not exceeding 150 mm compacted thickness.

.6 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.

.7 Remove and replace that portion of layer in which material becomes segregated during spreading.

.2 Compaction Equipment

.1 Compaction equipment to be capable of obtaining required material densities.

.3 Compacting

.1 Compact to no less than 100% of standard proctor maximum dry density (SPMDD).

.2 Shape and roll alternately to obtain smooth, even and uniformly compacted base.

.3 Apply water as necessary during compacting to obtain specified density.

.4 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved by Contract Administrator.

.5 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

2.3 SITE TOLERANCES

.1 Finished base surface to be within plus or minus 10 mm of established grade and cross section but not uniformly high or low.

2.4 PROTECTION

.1 Maintain finished base in condition conforming to this section until succeeding material is applied or until acceptance by Contract Administrator.

END OF SECTION

ASPHALT PAVEMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

.1 Materials and installation for asphalt pavement for areas identified on the Contract Drawings.

1.2 RELATED SECTIONS

.1 Section 31 05 16 – Aggregate Materials.

.2 Section 31 23 33 – Excavating, Trenching and Backfilling.

.3 Section 32 11 23 – Aggregate Base Course.

.4 Section 32 16 15 – Concrete Walks, Curbs and Gutters.

.5 Section 32 17 28 – Pavement Marking.

1.3 REFERENCES

.1 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-8.2, Sieves Testing, Woven Wire, Metric.

.2 CAN/CGSB-16.1, Cutback Asphalts for Road Purposes.

.2 American Association of State Highway and Transportation Officials (AASHTO)

.1 AASHTO M320 - Standard Specification for Performance Grade Asphalt Binder.

.3 American Society for Testing and Materials International, (ASTM)

.1 ASTM C88, Standard Test Method for Soundness of Aggregates by Use of Sodium Sulphate or Magnesium Sulphate.

.2 ASTM C117, Standard Test Method for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.

.3 ASTM C123, Standard Test Method for Lightweight Particles in Aggregate.

.4 ASTM C127, Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate.

.5 ASTM C128, Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate.

.6 ASTM C131, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

.7 ASTM C136, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.

.8 ASTM D698, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3) (600 kN-m/m^3).

.9 ASTM D977 – Standard Specification for Emulsified Asphalt.

.10 ASTM D995, Standard Specification for Requirements Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures.

.11 ASTM D2419, Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.

.12 ASTM D3203, Standard Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures.

.4 Asphalt Institute (AI)

.1 Asphalt Institute MS-2-1993 Sixth Edition, Mix Design Methods for Asphalt Concrete.

.5 Ontario Provincial Standard Specifications (OPSS).

1.4 SUBMITTALS

.1 Submit asphalt concrete mix design to Contract Administrator for approval.

.2 Materials to be tested by testing laboratory approved by Contract Administrator.

.3 Submit test certificates showing suitability of materials at least 4 weeks prior to commencing work.

.4 Inform Contract Administrator of proposed source of aggregates and provide access for sampling at least 4 weeks prior to commencing work.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Granular base and sub-base material: to Section 31 05 16 – Aggregate Materials, Section 32 11 16 Granular Sub-Base and Section 31 11 23 Aggregate Base Courses.

.2 HL-3 and HL-8 hot mix asphalt, compacted thickness as indicated on drawings, PGAC 58-34, per OPSS 1001, 1003, 1101 and 1150.

.3 Asphalt cement: to AASHTO M320.

.4 Aggregates per Section 31 05 16 – Aggregate Materials; gradation per OPSS 1003.

.5 Asphalt tack coat: to SS-1 or RS-1 as per OPSS 1103, depending on weather at the time of asphalt paving operations.

2.2 MIX DESIGN

.1 Job mix formula to be approved by Contract Administrator.

.2 Do not change job-mix without prior approval of Contract Administrator. When change in material source proposed, new job-mix formula to be approved by Contract Administrator.

.3 Return plant dust collected during processing to mix in quantities acceptable to Contract Administrator.

2.3 EQUIPMENT

.1 Pavers: mechanical grade controlled self-powered pavers capable of spreading mix within specified tolerances, true to line, grade and crown indicated.

.2 Rollers: sufficient number of rollers of type and weight to obtain specified density of compacted mix. Roller combination shall be as per OPSS 310 for a production rate of 120 t/hr.

.3 Vibratory rollers for parking lots and driveway:

- .1 Minimum drum diameter: 750mm.
- .2 Maximum amplitude of vibration (machine setting): 0.5mm for lifts less than 40mm thick.

.4 Haul trucks: of sufficient number and of adequate size, speed and condition to ensure orderly and continuous operation and as follows:

- .1 Boxes with tight metal bottoms.
- .2 Covers of sufficient size and weight to completely cover and protect asphalt mix when truck fully loaded.
- .3 In cool weather or for long hauls, insulate entire contact area of each truck box.

.5 Suitable hand tools

PART 3 EXECUTION

3.1 PREPARATION

.1 Fine grade aggregate base course, add/remove aggregate as required.

.2 Re-compact aggregate base course to achieve 100% Standard Proctor Maximum Dry Density (SPMDD) as required.

.3 Install tack coat on all milled surfaces and on all vertical surfaces abutting new asphalt.

3.2 ASPHALT PAVING

.1 Obtain approval of primer from Contract Administrator before placing asphalt mix.

.2 Place asphalt mix only when base or previous course is dry and air temperature is above 7°C and rising.

.3 When temperature of surface on which the material is to be placed falls below 10º C, provide extra rollers as necessary to obtain required compaction before cooling.

.4 Place asphalt concrete in compacted layers as indicated on construction drawings but not exceeding 50 mm.

.5 Minimum 120°C mix temperature required when spreading.

.6 Maximum 160°C mix temperature permitted at any time.

.7 Compact each course with roller as soon as it can support roller weight without undue cracking or displacement.

.8 Compact asphalt concrete to density not less than 92 % of Maximum Relative Density (MRD) obtained with Marshall specimens prepared in accordance with ASTM D1559, from samples of mix being used. Roll until roller marks are eliminated.

.9 Keep roller speed slow enough to avoid mix displacement and do not stop roller on fresh pavement.

.10 Moisten roller wheels with water to prevent pick up of material.

.11 Compact mix with hot tampers or other equipment approved by Contract Administrator in areas inaccessible to roller.

.12 Finish surface to be within 5 mm of design elevation and with no irregularities greater than 10 mm in 4.5 m.

.13 Repair areas showing checking, rippling or segregation as directed by Contract Administrator.

3.3 JOINTS

.1 Remove surplus material from surface of previously laid strip. Do not deposit on surface of freshly laid strip. Complete joints to existing asphalt as indicated on contract drawings.

.2 Paint contact surfaces of existing structures such as manholes, curbs or gutters with tack coat prior to placing adjacent pavement.

.3 For cold joints, cut back to full depth vertical face and tack face with tack coat.

.4 For longitudinal joints, overlap previously laid strip with spreader by 150 mm.

.5 Carefully place and compact hot asphaltic material against joints.

.6 Mill existing asphalt and step connect to existing asphalt as per Contract Drawings where existing asphalt thickness is equal to or greater than 80 mm. Tack coat vertical and horizontal surfaces.

3.4 PROTECTION

.1 Keep vehicular traffic off newly paved areas until paving surface temperature has cooled below 38°C. Do not permit stationary loads on pavement until 24 hours after placement.

.2 Provide access to buildings as required. Arrange paving schedule so as not to interfere with normal use of premises.

END OF SECTION

CONCRETE WALKS, CURBS, AND GUTTERS

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 03 30 00 – Cast-In-Place Concrete

.2 Section 31 23 33 - Excavating, Trenching and Backfilling.

.3 Section 32 11 23 – Aggregate Base Courses.

1.2 REFERENCES

.1 Canadian Standards Association (CSA).

.1 CAN/CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.

.2 American Society for Testing and Materials (ASTM).

.1 ASTM D698, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft^3) (600kN-m/m^3).

.2 ASTMD2628, Standard Specification for Performed Polychloroprene Elastomeric Joint Seals for concrete Pavements.

.3 Ontario Provincial Standard Specifications (OPSS) and Drawings (OPSD)

1.3 TESTING

.1 Testing of concrete to CAN3-A23.1.

1.4 ENVIRONMENTAL CONDITIONS

.1 If temperature is below 5°C or if Contract Administrator anticipates a temperature drop below this value within the next 24 hours, take all necessary measures to protect concrete from freezing.

.2 Do not place concrete on frozen base.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Concrete mixes and materials: according to Section 03 30 00 – Cast-in-Place Concrete.

.2 Granular base: Granular “A” to OPSS.MUNI 1010, to Section 32 11 23 – Aggregate Base Courses and to Section 31 23 33 - Excavating, Trenching and Backfilling.

.3 Non-staining mineral type form release agent: chemically active release agents containing compounds that react with free lime to provide water soluble soap.

.4 Curing blankets shall be burlap.

.5 Expansion joints to be 12mm thick bituminous fibre per OPSS 1308.

.6 Formwork shall be as per OPSS 919.

.7 Tactile walking surface indicator plates (TWSI) shall be made from gray cast iron conforming to ASTM A 48M, Class 35B and shall be bare and not coated with paint or other coatings. TWSI plates shall be parallel with the curb radius where applicable, which will require the use of radius plates in some locations.

PART 3 EXECUTION

3.1 GRADE PREPARATION

.1 Do grade preparation work in accordance with Section 31 23 33 - Excavating, Trenching and Backfilling.

.2 Construct embankments using excavated material free from organic matter or other objectionable materials. Dispose of surplus and unsuitable excavated material off site.

.3 Place fill in maximum 150 mm layers and compact to at least 95% of Standard Proctor Maximum Dry Density (SPMDD) to ASTM D698.

.4 Ensure that Sub Grade and Granular Base preparation has been inspected and approved by Contract Administrator before commencing work.

3.2 GRANULAR BASE

.1 Obtain Contract Administrator approval of subgrade before placing granular base.

.2 Place granular base material to lines, widths, and depths as indicated.

.3 Compact granular sub base to at least 100% of Standard Proctor Maximum Dry Density (SPMDD) to ASTM D698.

3.3 FORMING

.1 Form vertical surfaces to full depth using forming material that will not deform under loading by plastic concrete.

.2 Securely position forms to required lines and grades.

.3 Coat forms with form release agent.

.4 Obtain approval of forms before placing concrete.

.5 Install metal fabrication as required.

.6 Install rigid insulation at all barrier free doors.

.7 Monolithic curb and sidewalk will not be allowed.

3.4 CONCRETE

.1 Obtain Contract Administrator approval of granular base and reinforcing steel prior to placing concrete.

.2 Do concrete work in accordance with OPSS 351 and OPSS.MUNI 353.

.3 Finish exposed surface to a smooth, uniform finish, free of open texturing and exposed aggregate. Do not work more mortar to the surface than required. Do not use neat cement as a dryer to facilitate finishing.

.4 Immediately after floating, give sidewalk surface uniform finish to produce regular corrugations not exceeding 2 mm deep, by drawing broom in direction normal to centre line.

.5 Provide edging as indicated with 10 mm radius edging tool.

.6 Cure and protect concrete in accordance with OPSS 904.

.7 No water may be added to the concrete on site or in transit. Concrete which is unworkable or that is too stiff to produce a satisfactory product shall be discarded.

3.5 TOLERANCES

.1 Finish surfaces to within 3mm in 3m as measured with 3m straightedge placed on surface.

3.6 EXPANSION AND CONTRACTION JOINTS

.1 Install tooled transverse contraction joints after floating, when concrete is stiff, but still plastic, at intervals of 1.5 m.

.2 Install expansion joints at intervals of 6 m.

.3 Install expansion joints around manholes and catch basins and along length adjacent to concrete curbs, catch basins, buildings, or permanent structure.

.4 When sidewalk is adjacent to curb, make joints of curb, gutters and sidewalk coincide.

3.7 ISOLATION JOINTS

.1 Install isolation joints around manholes and catch basins and along length adjacent to concrete curbs, catch basins, buildings, or permanent structure.

.2 Install joint filler in isolation joints as indicated.

3.8 CURING

.1 When the air temperature is less than 25 C, two layers of burlap shall be carefully laid on the surface of the concrete. Strips shall overlap by 75 mm and shall be held down as required against displacement. The burlap shall be maintained in place and kept thoroughly wet for a minimum of 24 hours.

.2 If the air temperature exceeds 25 °C, two layers of burlap shall be used as a curing agent and shall be placed upon the concrete setting up, shall be then wetted and kept in a wet condition for 96 hours after the pour.

.3 During hot weather, the Contractor must cool down the forms and aggregate as outlined in OPSS.MUNI 904.

3.9 BACKFILL

.1 Allow concrete to cure for 7 days prior to backfilling.

.2 Backfill to designated elevations with material approved by Contract Administrator. Compact and shape to required contours as indicated or as directed by Contract Administrator.

END OF SECTION

PAVEMENT MARKINGS

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 32 12 16 – Asphalt Paving

1.2 REFERENCES

.1 Master Painters Institute (MPI)

.1 Architectural Painting Specification Manual, MPI #32 Traffic Markings Paint, Alkyd.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGB -1.5-M91, Low Flash Petroleum Spirits thinner.

.2 CGSB 1-GP-12c-68, Standard Paint Colours.

.3 CGSB 1-GP-71-83, Method of Testing Paints and Pigments.

.3 Ontario Provincial Standard Specifications (OPSS).

1.3 SUBMITTALS

.1 Submit to Contract Administrator product data sheets for pavement markings and include product characteristics, performance of criteria, physical size, finish and limitations.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Paint and Markings:

.1 Water borne traffic paint as per OPSS 1716.

.2 Colour: yellow matching the yellow paint chip of the Ontario Ministry of Transportation.

.3 Glass beads are not required.

.4 In accordance with MPI recommendation for surface conditions.

.2 Thinner: to MPI listed manufacturer.

PART 3 EXECUTION

3.1 EQUIPMENT REQUIREMENTS

.1 Paint applicator to be an approved pressure type mobile distributor capable of applying paint in single, double and dashed lines. Applicator to be capable of applying marking components uniformly, at rates specified, and to dimensions as indicated, and to have positive shut-off.

3.2 CONDITION OF SURFACES

.1 Pavement surface to be dry, free from ponded water, frost, ice, dust, oil, grease and other foreign materials.

3.3 APPLICATION

.1 Lay out pavement markings as indicated on drawings.

.2 Unless otherwise approved by Contract Administrator, apply paint only when air temperature is above 10°C, wind speed is less than 60km/h and no rain is forecast within next 4h.

.3 Apply traffic paint evenly at rate of 3m2/L.

.4 Do not thin paint unless approved by Contract Administrator.

.5 Symbols and letters to conform to dimensions indicated.

.6 Paint lines to be of uniform colour and density with sharp edges.

.7 Thoroughly clean distributor tank before refilling with paint of different colour.

3.4 TOLERANCE

.1 Paint markings to be within plus or minus 12mm of dimensions indicated.

.2 Remove incorrect markings.

3.5 PROTECTION OF COMPLETED WORK

.1 Protect pavement markings until dry.

END OF SECTION

CHAIN LINK FENCES AND GATES

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 03 30 00 - Cast-in-Place Concrete.

.3 Section 09 91 13 - Exterior Painting.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM).

.1 ASTM A53/A53M, Standard Specification for Pipe, Steel, Black and Hot-dipped, Zinc-Coated Welded and Seamless.

.2 ASTM A90/A90M, Standard Test Method for Weight Mass of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.

.3 ASTM A116, Standard Specification for Metallic-Coated, Steel-Woven Wire Fence Fabric.

.4 ASTM A121, Standard Specification for Zinc-Coated (Galvanized) Steel Barbed Wire.

.5 ASTM A123/A123M, Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel.

.6 ASTM A641/A641M, Standard Specification for Zinc-coated (Galvanized) Carbon Steel Wire.

.7 A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanized) by the Hot-Dip Process.

.2 Canadian General Standards Board (CGSB).

.1 CAN/CGSB-138.1, Fabric for Chain Link Fence.

.2 CAN/CGSB-138.2, Steel Framework for Chain Link Fence.

.3 CAN/CGSB-138.3, Installation of Chain Link Fence.

.4 CAN/CGSB-138.4,Gates for Chain Link Fence.

.5 CAN/CGSB-1.181, Ready-Mixed Organic Zinc-Rich Coating.

.3 Canadian Standards Association (CSA).

.1 CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.

.2 CAN/CSA-G164, Hot Dip Galvanizing of Irregularly Shaped Articles.

.3 CAN/CSA-A3000, Cementitious Materials Compendium. Includes:

.4 Ontario Provincial Standard Specifications (OPSS):

.1 OPSS 541 – Construction Specification for Chain-Link Fence

1.3 SUBMITTALS

.1 Submit WHMIS MSDS – Material Safety Data Sheets.

.2 Submit manufacturer's data sheets including:

.1 Fence fabric gauge and finish.
.2 Post and rail dimension and finish.
.3 Gate frame dimension and finish.
.4 Required fittings and hardware.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Concrete mixes and materials: in accordance with Section 03 30 00- Cast-in-Place Concrete.

.1 Nominal coarse aggregate size: 20 mm.
.2 Compressive strength: 20 MPa minimum at 28 days.

.2 Chain-link fence fabric: to CAN/CGSB-138.1.

.1 Type 1, Class A, medium style.
.2 Height of fabric: as indicated.

.3 Posts, braces and rails: to CAN/CGSB-138.2, galvanized steel pipe. Dimensions as indicated.

.4 Bottom tension wire: to CAN/CGSB-138.1, Table 2 single strand, galvanized steel wire, 5 mm diameter.

.5 Tie wire fasteners: to CAN/CGSB-138.1, Table 2 (steel wire), single strand, galvanized steel wire confirming to requirements of fence fabric, 5 mm diameter.

.6 Tension bar: to A653/A653M, 5 x 20 mm minimum galvanized steel.

.7 Tension bar brands: 3 x 20 mm minimum galvanized steel or 5 x 20 mm minimum aluminum.

.8 Gates: to CAN/CGSB-138.4.

.9 Gate frames: to ASTM A53/A53M, galvanized steel pipe, standard weight 45 mm outside diameter pipe for outside frame, 35mm outside diameter pipe for interior bracing.

.1 Fabricate gates as indicated with electrically welded joints, and hot-dip galvanized after welding.
.2 Fasten fence fabric to gate with twisted selvage at top.

.3 Furnish gates with galvanized malleable iron hinges, latch and latch catch with provision for padlock which can be attached and operated from either side of installed gate.

.4 Furnish double gates with chain hook to hold gates open and centre rest with drop bolt for closed position.

.10 Fittings and hardware: to CAN/CGSB-138.2, cast aluminum alloy, galvanized steel or malleable or ductile cast iron.

.1 Tension bar bands: 3 x 20 mm minimum galvanized steel or 5 x 20 mm minimum aluminum.

.2 Post caps to provide waterproof fit, to fasten securely over posts and to carry top rail.

.3 Overhang tops to provide waterproof fit, to hold top rails and an outward inward projection to hold barbed wire overhang.

.4 Provide projection with clips or recesses to hold 3 strands of barbed wire spaced 100 mm apart.

.5 Projection of approximately 300 mm long to project from fence at 45° above horizontal.

.6 Turnbuckles to be drop forged.

.11 Organic zinc rich coating: to CAN/CGSB-1.181.

.12 Barbed wire : 2.5 mm diameter galvanized steel wire to ASTM A121, 4 point barbs 125 mm spacing.

.13 Grounding rod: 16 mm diameter copper well rod, 3 m long.

2.2 FINISHES

.1 Galvanizing:

.1 For chain link fabric: to CAN/CGSB-138.1, Grade2.

.2 For pipe: 550 g/m^2 minimum to ASTM A90.

.3 For barbed wire: to ASTM A121, Class 2.

.4 For other fittings: to CAN/CSA-G164.

PART 3 EXECUTION

3.1 GRADING

.1 Remove debris and correct ground undulations along fence line to obtain smooth uniform gradient between posts.

.1 Provide clearance between bottom of fence and ground surface of 30 mm to 50 mm.

3.2 ERECTION OF FENCE

.1 Erect fence along lines as indicated and as directed by Contract Administrator and in accordance with CAN/CGSB-138.3.

.2 Excavate post holes 1200 mm depth x 300 mm diameter by methods approved by Contract Administrator.

.3 Space line posts 3 m apart, measured parallel to ground surface.

.4 Space straining posts at equal intervals not exceeding 150 m if distance between end or corner posts on straight continuous lengths of fence over reasonably smooth grade is greater than 150 m.

.5 Install additional straining posts at sharp changes in grade and where directed by Contract Administrator.

.6 Install corner post where change in alignment exceeds 10˚.

.7 Install end posts at end of fence and at buildings. Install gate posts on both sides of gate openings.

.8 Place concrete in sonotube forms for posts required to be set in concrete then embed posts into concrete to minimum 1200 mm depth.

.1 Extend concrete 50 mm above ground level and slope to drain away from posts.

.2 Brace to hold posts in plumb position and true to alignment and elevation until concrete has set.

.9 Do not install fence fabric until concrete has cured minimum of 5 days.

.10 Install brace between end and gate posts and nearest line post, placed in centre of panel and parallel to ground surface.

.1 Install braces on both sides of corner and straining posts in similar manner.

.11 Install overhang tops and caps.

.12 Install top rail between posts and fasten securely to posts and secure waterproof caps and overhang tops.

.13 Install bottom tension wire, stretch tightly and fasten securely to end, corner, gate and straining posts with turnbuckles and tension bar bands.

.14 Lay out fence fabric. Stretch tightly to tension recommended by manufacturer and fasten to end, corner, gate and straining posts with tension bar secured to post with tension bar bands spaced at 300 mm intervals.

.1 Knuckled selvedge at bottom.

.2 Twisted selvedge at top.

.15 Secure fabric to top rails, line posts and bottom tension wire with tie wires at 450 mm intervals.

.1 Give tie wires minimum two twists.

.16 Install barbed wire strands and clip securely to lugs of each projection.

.17 Install grounding rods as indicated.

3.3 INSTALLATION OF GATES

.1 Install gates in locations as indicated.

.2 Level ground between gate posts and set gate bottom approximately 40 mm above ground surface.

.3 Determine position of centre gate rest for double gate. Cast gate rest in concrete as directed. Dome concrete above ground level to shed water.

.4 Install gate stops where indicated.

3.4 TOUCH UP

.1 Clean damaged surfaces with wire brush removing loose and cracked coatings. Apply two coats of organic zinc-rich paint to damaged areas in accordance with Section 09 91 13 – Exterior Painting or as approved by the Contract Administrator. Pre-treat damaged surfaces according to manufacturers' instructions for zinc-rich paint.

3.5 CLEANING

.1 Clean and trim areas disturbed by operations. Dispose of surplus material as directed by Contract Administrator.

END OF SECTION

BLOCK RETAINING WALLS

PART 1 GENERAL

1.1 SCOPE

.1 This specification covers the requirements for the design, supply, placement, and finishing of the pre-cast concrete block retaining walls identified in the design.

.2 This specification also covers the requirements for the foundation preparation, and accessories required for a complete installation of the retaining walls.

.3 The design indicates the basic requirements of the retaining wall system, the contractor will complete the design, supply and installation as per the suppliers design requirements.

1.2 RELATED SECTIONS

.1 Division 1 – General Requirements

.2 Section 31 05 16 – Aggregate Materials

.3 Section 31 23 19 – Dewatering

.4 Section 31 32 19 – Geotextiles

.5 Section 31 23 33 – Excavating, Trenching and Backfilling

.6 Section 32 11 16 – Granular Sub-Base

.7 Section 32 16 15 – Concrete Walks, Curbs and Gutters

1.3 REFERENCES

.1 Occupational Health and Safety Act, R.S.O. 1990, c.O.1, as amended.

.2 Canadian Standards Association (CSA International)

- .1 CSA-G30.3-M1983(R1998), Cold-Drawn Steel Wire for Concrete Reinforcement.
- .2 CSA-G30.5-M1983(R1998), Welded Steel Wire Fabric for Concrete Reinforcement.
- .3 CAN/CSA-A3000-23, Cementitious Materials Compendium. Includes:
  - .1 CAN/CSA-A23.5-98, Supplementary Cementing Materials
- .4 ASTM C94/C94M-23 Ready-Mixed Concrete.
- .5 ASTM C1372-17 Segmental Retaining Wall Units.

.3 All references as amended.

1.4 DESIGN CRITERIA

.1 Engage a professional engineer, registered in the Province of Ontario, who has demonstrated competence in retaining wall design, to design and supervise construction of the retaining walls to execute construction of permanent Works.

.2 Take full responsibility for design, supply, placement, installation of the retaining wall system.

.3 Comply with all safety requirements of The Occupational Health and Safety Regulations and Ontario Building Code.

.4 Consider both internal and external stability of wall system in design. External stability to include safety against sliding, overturning, bearing failure and slip circle failure.

1.5 STORAGE AND HANDLING

.1 Follow storage and handling instructions of supplier of Redi Rock retaining wall system.

.2 Prevent chipping and cracking of precast concrete facing blocks and damage to embedded connectors for reinforcing elements. Replace damaged blocks as directed by Contract Administrator

.3 Contractor shall prevent excessive mud, wet cement and like materials from coming in contact with units.

1.6 SUBMITTALS

.1 Submit shop drawings as per the requirements of Specification 01 33 00 Submittals. Shop drawing to bear seal and signature of a Professional Engineer, registered in the Province of Ontario, who has carried out the design and who will provide construction supervision of permanent installation.

.2 Indicate on shop drawings the following:

.1 Dimensions and elevations

.2 Relationship to new and existing structures and utilities

.3 Material designations, grades, sizes, mix design, etc.

.4 Permanent tie backs locations, size and embedment.

.5 Design loads, design assumptions, surcharge loads and all loading restrictions.

.6 Identification of the design Engineer of record who will be responsible for design calculations, checking of shop drawings, inspection and supervision of fabrication and installation.

.7 Complete field instructions required during installation and any other pertinent information..

PART 2 PRODUCTS

2.1 WALL SYSTEMS

.1 Only proprietary wall systems are acceptable.

.2 Acceptable systems: Redi-Rock International segmental retaining wall system. Main wall shall consist of a combination of 28", 41", and 60" Series Blocks.

.3 All pre-cast concrete shall provide a minimum 35 Mpa strength.

.4 The precast product shall provide a Limestone type face finish.

2.2 SUBDRAINS

.1 Subdrain is to be 100mm diameter perforated polyethylene pipe covered with a knitted geotextile sock as per OPSS 1860. Subdrain outlet to be 2.5m long, 150mm diameter galvanized CSP c/w rodent grate. Coordinate the sub-drain outlet(s) with the Civil design drawings.

2.3 GRANULAR MATERIALS

.1 All granular materials will be as per Specification 31 05 16 – Aggregate Materials.

.1 Granulars: OPSS 1010.

.1 Granular A Type II

.2 Granular B Type II

.3 19mm Clear Stone.

2.4 GEOTEXTILE

.1 All granular materials will be as per Specification 31 32 19 – Geotextiles.

.1 Class II Non-woven geotextile as per OPSS 1860.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Arrange for technical representative of supplier of to be on site for initial stage of wall construction to ensure correct installation procedures. Arrange for subsequent visits as directed by Contract Administrator.

.2 Excavate, remove and dispose of materials of all types and descriptions, including rock and concrete encountered during the installation of the block wall and dispose of any material not useable for backfill off site.

.3 Supply, place and compact minimum 300mm thick by 2400mm wide Granular B and 150mm thick by 2400mm wide Granular A bedding material compacted to

100% SPD. Granular bedding shall be placed on undisturbed native soils or suitable replacement fill. This bedding shall be the minimum founding platform for the retaining walls. The founding granulars shall be underlain by geotextile.

.4 At all locations where the retaining walls abut the building structures, the contractor shall place, at a minimum, two layers of expansion joint materials, as per the material specifications of Section 32 16 15.

.5 Supply, place and compact Granular B backfill material a min. thickness 300mm lifts behind/in front of, block to 100% SPD in maximum 200mm lifts.

.6 Supply, place and compact select subgrade backfill material and compact to 100% SPD in maximum 200mm lifts.

.7 Place non-woven geotextile between granular backfill material and select subgrade or native material to maintain separation of dissimilar materials.

.8 Install block as per manufacturer's recommendations.

.9 Supply and place 100mm perforated polyethylene pipe c/w knitted geotextile sock as indicated on drawings. Slope perforated pipe at a min. 1% to outlet; min. 2m beyond end of new block wall. Supply and place a 150mm CSP outlet pipe; 2.5m long complete with a galvanized rodent screen at location of the subdrain outlet.

.10 Backfill material behind block wall is to be compacted with a plate packer. No wheeled loads will be permitted to travel over backfill behind block wall. Backfill shall be placed and compacted to the top of each block course upon the placement of each successive course.

.11 The first course of wall units shall be placed on the granular bedding with the aesthetic surface facing out and the front edges

END OF SECTION

TOPSOIL PLACEMENT AND GRADING

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 31 23 33 – Excavating, Trenching and Backfilling

.2 Section 32 92 19.16 – Hydraulic Seeding

1.2 REFERENCES

.1 Agriculture and Agri-Food Canada

.1 The Canadian System of Soil Classification, Third Edition, 1998.

.2 Canadian Council of Ministers of the Environment

.1 PN1340-2005, Guidelines for Compost Quality.

.3 U.S. Environmental Protection Agency (EPA)/Office of Water

.1 EPA 832R92005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

1.3 DEFINITIONS

.1 Compost:

.1 Mixture of soil and decomposing organic matter used as fertilizer, mulch, or soil conditioner.

.2 Compost is processed organic matter containing 40% or more organic matter as determined by Walkley-Black or Loss on Ignition (LOI) test.

.3 Product must be sufficiently decomposed (i.e. stable) so that any further decomposition does not adversely affect plant growth (C:N ratio below (25) (50)) and contains no toxic or growth inhibiting contaminates.

.4 Composed bio-solids to: CCME Guidelines for Compost Quality, Category (A) (B).

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling.

.2 Divert unused soil amendments from landfill to official hazardous material collections site approved by Consultant.

.3 Do not dispose of unused soil amendments into sewer systems, into lakes, streams, onto ground or in locations where it will pose health or environmental hazard.

PART 2 PRODUCTS

2.1 TOPSOIL

.1 Topsoil: imported screened or native screened topsoil with a mixture of particulates, microorganisms and organic matter which provides suitable medium for supporting intended plant growth.

.1 Soil texture based on The Canadian System of Soil Classification, to consist of 20 to 70 % sand, minimum 7 % clay, and contain 2 to 10 % organic matter by weight.

.2 Contain no toxic elements or growth inhibiting materials.

.3 Finished surface free from:

.1 Debris and stones over 25 mm diameter.

.2 Course vegetative material, 10 mm diameter and 100 mm length, occupying more than 2% of soil volume.

.4 Consistence: friable when moist.

2.2 SOIL AMENDMENTS

.1 Fertilizer:

.1 Fertility: major soil nutrients present in following amounts:

.2 Nitrogen (N): 20 to 40 micrograms of available N per gram of topsoil.

.3 Phosphorus (P): 40 to 50 micrograms of phosphate per gram of topsoil.

.4 Potassium (K): 75 to 110 micrograms of potassium per gram of topsoil.

.5 Calcium, magnesium, sulfur, and micro-nutrients present in balanced ratios to support germination and/or establishment of intended vegetation.

.6 Ph value: 6.5 to 8.0.

.2 Peatmoss:

.1 Derived from partially decomposed species of Sphagnum Mosses.

.2 Elastic and homogeneous, brown in colour.

.3 Free of wood and deleterious material which could prohibit growth.

.4 Shredded particle minimum size: 5 mm.

.3 Sand: washed coarse silica sand, medium to course textured.

.4 Organic matter: compost Category A in accordance with CCME PN1340, unprocessed organic matter, such as rotted manure, hay, straw, bark residue or sawdust, meeting the organic matter, stability, and contaminant requirements.

.5 Fertilizer: industry accepted standard medium containing nitrogen, phosphorous, potassium and other micro-nutrients suitable to specific plant species or application or defined by soil test.

2.3 SOURCE QUALITY CONTROL

.1 Advise Consultant of sources of topsoil and manufactured topsoil to be utilized with sufficient lead time for testing.

.2 Contractor is responsible for amendments to supply topsoil as specified.

.3 Soil testing by recognized testing facility for PH, P and K, and organic matter.

.4 Testing of topsoil will be carried out by testing laboratory designated by Consultant.

.1 Soil sampling, testing and analysis to be in accordance with Provincial standards.

PART 3 EXECUTION

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

.1 Provide temporary erosion and sedimentation control measures as per Section 31 32 25 – Erosion and Sedimentation Control.

3.2 PREPARATION OF EXISTING GRADE

.1 Verify that grades are correct.

.1 If discrepancies occur, notify Consultant and do not commence work until instructed by Consultant.

.2 Grade soil, eliminating uneven areas and low spots, ensuring positive drainage.

.3 Remove debris, roots, branches, stones in excess of 50 mm diameter and other deleterious materials.

.1 Remove soil contaminated with calcium chloride, toxic materials, and petroleum products.

.2 Remove debris which protrudes above surface.

.3 Dispose of removed material off site.

.4 Cultivate entire area which is to receive topsoil to minimum depth of 100 mm.

.1 Cross cultivate those areas where equipment used for hauling and spreading has compacted soil.

3.3 PLACING AND SPREADING OF TOPSOIL/PLANTING SOIL

.1 Place topsoil after Consultant has accepted subgrade.

.2 Spread topsoil in uniform layers not exceeding 150 mm.

.3 For sodded areas keep topsoil 15 mm below finished grade.

.4 Spread topsoil as indicated to following minimum depths after settlement.

.1 100 mm for seeded areas.

.2 100 mm for sodded areas.

.3 300 mm for flower beds.

.4 500 mm for shrub beds.

.5 Manually spread topsoil/planting soil around trees, shrubs, and obstacles.

3.4 FINISH GRADING

.1 Grade to eliminate rough spots and low areas and ensure positive drainage.

.1 Prepare loose friable bed by means of cultivation and subsequent raking.

.2 Consolidate topsoil to required bulk density using equipment approved by Consultant.

.1 Leave surfaces smooth, uniform, and firm against deep foot printing.

3.5 ACCEPTANCE

.1 Consultant will inspect and test topsoil in place and determine acceptance of material, depth of topsoil and finish grading.

3.6 SURPLUS MATERIAL

.1 Dispose of all surplus materials offsite.

3.7 CLEANING

.1 Leave Work area clean at the end of each day.

.2 Upon completion of installation, remove surplus materials, rubbish, tools, and equipment.

END OF SECTION

HYDRAULIC SEEDING

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 31 23 33 – Excavating, Trenching and Backfilling

.2 Section 32 91 19.13 – Topsoil Placement and Grading

1.2 REFERENCES

.1 Ontario Provincial Standard Specifications (OPSS) by the Ontario Ministry of Transportation:

.1 OPSS.MUNI 804 – Construction Specification for Seed and Cover, November 2014.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittals.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for seed, mulch, tackifier, fertilizer, liquid soil amendments and micronutrients.

.2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 30 - Safety Requirements.

.3 Submit in writing 7 days prior to commencing work:

.1 Volume capacity of hydraulic seeder in litres.

.2 Amount of material to be used per tank based on volume.

.3 Number of tank loads required per hectare to apply specified slurry mixture per hectare.

.4 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.5 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.

1.4 QUALITY ASSURANCE

.1 Qualifications:

.1 Landscape Contractor: to be a Member in Good Standing of Horticultural Trades Association.

.2 Landscape Planting Supervisor: Landscape Industry Certified Technician with Softscape Installation designation.

.3 Landscape Maintenance Supervisor: Landscape Industry Certified Technician with Turf Maintenance designation.

1.5 WARRANTY

.1 For seeding, 12 months warranty period is extended to 24 months.

.2 Contractor hereby warrants that seeding will remain free of defects in accordance with General Conditions CCDC GC 12.3, but for 24 months.

.3 End-of-warranty inspection will be conducted by Consultant.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Seed: "Canada pedigreed grade" in accordance with Government of Canada Seeds Act and Regulations.

.1 Grass mixture: "Certified", "Canada No. 1 Lawn Grass Mixture" in accordance with Government of Canada "Seeds Act" and "Seeds Regulations".

.1 Mixture composition:

.1 55% Creeping Red Fescue.

.2 27% Canada Blue Grass.

.3 15% Perennial Rye Grass.

.4 3% White Clover.

.2 Mulch: specially manufactured for use in hydraulic seeding equipment, non-toxic, water activated, green colouring, free of germination and growth inhibiting factors and as per OPSS.MUNI 804.

.3 Tackifier: as per OPSS.MUNI 804.

.4 Water: free of impurities that would inhibit germination and growth.

.5 Fertilizer: 8-32-16

PART 3 EXECUTION

3.1 PROTECTION OF EXISTING CONDITIONS

.1 Protect structures, signs, guide rails, fences, plant material, utilities and other surfaces not intended for spray.

.2 Immediately remove any material sprayed where not intended as directed by Consultant.

3.2 PREPARATION OF SURFACES

.1 Do not perform work under adverse field conditions such as wind speeds over 10 km/h, frozen ground or ground covered with snow, ice or standing water.

.2 Fine grade areas to be seeded free of humps and hollows.

.1 Ensure areas are free of deleterious and refuse materials.

.3 Cultivated areas identified as requiring cultivation to depth of 25 mm.

.4 Ensure areas to be seeded are moist to depth of 150 mm before seeding.

.5 Obtain Consultant's approval of grade and topsoil depth before starting to seed.

3.3 PREPARATION OF SLURRY

.1 Measure quantities of materials by weight or weight-calibrated volume measurement satisfactory to Consultant. Supply equipment required for this work.

.2 Charge required water into seeder. Add material into hydraulic seeder under agitation. Pulverize mulch and charge slowly into seeder.

.3 After materials are in seeder and well mixed, charge tackifier into seeder and mix thoroughly to complete slurry.

3.4 SLURRY APPLICATION

.1 Ensure seed is placed under supervision of certified Landscape Planting Supervisor.

.2 Hydraulic seeding equipment:

.1 Slurry tank.

.2 Agitation system for slurry to be capable of operating during charging of tank and during seeding, consisting of recirculation of slurry and/or mechanical agitation method.

.3 Capable of seeding by 50 m hand operated hoses and appropriate nozzles.

.4 Tank volume to be certified by certifying authority and identified by authorities "Volume Certification Plate".

.3 Apply slurry uniformly, at optimum angle of application for adherence to surfaces and germination of seed.

.1 Using correct nozzle for application.

.2 Using hoses for surfaces difficult to reach and to control application.

.4 Blend application 1,000 mm into adjacent grass areas or sodded areas previous applications to form uniform surfaces.

.5 Re-apply where application is not uniform.

.6 Remove slurry from items and areas not designated to be sprayed.

3.5 CLEANING

.1 Leave Work area clean at end of each day.

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

3.6 PROTECTION

.1 Protect seeded areas from trespass until plants are established.

.2 Remove protection devices as directed by Consultant.

3.7 MAINTENANCE DURING ESTABLISHMENT PERIOD

.1 Ensure maintenance is carried out under supervision of certified Landscape Maintenance Supervisor.

.2 Perform following operations from time of seed application until acceptance:

- .1 Repair and reseed dead or bare spots to allow establishment of seed prior to acceptance.
- .2 Mow grass to 40 mm whenever it reaches a height of 70 mm. Remove clippings which will smother grass.
- .3 Fertilize seeded areas after first cutting in accordance with fertilizing program. Spread half of required amount of fertilizer in one direction and remainder at right angles
- .4 Water seeded areas in sufficient quantities and at a frequency required to establish and maintain grass and optimum soil moisture condition. Control watering to prevent washouts.
- .5 Control weeds by mechanical means.
- .6 Install temporary barriers or signage where required to protect newly established seed.

3.8 ACCEPTANCE

.1 Seeded areas will be accepted by Consultant provided that:

- .1 Seeded areas are uniformly established.
- .2 Seeded areas are free of rutted, eroded, bare or dead spots.
- .3 Areas have been mown at least twice.
- .4 Areas have been fertilized.
- .5 No surface soil is visible from a height of 1500 mm when grass has been cut to height of 50 mm.

3.9 MAINTENANCE DURING WARRANTY PERIOD

.1 Perform following operations from time of acceptance until end of warranty period:

.1 Repair and reseed dead or bare spots to satisfaction of Consultant.

.2 Fertilize seeded areas in accordance with fertilizing program. Spread half of the required amount of fertilizer in one direction and the remainder at right angles.

.3 Water seeded areas as required to maintain continued growth of grass.

END OF SECTION

DIVISION 33 INDEX

MANHOLES, CATCHBASINS, AND PRECAST STRUCTURES

PART 1 GENERAL

1.1 SECTION INCLUDES

.1 Materials and installation for constructing new precast maintenance holes, precast wet well and precast metering chamber.

1.2 RELATED SECTIONS

.1 Section 00 31 13 – Construction Phasing

.2 Section 02 05 20 – Temporary By-Pass Pumping

.3 Section 31 05 16 - Aggregate Materials

.4 Section 31 23 19 - Dewatering

.5 Section 31 23 33 - Excavation, Trenching and Backfilling.

1.3 REFERENCES

.1 American Society for Testing and Materials (ASTM International).

.1 ASTM A48/A48M, Standard Specification for Gray Iron Castings.

.2 ASTM A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.3 ASTM C478M, Specification for Precast Reinforced Concrete Manhole Sections Metric.

.4 ASTM D412, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.

.5 ASTM D2240, Standard Test Method for Rubber Property-Durometer Hardness.

.2 Canadian General Standards Board (CGSB).

.1 CAN/CGSB-8.2, Sieves, Testing, Woven Wire, Metric.

.3 Canadian Standards Association (CSA International).

.1 CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.

.2 CSA G30.18, Carbon Steel Bars for Concrete Reinforcement.

.3 CSA A257.4, Precast Circular Concrete Manhole Sections, Catchbasins and Fittings.

.4 CAN/CSA-A165 Series, CSA Standards on Concrete Masonry Units (Consists of A165.1, A165.2 and A165.3).

.5 CSA A3000 “Cementitious Materials Compendium”.

.6 The Structural Manuals – Division 1

.4 Ontario Provincial Standard Specifications (OPSS) and Drawings (OPSD) by the Ontario Ministry of Transportation.

1.4 SUBMITTALS

.1 Submit manufacturer's test data and certification at least 4 weeks prior to beginning Work. Include manufacturer's drawings, information and shop drawings where pertinent.

.2 All shop drawings submittals must be stamped and signed by a professional engineer licensed in the Province of Ontario.

1.5 SCHEDULING OF WORK

.1 Schedule work to minimize interruptions to existing services and to maintain existing flow during construction.

.2 Submit schedule of expected interruptions for approval and adhere to approved schedule.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Precast maintenance holes: to OPSD 701.010

.2 Precast wet well: to OPSD 1101.012

.3 Precast concrete wet-well and valve chambers: Leak free, pre-cast reinforced concrete with access openings, ladders, service platforms and designed for the following forces:

.1 Dead load of stations and components, dynamic and kinetic forces of rotating equipment.

.2 Dead load from soil over structure, superimposed live load of 12 kN/m^2 or single wheel load of 54 kN over an area of 750 x 750mm.

.3 Hydrostatic uplift force, horizontal earth loadings and full hydrostatic pressure assuming water at ground elevation.

.4 Joints: to be made watertight using rubber rings, bituminous compound, epoxy resin cement or cement mortar.

.5 Mortar:

.1 Aggregate: to CSA A82.56.

.2 Cement: to CAN/CSA-A8.

.6 Ladder rungs: to OPSD 405.010.

.7 Adjusting rings: to OPSD 704.010 for maintenance holes outside roadway.

.8 Frames, gratings, covers to dimensions as indicated and following requirements:

.1 Sanitary maintenance holes in roadway: self leveling type as per CC-205

.2 Sanitary maintenance holes outside roadway: to OPSD 401.010.

.9 Granular bedding and backfill: Granular 'A' as per OPSS.MUNI 1010.

.10 Unshrinkable Fill: in accordance with Section 31 23 33 – Excavation, Trenching and Backfilling.

.11 Benching: 25 MPa concrete

.12 Waterproofing membrane – Blue skin WP 200.

.13 Aluminum Access Hatches:

.1 All hatches to be MSU Mississauga aluminum and/or stainless-steel access hatches complete with slam lock or approved alternate. For sizes and locations, refer to drawings.

.2 Covers: fabricate with minimum 6.4mm aluminum or stainless-steel tread plate, reinforced on underside to eliminate warpage, limit deflection to 1/150 of span. Design for a minimum live load of 14.4 kPa.

.3 CL-625-ONT Cover: The valve chamber covers shall be reinforced to support CAN/CSA S6 CL-625-ONT wheel load with an impact factor of 15% and a maximum deflection of $1/150^{th}$ of the span.

.4 Angle frames: fabricate from extruded aluminum or stainless-steel angles with a minimum thickness of 6.35 mm complete with welded 100 mm long strap anchors located at 250 mm on centre.

.5 Access Hatches: Provide MSU M-Style access hatches for exterior applications as noted on the drawings. Equip with the following:

.1 Recessed Stainless Steel butt hinges.

.2 90 deg. Hold Open Arm.

.3 Flush lift handle.

.4 All 304 Stainless Steel hardware.

.5 Perimeter sealing gasket.

.6 Aluminum removable sealing plug and opening tool.

.7 Gas-spring assist cylinder.

.8 Drain.

.9 Safety chain and pull up bars around opening when door leafs are in open position for all access hatches

.10 Lockable and removable key.

.14 Aluminum Access Ladders:

.1 All access ladders shall be: Model MSU Type "FB" aluminum access ladder, 406 Std. wide c/w aluminum Model 8120 ladder brackets bolt-on-style (for Hilti-Hit kit) and Dual Model 3100 by 'MSU' (Mississauga Ltd.) removable pull-up bars or approved equivalent.

.15 Landing and Handrails:

.1 Landings shall be of aluminum construction. Openings shall be complete with stainless steel hinges and be as per contract drawings.

.2 Landings shall be designed to a minimum uniform load of 9.6 kPa and have a maximum deflection of L/360 less than or equal to 6mm.

.3 Handrails: 49mm OD aluminum handrails, all welded construction. Provide posts at centres required to meet horizontal live loads. Construction to be fully welded and ground smooth design to applicable OBC standards.

.4 All handrails and guardrails to have clear anodized coating.

.16 Pumping Station Trash Basket

.1 All trash baskets shall be retractable, constructed of 316L SS 10mm diameter rod, 38 x 38 x 6mm angle and 6mm plate - MSU Type TB-SS as supplied by MSU Mississauga Ltd.

.2 Trash baskets to be constructed to the size and dimensions shown on the construction drawings and shall be supplied complete with all required components including sch 80 316L - 50mm guiderails, 5.6mm type 316L stainless steel chain, chain hook plate, and brackets.

.3 Trash baskets shall be constructed square, true, and accurate to require size, with joints closely fitted. Remove all burs and sharp edges.

.17 Pumping Station Vent Pipes

.1 Vent piping in pumping station wet-wells shall be fabricated using type 316 stainless steel schedule 10s pipe and shall be completed with bolt down flanges, goose neck and insect screen. Diameter as noted on construction drawings.

.2 Vent pipes to be supplied with 316 SS wall brackets and installed at 1500 mm O/C.

.3 Vent pipes shall be supplied by MSU Mississauga Ltd. or approved equivalent.

.18 Isolation Coating

.1 Isolate aluminum from concrete, mortar, or masonry and dissimilar metals with two coats of bituminous paint.

PART 3 EXECUTION

3.1 EXCAVATION AND BACKFILL

.1 Excavate and backfill in accordance with Section 31 23 33 - Excavating Trenching and Backfilling and as indicated.

.2 Obtain approval of Contract Administrator before installing manholes or ditch inlets.

3.2 INSTALLATION

.1 Construct units in accordance with details indicated, plumb and true to alignment and grade.

.2 Complete units as pipe laying progresses. Maximum of three units behind point of pipe laying will be allowed.

.3 Dewater excavation to approval of Contract Administrator and remove soft and foreign material before placing concrete base.

.4 Set precast concrete base on 150 mm minimum of granular bedding compacted to 100% corrected maximum dry density.

.5 All Precast units:

.1 Set bottom section of precast unit in bed of cement mortar and bond to concrete slab or base. Make each successive joint watertight with Contract Administrator approved rubber ring gaskets, bituminous compound, cement mortar, epoxy resin cement, or combination thereof.

.2 Clean surplus mortar and joint compounds from interior surface of unit as work progresses.

.3 Plug lifting holes with precast concrete plugs set in mortar or mastic compound.

.6 For precast concrete wet-wells and valve chambers:

.1 Prior to fabricating chamber covers, coordinate with hatch, lifting davit and fall arrest and retrieval davit suppliers to ensure all cast-in items shown on the construction drawings are properly integrated into the cover fabrication.

.2 Wrap each joint with blueskin membrane. Membrane to be 450 mm wide at each joint.

.7 Compact granular backfill to 100% Standard Proctor Maximum Dry Density (SMPDD). Granular backfill shall extend from the base of the structure to 300 mm above the inlet pipe obvert.

.8 Place unshrinkable backfill in accordance with Section 31 23 33 - Excavating, Trenching and Backfill.

.9 Set frame and cover to required elevation such that the distance from the top of manhole cover to the first ladder rung is less that 450 mm. If adjustment is required use concrete rings, parge and make smooth and watertight.

.10 Place frame and cover on top section to elevation as indicated prior to final lift of asphalt. If adjustment required use concrete ring.

.11 Clean units of debris and foreign materials. Remove fins and sharp projections. Prevent debris from entering system.

END OF SECTION

SITE WATER UTILITY DISTRIBUTION PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

.1 Materials and installation for water mains, services, yard hydrants, and valves.

.2 All watermain and appurtenances shall conform to Ontario Provincial Standard Specifications (OPSS) 514 and 701.

.3 All cathodic protection of watermains and appurtenances shall conform to Ontario Provincial Standard Specification (OPSS) 702.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 78 00 - Closeout Submittals.

.3 Section 03 20 00 – Concrete Reinforcing.

.4 Section 03 30 00 – Cast-in-Place Concrete.

.5 Section 31 23 33 – Excavating, Trenching and Backfilling.

1.3 REFERENCES

.1 American National Standards Institute/American Water Works Association (ANSI/AWWA)

.1 ANSI/AWWA B301, Liquid Chlorine.

.2 ANSI/AWWA C104/A21.4, Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.

.3 ANSI/AWWA C110/A21.10, Ductile-Iron and Gray Iron Fittings, 3 inch through 48 inch (75 mm through 1200 mm), for Water.

.4 ANSI/AWWA C111/A21.11, Rubber-Gasket Joints for Ductile-Iron and Gray Iron Pressure Pipe and Fittings.

.5 ANSI/AWWA C151/A21.51, Ductile-Iron Pipe, Centrifugally Cast, for Water.

.6 ANSI/AWWA C153/A21.53, Ductile-Iron Compact Fittings for Water Service.

.7 ANSI/AWWA C500, Metal-Seated Gate Valves for Water Supply Service (Includes Addendum C500a-95).

.8 ANSI/AWWA C600, Installation of Ductile-Iron Water Mains, and Their Appurtenances.

.9 ANSI/AWWA C651, Disinfecting Water Mains.

.2 American Society for Testing and Materials International, (ASTM)

.1 ASTM A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile.

.2 ASTM C117, Standard Test Method for Material Finer Than 75 [MU] m (No. 200) Sieve in Mineral Aggregates by Washing.

.3 ASTM C136, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.

.4 ASTM C478M, Standard Specification for Precast Reinforced Concrete Manhole Sections, Metric.

.5 ASTM D698, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft (600 kN-m/m^3)).

.3 American Water Works Association (AWWA)/Manual of Practice

.1 AWWA M17, Installation, Field Testing, and Maintenance of Fire Hydrants.

.4 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-8.1, Sieves, Testing, Woven Wire, Inch Series.

.5 Canadian Standards Association (CSA International)

.1 CAN/CSA-A257 Series, Standards for Concrete Pipe.

.2 CSA A3000, Cementitious Materials Compendium

.3 CSA B137 Series, Thermoplastic Pressure Piping Compendium

.4 CAN/CSA-G30.18, Billet Steel Bars for Concrete Reinforcement.

.5 CAN/CSA-G164, Hot Dip Galvanizing of Irregularly Shaped Articles.

.6 Ontario Provincial Standard Specifications (OPSS)

.1 OPSS Muni 441 – Construction Specification for Watermain Installation in Open Cut

1.4 SUBMITTALS

.1 Submit complete shop drawings for all watermains and appurtenances for approval by the Contract Administrator as per the requirements of Specification 01 33 00 Submittals.

.2 Inform Contract Administrator of proposed source of bedding materials and provide access for sampling at least 4 weeks prior to commencing work.

.3 Submit manufacturer's test data and certification that pipe materials and appurtenances meet requirements of this section at least 4 weeks prior to beginning work. Include manufacturer's drawings, information and shop drawings where pertinent.

.4 Pipe certification to be on pipe.

1.5 CLOSEOUT SUBMITTALS

.1 Provide record drawings, including directions for operating valves, list of equipment required to operate valves, details of pipe material, location of air and vacuum release valves, hydrant details, maintenance and operating instructions.

.1 Include top of pipe, horizontal location of fittings and type, valves, valve boxes, valve chambers and hydrants.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 – Common Product Requirements.

1.7 SCHEDULING OF WORK

.1 Schedule Work to minimize interruptions to existing services.

.2 Submit schedule of expected interruptions to Contract Administrator for approval and adhere to interruption schedule as approved by Contract Administrator.

.3 Notify Contract Administrator, building occupants, superintendent minimum of two (2) working days in advance of interruption in service.

1.8 COLD WEATHER WORK

.1 Protect all work from freezing.

.2 Do not lay pipes on frozen soil.

.3 Do not place frozen bedding, cover or backfill materials.

1.9 PROTECT AGAINST FLOATATION

.1 Prevent damage to any pipeline due to hydrostatic uplift during construction and until the work is completed.

PART 2 PRODUCTS

2.1 PIPE, JOINTS AND FITTINGS

.1 Polyvinyl chloride pipe (PVC) to AWWA C900 and CSA – B137.3, class 235 DR18

.2 Fitting to conform to AWWA – C-110 P21.10.08 Ductile Iron Fittings lined as per AWWA C104

.3 Restrainer gland – uniflange series 1350 or approved equal with a full rated pressure of the pipe on which it is installed, with a minimum of 2:1 safety factor.

.4 Valves shall be to ANSI/AWWA C-509, Mueller, Canada Valve or Clow

.5 Restraint coupler Hymax Grip as per AWWA C-219, NSF61 certified

.6 Hydrant shall be Century EM", complete with 2-65 mm hose nozzle s and 1-100 mm nozzle with a storz fitting.

.7 Service Connections shall be cross-linked polyethylene (PEX) Blue 904 SDR9 to CSA B 137.5 and AWWAC904 and complete with tracer wire.

.8 Fittings, couplers and curb stops are to be Mueller Compression Style.

.9 Service boxes (Mueller A-714) shall be included at the curb stop complete with stainless steel valve extensions. Valve boxes and extensions shall be as per OPSD 1101.020. Valve boxes shall be a 130 mm diameter slide type box complete with a cast iron lid.

2.2 YARD HYDRANTS

.1 Yard hydrants to be exposed, non-freeze post hydrant with lift handle and lock option, complete with galvanized steel casing guard. All bronze seat and replaceable seat washer, and non-turning operating rod with free-floating compression closure valve with 25mm connection. Hydrant to be equipped with a tapped 3mm drain port in valve housing.

.2 Depth of bury of hydrant shall be 2.0m. Outlet connection shall be minimum 750mm above finished grade.

.3 Hydrants to be installed with concrete protective base, surround by granulars to allow for draining.

.4 Standard of Acceptance: Merrill R-6000 Galvanized Frost Proof Yard Hydrant 1" Inlet.

2.3 TRACING WIRE

.1 Tracing wire to be TWU or RWU, 10 guage, 7 strands or more, copper, 60°C or higher, 600 V, plastic coated or approved equivalent.

.2 C-tap to be approved by CSA and to be sized to connect two tracer wires as specified above.

.3 Tapes to be rugged, pressure-sensitive, PVC-based, minimum:

.1 1mm thickness. Tapes must protect against water, salts and sewage and be suitable for direct burial applications.

.4 All trace wire termination points must utilize an approved trace wire access box (above ground access box or grade level/in-ground access box as applicable), specifically manufactured for this purpose.

2.4 PIPE BEDDING AND SURROUND MATERIAL

.1 Type 1 in accordance with Section 31 05 16 - Aggregate Materials and following requirements:

2.5 BACKFILL MATERIAL

.1 Type 3, in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

2.6 PIPE DISINFECTION

.1 Undertake disinfection of water mains in accordance with ANSI/AWWA C651.

.2 After watermain has been disinfected as described in AWWA C651, two consecutive sets of acceptable samples taken at least 24 hours apart shall be collected. Samples to be tested for Total Choloform, HPC and *E. Coli*. All testing will be conducted by the Contractor in the presence of the Contract Administrator, and paid for by the Contractor.

2.7 MECHANICAL JOINT RETAINER GLANDS

.1 Mechanical joint retainer glands shall be cast from ductile iron no less that grade 70-50-5 and shall comply with all application provisions of AWWA/ANSI C110/A21.10 and C111/A21.11. Set screws shall be 5/8" NC thread with torque-set head, or 5/8" square head bolts, with knurled cup-point, made of 4140 steel and shall be hardened to Rockwell "C" scale 45 – 47. The restraining devices shall have a working pressure rating to the full rated pressures of the installed pipe 1035 kPa with a minimum safety factor of 2:1. 16mm ø or greater threaded tie rods shall be used on blind flanges and elbows as indicated in contract drawings. A minimum of 3 rods shall be used for each connection unless otherwise noted.

2.8 CATHODIC PROTECTION

.1 Cathodic Protection must be to the OPSS 702 and OPSD 1109 Standards.

.2 The chemical composition of a zinc alloy anodes shall conform to the latest edition of ASTM B418 Type II.

.3 Zinc anodes, each must be labelled with their type as follows: "Z-24-48 Anode" as per OPSS 702 and OPSD 1109.

2.9 PIPE INSULATION

.1 Pipe shall be insulated where indicated on the drawings or as noted on the drawings. D.O.W HI-40 or Owens Corning Foamular 400 brand; 50mm thick extruded Polystyrene foam, minimum compressive strength 275kPa as per ASTM D 1621-73.

2.10 PIPE COATINGS

.1 Denso Glass Outerwrap 70.

2.11 TOOLS AND EQUIPMENT

.1 Provide Contract Administrator with following tools:

.1 One tee-handle operating keys for valves.

PART 3 EXECUTION

3.1 PREPARATION

.1 Clean pipes, fittings, valves, hydrants, and appurtenances of accumulated debris and water before installation. Carefully inspect materials for defects to approval of Contract Administrator. Remove defective materials from site as directed by Contract Administrator.

3.2 TRENCHING

.1 Do trenching work in accordance with Section 31 23 33.01 - Excavating Trenching and Backfilling.

.2 Trench depth to provide cover over pipe of not less than 2.0 m from finished grade or as indicated. Trench minimum width shall be as indicated in the contract drawings allowing for a minimum 300mm of bedding material.

.3 Trench alignment and depth require Contract Administrator approval prior to placing bedding material and pipe.

3.3 GRANULAR BEDDING

.1 Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness to depth of 300 mm below bottom of pipe. Place Granular ‘A’ from 300mm below the watermain invert to 300mm above the watermain obvert.

.2 Do not place material in frozen condition.

.3 Shape bed true to grade to provide continuous uniform bearing surface for pipe.

.4 Shape transverse depressions in bedding as required to suit joints.

.5 Compact each layer full width of bed to at least 100% of corrected maximum dry density.

.6 Fill authorized or unauthorized excavation below design elevation of bottom of specified bedding in accordance with Section 31 23 33 - Excavating Trenching and Backfilling.

3.4 PIPE INSTALLATION

.1 Terminate building water service outside building wall opposite point of connection to main. Install flange adapter and or coupling necessary for connection to building plumbing. If plumbing is already installed, make connection; otherwise cap or seal end of pipe and place temporary marker to locate pipe end. Provide mechanical restraints as required and coordinate with Building Mechanical division.

.2 Lay pipes to ANSI/AWWA C-600-85, ANSI/AWWA C603, ANSI/AWWA Manual of Practice and manufacturer's standard instructions and specifications.

.3 Join pipes in accordance with ANSI/AWWA C-600, ANSI/AWWA C602/C206, ANSI/AWWA Manual of Practice and manufacturer's recommendations.

.4 Handle pipe by methods recommended by pipe manufacturer. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends.

.5 Lay pipes on prepared bed, true to line and grade. Ensure barrel of each pipe is in contact with shaped bed throughout its full length. Take up and replace defective pipe. Correct pipe which is not in true alignment or grade or pipe which shows differential settlement after installation greater than 10 mm in 3 m.

.6 Face socket ends of pipe in direction of laying. For mains on a grade of 2% or greater, face socket ends up-grade.

.7 Do not exceed permissible deflection at joints as recommended by pipe manufacturer.

.8 Keep jointing materials and installed pipe free of dirt and water and other foreign materials. Whenever work is stopped, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.

.9 Position and join pipes with equipment and methods approved by Contract Administrator.

.10 Cut pipes in approved manner as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.

.11 Align pipes before jointing.

.12 Apply sufficient pressure in making joints to ensure that joint is completed to manufacturer's recommendations.

.13 When stoppage of work occurs, block pipes in an approved manner to prevent creep during down time.

.14 Do not lay pipe on frozen bedding.

.15 Do hydrostatic and leakage test and have results approved by Contract Administrator before surrounding and covering joints and fittings with granular material. Hydrostatic and leakage testing to be completed in accordance with OPSS 441.

.16 Backfill remainder of trench.

3.5 VALVE INSTALLATION

.1 Install valves to manufacturer's recommendations at locations as indicated.

.2 Support valves located in valve boxes or valve chambers by means of concrete blocks, located between valve and solid ground. Valves not to be supported by pipe.

3.6 YARD HYDRANTS

.1 Install yard hydrants at locations as indicated.

.2 Install hydrants in accordance with AWWA M17.

.3 Install gate valve and cast iron valve box on hydrant services leads as indicated.

.4 Place concrete blocks as indicated and specified, ensuring that drain holes are unobstructed.

.5 Place appropriate sign on installed hydrants indicating whether or not they are in service during construction.

3.7 THRUST BLOCKS AND RESTRAINED JOINTS

.1 Do concrete work in accordance with Section 03 30 00 - Cast-in-Place Concrete.

.2 Place concrete thrust blocks between valves, tees, plugs, caps, bends, changes in pipe diameter, reducers, hydrants and fittings and undisturbed ground as indicated or as directed by Contract Administrator.

.3 Keep joints and couplings free of concrete.

.4 Do not backfill over concrete within 24 hours after placing.

.5 For restrained joints: only use restrained joints approved by Contract Administrator.

.6 Mechanical joint restraint glands to be used at all valves, tees, plugs, caps, bends, changes in pipe diameter, reducers, hydrants and fittings. Additionally, mechanical joint restraint glands to be used at all pipe joints within 6.0 m of the fittings listed above. These are to be installed as per manufacturer's specifications.

3.8 CATHODIC PROTECTION

.1 Cathodic protection shall be installed to the current standard of OPSS 442.

.2 Spacing of anodes shall be:

.1 100-300mmø DI fittings/valves Z-12-24 @ 1 per each.

3.9 TRACER WIRE

.1 Tracer wire shall be installed as per OPSS standards and shall be connected on all PVC pipe, fittings etc. to form a continuous loop.

.2 Test the loop of tracer wire and demonstrate to Consultant that it functions properly after the backfill has been completed.

3.10 HYDROSTATIC AND LEAKAGE TESTING

.1 Do tests in accordance with ANSI/AWWA C600, and OPSS 441.

.2 Provide labour, equipment and materials required to perform hydrostatic and leakage tests hereinafter described.

.3 Notify Contract Administrator at least two (2) working days in advance of proposed tests. Perform tests in presence of Contract Administrator.

.4 Where section of system is provided with concrete thrust blocks, conduct tests at least 5 days after placing concrete or 2 days if high early strength concrete is used.

.5 Test pipeline in sections not exceeding 365 m in length, unless otherwise authorized by Contract Administrator.

.6 Upon completion of pipe laying and after Contract Administrator has inspected work in place, surround and cover pipes between joints with approved granular material placed to dimensions indicated.

.7 Leave valves, joints and fittings exposed.

.8 When testing is done during freezing weather, protect hydrants, valves, joints and fittings from freezing.

.9 Strut and brace caps, bends, tees, and valves, to prevent movement when test pressure is applied.

.10 Open valves.

.11 Expel air from main by slowly filling main with potable water. Install corporation stops at high points in main where no air-vacuum release valves are installed. Remove stops after satisfactory completion of test and seal holes with plugs.

.12 Thoroughly examine exposed parts and correct for leakage as necessary.

.13 Apply hydrostatic test pressure of 1000 kPa based on elevation of lowest point in main and corrected to elevation of test gauge, for period of 1 hour.

.14 Examine exposed pipe, joints, fittings and appurtenances while system is under pressure.

.15 Remove joints, fittings and appurtenances found defective and replace with new sound material and make watertight.

.16 Repeat hydrostatic test until defects have been corrected.

.17 Define leakage as amount of water supplied from water storage tank in order to maintain test pressure for 2 h.

.18 Do not exceed allowable leakage of 0.03 L/mm diameter per 300 m of pipe, including lateral connections, per hour.

.19 Locate and repair defects if leakage is greater than amount specified.

.20 Repeat test until leakage is within specified allowance for full length of watermain.

.21 Co-ordinate test procedure with Contract Administrator and provide certification of test acceptance.

3.11 PIPE SURROUND

.1 Upon completion of pipe laying and after Contract Administrator has inspected work in place, surround and cover pipes as indicated.

.2 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated. Do not dump material within 1.00 m of pipe.

.3 Place layers uniformly and simultaneously on each side of pipe.

.4 Do not place material in frozen condition.

.5 Compact each layer from pipe invert to mid height of pipe to at least 100% maximum density.

.6 Compact each layer from mid height of pipe to underside of backfill (300mm above pipe obvert, or as shown on drawings) to 100 % of corrected maximum density.

3.12 BACKFILL

.1 Place backfill material, above pipe surround, in uniform layers not exceeding 300 mm compacted thickness up to grades as indicated.

.2 Do not place backfill in frozen condition.

.3 Under footings, parking area and walks, compact backfill to at least 100% maximum density.

3.13 HYDRANT FLOW TESTS

.1 Conduct flow tests on every hydrant.

3.14 PAINTING OF HYDRANTS

.1 N/A

3.15 FLUSHING AND DISINFECTING

.1 Flushing and disinfecting operations shall be carried out by specialist contractor and witnessed by Contract Administrator. Notify Contract Administrator at least 4 days in advance of proposed date when disinfecting operations will commence.

.2 Flush water mains in accordance with AWWA C651.

.3 Flushing shall be through available outlets with a sufficient flow of potable water to produce velocity of 1.5 m/s, within pipe for minimum 10 minutes, or until foreign materials have been removed and flushed and water is clear.

.4 Flushing flows as follows: 38 L/s minimum.

.5 Provide connections and pumps for flushing as required.

.6 Open and close valves, hydrants and service connections to ensure thorough flushing.

.7 When flushing has been completed to satisfaction of Contract Administrator complete the disinfection procedure as per AWWA C651.

.8 Disinfect watermains.

.9 Rate of chlorine application to be proportional to rate of water entering pipe.

.10 Chlorine application to be close to point of filling water main and to occur at same time.

.11 Operate valves, hydrants and appurtenances while main contains chlorine solution.

.12 Flush line to remove chlorine solution after 24 hours.

.13 Measure chlorine residuals at extreme end of pipe-line being tested.

.14 Perform bacteriological tests on water main, after chlorine solution has been flushed out. Take samples daily for minimum of two days. Should contamination remain or recur during this period, repeat disinfecting procedure. Specialist contractor to submit certified copy of test results.

.15 Take water samples at hydrants and service connections, in suitable sequence, to test for chlorine residual.

.16 Co-ordinate flushing disinfection with Contract Administrator.

.17 Provide certification of test acceptance.

3.16 SURFACE RESTORATION

.1 After installing and backfilling over water mains, restore surface to original condition as directed by Contract Administrator.

3.17 QUALITY ASSURANCE

.1 Provide copies of all inspections and test results for Commissioning Manuals.

.2 Contractor shall supply to the Contract Administrator an As-Built drawing indicating the horizontal and vertical alignment of the watermain and appurtenances. All anodes, valves, bends, hydrants, tees, changes in material etc. shall be noted.

END OF SECTION

PART 1 GENERAL

1.1 RELATED WORK

.1 Section 00 31 13 – Construction Phasing

.2 Section 02 05 20 – Temporary By-Pass Pumping

.3 Section 31 05 16 - Aggregate Materials.

.4 Section 31 23 19 - Dewatering

.5 Section 31 23 33 - Excavating Trenching and Backfilling.

.6 Section 33 05 14 – Precast Structures

1.2 REFERENCES

.1 American Society for Testing and Materials International, (ASTM)

.1 ASTM B745/745M, Standard Specification of Corrugated Aluminum Pipes for Sewers and Drains.

.2 ASTM D3034, Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

.3 ASTM D2774 – Standard Practice for Underground Installation of Thermoplastic Pressure Piping

.4 ASTM D3350-14 – Polyethylene Plastic Pipe and Fittings Material

.5 ASTM F1290 – Standard Practice for Electrofusion Joining Polyolefin Pipe and Fittings

.6 ASTM F2164 – Field Leak Testing of Polyethylene (PE) Pressure Piping Systems Using Hydrostatic Pressure

.7 ASTM F2206 – Fabricated Fittings for Butt-Fused Polyethylene Plastic Pipe

.8 ASTM F2620 – Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings

.2 Canadian General Standards Board (CGSB). CSA B137, Thermoplastic Pressure Piping Compendium.

.3 Canadian Standards Association (CSA International)

.1 CAN/CSA-A3000, Cementitious Materials Compendium (Consists of A5-98, A8-98, A23.5-98, A362-98, A363-98, A456.1-98, A456.2-98, A456.3-98).

.1 CAN/CSA-A5, Portland Cement.

.2 CSA B1800, Plastic Non-pressure Pipe Compendium - B1800 Series (Consists of B181.1, B181.2, B181.3, B181.5, B182.1, B182.2, B182.4, B182.6, B182.7, B182.8 and B182.11).

.1 CSA B182.2, PVC Sewer Pipe and Fittings (PSM Type).

.4 Ontario Provincial Standard Specifications (OPSS)

.1 OPSS Sections 401, 403, 405, 409, 410, 412, MUNI 1841

1.3 DEFINITIONS

.1 Pipe section is defined as length of pipe between successive manholes and/or between manhole and any other structure which is part of sewer system.

1.4 SUBMITTALS

.1 Submit shop drawings in accordance with Section 01 33 00 – Submittals.

.2 Inform Contract Administrator at least 4 weeks prior to beginning Work, of proposed source of bedding materials and provide access for sampling.

.3 Submit manufacturer's test data and certification at least 2 weeks prior to beginning Work.

.4 Ensure certification is marked on pipe.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

1.6 SCHEDULING

.1 Schedule Work to minimize interruptions to existing services and maintain existing sewage flows during construction with temporary bypass pumping.

.2 Submit schedule of expected interruptions for approval and adhere to approved schedule.

.3 Notify Contract Administrator and plant superintendent two (2) working days in advance of any interruption in service.

PART 2 PRODUCTS

2.1 SANITARY AND STORM SEWERS

.1 Less than or equal to 450 mm Ø:

.1 PVC SDR 35 as per ASTM A2412 and in compliance with CSA B182.2 and ASTM A3034. Pipe stiffness minimum 320 kPa. Pipe joints to be bell and spigot with rubber gaskets.

2.2 FORCEMAINS

.1 Polyvinyl Chloride (PVC) SDR 26 to AWWA C905 and CSA B 137.3. Joints are to be bell and spigot with rubber gasket or mechanical joints to AWWA C110/A21.10.

.2 Fittings to AWWA C907 and certified to CSA B137.2. Ductile iron fittings may also be used. They shall be in accordance with ANSI/AWWA C153/A21.53. Mechanical joints shall conform to ANSI/AWWA C111/A21.11.

.3 High Density Polyethylene Pipe (HDPE) SDR 21 to CSA B 137.1. Pipe shall be in accordance with NSF/ANSI 61.

.1 All material must be produced from a PE 4710 resin listed in the Plastic Pipe Institute (PPI) TR-4. The resin material should comply with ASTM D 3350 with a minimum cell classification of 445474C. HDPE pipe and fittings must not contain any recycled compounds except that generated in the manufacturer's own facility from resin meeting the same specifications, sourced from the same raw material. HDPE products shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions, voids, or other injurious defects.

.2 Pipe shall be made of HDPE material with a minimum material designation code of PE4710 and with a minimum Cell Classification of 445474C. The polyethylene compound shall be UV protected by means of carbon black of not less than 2 percent.

.3 Pipe sizes 4” – 63” shall be manufactured in accordance with ASTM F 714, while pipe sizes 3/4” – 3” shall be manufactured in accordance with ASTM D 3035. All HDPE pipes shall adhere to Sandale’s Inspection and Test Procedure (ITR-04).

.4 HDPE Fittings – Fittings shall be made of HDPE Material with a minimum designation code of PE 4710 & a minimum cell classification of 445474C. All fittings shall be manufactured by Sandale Utility Products, CRP or approved equal. Fittings shall have a minimum pressure rating equal to or greater than the pipe to which they are joined unless otherwise specified by the owner/engineer. All fittings shall meet the requirements of AWWA C901 or C906 and all applicable ASTM Standards.

.5 Fusion Equipment Requirements

.1 Butt fusion equipment must be in satisfactory working order and the hydraulic system must be leak free. Heater plates shall be free from scrapes, gouges, and have a consistent clean coated surface. The pressure gage and thermometer should be checked for accuracy. When requested by the owner, records showing a maintenance service/inspection within 3 months prior to use for this project shall be provided.

.2 Electrofusion Processors shall be maintained and calibrated per manufacturer’s requirements and recommendations.

.4 Transition coupling to AWWA C219, fusion bonded epoxy in accordance with AWWA C213 and supplied with stainless steel nuts, bolts, non-corrosive washers and rubber gaskets to AWWA/ANSI specifications C111/A21.11.

.5 Direct Bury Plug Valves shall be 100% port eccentric direct buried plug valves to AWWA C517-05 and sized to match pipe size noted or as noted on drawings. Valves shall be cast iron body, supplied with mechanical joint ends, Acrylonitrile-Butadiene V-type multiple V-Ring packing, Chloroprene plug facing, a gear actuator suitable for burial applications and supplied with an extended nut actuator and valve box. Valves shall be supplied with a two part epoxy and suitable for direct burial applications. Valves to be Dezurik PEF 100% port eccentric plug valve or approved equivalent.

.6 Valve boxes shall be a 130mm diameter slide type box complete with cast iron lid.

2.3 COUPLERS

.1 Flexible couplers to be carbon steel with fusion-bonded epoxy coating. Couplers to be supplied with ANSI 304/303 stainless steel bolts and nuts. Gasket compound to be approved for contact with sanitary sewage. Couplers to be properly sized to accommodate different O.D. of pipes when a transition between pipe types occur at the flexible coupler. Couplers to be Robar 1506 or approved equivalent.

2.4 RESTRAINTS

.1 Mechanical joint retainer glands shall be cast from ductile iron grade 70-50-5 (minimum) and shall comply with all applicable provisions of AWWA/ANSI C110/A21.10 and C111/A21.11. Square head bolts (5/8”) made of 4140 steel and hardened to Rockwell “C” scale 45-47 shall be used. Restraining devices shall have a pressure rating of 1035 kPa (150 psi) or the rated pressure of the pipe, whichever is greater; with a minimum safety factor of 2. Tie rods shall be 16mm in diameter (minimum) and used on blind flanges and elbows as indicated on contract drawings. The minimum number of rods required for each connection shall be three (3), unless noted otherwise.

2.5 FITTINGS

.1 PVC fittings shall conform to AWWA C907 and be certified to CSA B137.2 Ductile Iron fittings shall conform to ANSI/AWWA C153/A21.53; mechanical joints are to conform to ANSI/AWWA C11/A21.11.

.2 HDPE Fittings shall conform to AWWA C906 and ASTM D-3261.

2.6 PIPE BEDDING, COVER, AND SURROUND MATERIAL

.1 Granular ‘A’ as per OPSS.MUNI 1010 and Section 31 23 33 – Excavating, Trenching, and Backfilling.

2.7 LINK SEAL

.1 Link seals are to be used for connections to all concrete structures (sanitary and effluent piping). Link seals (and sleeves) are to be sized by various pipe O.D's as shown on contract drawings.

2.8 TRACER WIRE

.1 Install tracer wire along forcemains as per OPSS standards and connect to PVC pipe, fittings, valves, etc. to form a continuous loop.

.2 Test the loop of tracer wire and demonstrate to Contract Administrator that it functions properly after the backfill has been completed.

.3 TWU or RWU, 10 gauge, 7 strands or more, 60 C or higher, 600 V, plastic coated or approved equivalent.

.4 C-tap to be approved by CSA and to be sized to connect two tracer wires as specified above.

.5 Tapes to be rugged, pressure-sensitive, PVC-based, minimum 0.1mm thickness. Tapes must protect against waters, salts and be suitable for direct burial applications.

2.9 BACKFILL MATERIAL

.1 Select Subgrade material to OPSS.MUNI 1010.

2.10 INSULATION

.1 50mm thick extruded Polystyrene foam, minimum compressive strength 275kPa as per ASTM D 1621-73. Standard of acceptance:

.1 D.O.W HI-40,
.2 Owens Corning Foamular C400;

2.11 PROTECTIVE MASTIC/TAPE

.1 Protective mastic and tape shall be Densopol 60 or approved alternate.

PART 3 EXECUTION

3.1 PREPARATION

.1 Clean and dry pipes and fittings before installation.

.2 Obtain approval of pipes and fittings from Contract Administrator prior to installation.

3.2 TRENCHING

.1 Do trenching Work in accordance with Section 31 23 33 - Excavating, Trenching and Backfilling.

.2 Do not allow contents of any sewer or sewer connection to flow into trench.

.3 Trench alignment and depth require approval of Contract Administrator prior to placing bedding material and pipe.

3.3 GRANULAR BEDDING

.1 Place bedding in unfrozen condition.

.2 Place granular bedding materials in uniform layers not exceeding 150 mm compacted thickness to depth indicated.

.3 Shape bed true to grade and to provide continuous, uniform bearing surface for pipe.

.4 Shape transverse depressions as required to suit joints.

.5 Compact each layer full width of bed to at least 95% of Standard Proctor Maximum Dry Density (SPMDD).

.6 Fill excavation below bottom of specified bedding adjacent to manholes or structures with compacted bedding material.

3.4 INSTALLATION

.1 Lay and join pipes in accordance with manufacturer's recommendations and to approval of Contract Administrator.

.2 Lay pipes on prepared bed, true to line and grade, with pipe invert smooth and free of sags or high points. Ensure barrel of each pipe is in contact with shaped bed throughout its full length. Tolerances: 3mm in 3 m.

.3 Buried HDPE pipe and fittings shall be installed in accordance with ASTM D 2321 or ASTM D 2774 for pressure systems and AWWA Manual of Water Supply Practices M55 Chapter 8. For additional information, contractor should refer to Chapter 7 of PE Handbook of Polyethylene (2nd Edition)

.4 Do not exceed maximum joint deflection recommended by pipe manufacturer.

.5 Do not allow water to flow through pipe during construction, except as may be permitted by Contract Administrator.

.6 Make watertight connections to manholes using suitable gaskets in new structures or using a Link Seal at connections to existing structures.

.7 Install protective mastic and tape in accordance with manufacturer's recommendations on all metallic buried pipe, fittings and valves.

3.5 PIPE SURROUND AND COVER

.1 Place surround material in unfrozen condition.

.2 Hand place surround material in uniform layers not exceeding 200 mm compacted thickness as indicated. Do not dump directly on pipe.

.3 Place layers uniformly and simultaneously on each side of pipe.

.4 Install insulation as indicated on Contract Drawings.

3.6 BACKFILL

.1 Place backfill material in unfrozen condition.

.2 Place backfill material, above pipe surround in uniform layers not exceeding 300 mm compacted thickness up to grades as indicated. Backfill material is to be compacted to at least 95% of SPMDD.

3.7 FIELD TESTING OF SEWERS

.1 Repair or replace pipe, pipe joint or bedding found defective.

.2 When directed by Contract Administrator, draw metal mandrel 95% of inside diameter of pipe through sewer to ensure pipe is free of obstructions or deflections.

.3 Carry out CCTV camera inspection on each section of sewer.

.4 Provide colour digital video (DVD) inspection for sewers (2 copies of video and report). Report to document condition of sewer to satisfaction of Contract Administrator. Cost of inspection to be paid by Contractor.

.5 Repair and retest sewer sections as required, until test results are acceptable.

.6 Repair visible leaks regardless of test results.

.7 Obtain a letter of compliance from Municipality and submit to Contract Administrator.

3.8 FIELD TESTING OF FORCEMAINS

.1 Notify Contract Administrator a minimum of 48 hours in advance of proposed tests. Perform tests in presence of Contract Administrator.

.2 Strut and brace caps, bends, and tees to prevent movement when test pressure is applied.

.3 Expel air from forcemain by slowly filling forcemain with water.

.1 Drill and tap high points and install suitable cocks to vent air and to be shut when pressure is applied.

.2 Remove stops after satisfactory completion of test and seal holes with tight fitting plugs.

.4 Apply hydrostatic test pressure of 345 kPa (50 psi) minimum after backfilling of trench, based on elevation of lower point in forcemain and corrected to elevation of test gauge, for period of 2 hours.

.5 Remove joints, fittings and appurtenances found to be defective and replace with new sound material and make watertight.

.6 Define leakage as amount of water supplied from water storage tank in order to maintain test pressure for minimum of 2 hours.

.7 Do not exceed allowable leakage defined as A = T x F x D x L, where T is the time in hours, F is 0.041 L/mm of pipe dia/km of pipe/hour, D is pipe diameter in mm, and L is the pipe length in km.

.8 Locate and repair defects if leakage is greater than amount specified.

.9 Repeat test until leakage is within specified allowance for full length of forcemain.

END OF SECTION

OUTFALL SEWER

PART 1 GENERAL

1.1 SUMMARY

.1 The following section is to be included with Provisional Item P2 in the contract documents.

.2 This section includes design, supply, fabrication, installation, testing and placing into operation the new outfall diffuser.

1.2 RELATED SECTIONS

.1 Section 01 33 00 – Submittals

.2 Section 01 35 43 – Environmental Protection

.3 Section 31 23 33 – Excavation Trenching and Backfilling

.4 Section 31 32 25 – Erosion and Sedimentation Control

.5 Section 33 05 13 – Manholes, Catchbasins, and Pre-cast Structures

.6 Section 33 31 13 – Sanitary and Storm Sewers

1.3 REFERENCES

.1 ASTM F-714: Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR). Based on outside diameter.

.2 ASTM F-714-060: Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR). Based on outside diameter.

.3 ASTM D-1248: Standard specification for Polyethylene Plastics Molding and Extrusion Materials.

.4 ASTM D-3350: Standard Specification for Polyethylene Plastic Pipe and Fittings Materials.

.5 CSA B137.1: Polyethylene Pipe, Tubing and Fittings for Cold Water Pressure Services.

.6 ASTM D-3035: Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR). Based on Controlled Outside Diameter.

.7 ISO 9002: Model for Quality Assurance in Production and Installation

.8 ASTM D-3035: Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR). Based on Controlled Outside Diameter.

.9 AWWA C906: Standard for Polyethylene (PE) Pressure Pipe and fittings 4" through 63", for water distribution.

.10 OPSS & OPSD Latest Edition.

1.4 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00.

.2 Submit technical literature on all components.

PART 2 PRODUCTS

2.1 HIGH DENSITY POLYETHYLENE MATERIALS

.1 Resin/Material Classification

.1 All material must be produced from a PE 4710 resin listed in the Plastic Pipe Institute (PPI) TR-4. The resin material should comply with ASTM D 3350 with a minimum cell classification of 445474C. HDPE pipe and fittings must not contain any recycled compounds except that generated in the manufacturer's own facility from resin meeting the same specifications, sourced from the same raw material. HDPE products shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions, voids, or other injurious defects.

.2 HDPE Pipe and Fittings

.1 The new outfall and diffusers shall be comprised of HDPE DR21 piping.

.2 Pipe shall be made of HDPE material with a minimum designation code of PE4710 and with a minimum Cell Classification of 445474C. The polyethylene compound shall be UV protected by means of carbon black of not less than 2 percent.

.3 Pipe sizes 4” – 63” shall be manufactured in accordance with ASTM F 714, while pipe sizes 3/4” – 3” shall be manufactured in accordance with ASTM D 3035. All HDPE pipes shall adhere to Sandale’s Inspection and Test Procedure (ITR-04).

.4 Fittings shall be made of HDPE Material with a minimum designation code of PE 4710 & a minimum cell classification of 445474C. All fittings shall be manufactured by Sandale Utility Products, CRP or approved equal. Fittings shall have a minimum pressure rating equal to or greater than the pipe to which they are joined unless otherwise specified by the owner/engineer. All fittings shall meet the requirements of AWWA C901 or C906 and all applicable ASTM Standards.

.3 Fusion Joining Requirements

.1 All HDPE pipes shall be joined via butt (thermal) fusion which produces a homogeneous, monolithic seal, leak tight joints. Approved mechanical

couplings by the contractor may be used only when butt fusion is deemed unfeasible in consultation with Sandale, and by the Contract Administrator & supplier, in writing.

.2 Butt Fusion: The pipe shall be joined by the butt fusion procedure outlined in ASTM F 2620 or PPI TR-33. A record or certificate of training for the fusion operator must be provided documenting training to the fundamentals to the Supplier. Considerations should be given to, and provisions made for adverse weather conditions, such as temperatures below freezing, precipitation, or wind, which is accepted by the owner/engineer.

2.2 FUSION EQUIPMENT REQUIREMENTS

.1 Butt fusion equipment must be in satisfactory working order and the hydraulic system must be leak free. Heater plates shall be free from scrapes, gouges, and have a consistent clean coated surface. The pressure gage and thermometer should be checked for accuracy. When requested by the owner, records showing a maintenance service/inspection within 3 months prior to use for this project shall be provided.

.2 Electrofusion Processors shall be maintained and calibrated per manufacturer's requirements and recommendations.

2.3 COUPLINGS

.1 General Requirements

.1 Couplings are not allowed on HDPE pipe unless they are fully restrained and/or anchored with concrete, where approved by the Contract Administrator.

.2 Suitable for 3,310 kPa pressure rating

.3 Flanged Joint:

.1 Flat face conforming to the face dimension and drilling of ANSI B16.1, Class 125.

.2 On AWWA C119 fittings to AWWA C110 with minimum pressure rating of 3,310 kPa or higher

.3 On AWWA C153 fittings to AWWA C153 with minimum pressure rating of 3,310 kPa or higher.

.4 Flange Gaskets:

.1 Flange gaskets to be manufactured from black natural rubber 3.175mm thick with a layer of cotton both sides.

.2 Gaskets to be natural or SBR type rubber.

.5 To AWWA C219.

.6 Anti-corrosion coating of interior and exterior centre sleeve and rings to AWWA C210, C219, C213 or AWWA C550.

.7 Compression gaskets to AWWA C219.

.8 Bolts and nuts high strength low alloy steel AWWA C111, stainless steel to ASTM F593 or ASTM F738 for bolts and ASTM F594 or ASTM F836M for heavy hex nuts. Rolled threads, fit, and dimensions to AWWA C111.

.9 Ductile iron castings to ASTM A536, Grade 65-45-12.

.2 Plain end or transition couplings as shown on drawings.

.3 Flanged coupling adapters as shown in the drawings.

.4 Standard of Acceptance: Hymax Grip Swiveljoint

2.4 RESTRAINERS

.1 General Requirements:

.1 Ductile iron castings to ASTM A356

.2 Anti-corrosion coating of ductile iron castings to AWWA C219, AWWA C210, AWWA C213 or AWWA C550.

.3 Bolts and nuts high strength low allow steel to AWWA C111, stainless steel to ASTM F593 or ASTM F738 for bolts and ASTM F594 or ASSTM F836M for heavy hex nuts. Rolled threads, fit and dimensions to AWWA C111.

.4 Tie rods and nuts:

.1 Tie rods to be continuous threaded, quenched and tempered alloyed steel to ASTM B633 or cadmium plated to ASTM B766. Tie rod sizes to be minimum 19 mm diameter or greater.

.2 Nuts and internally threaded coupling to be heavy hex finish to ASTM A563. Washers to be flat hardened steel to ASTM F436. Zinc plated to ASTM B633 or cadmium plated ASTM B766.

2.5 SEDIMENT CURTAIN

.1 The geotextile shall be TERRTRACK 400W woven fabric, by TERRAFIX, or an approved equal.

.2 The sediment curtain shall have the following components: - Anchors - Polyester geotextile - Closed cell ethafoam boom - 8 mm steel chain - 12 mm synthetic rope - Flotation Devices as required

.3 The polypropylene geotextile curtain shall have the following properties:

.1	Grab tensile strength:	1275 N (min)
.2	Mullen Burst:	3600 KPa
.3	Tear Strength:	475 N
.4	Elongation at Break:	18 %
.5	Filtration Opening Size:	220 UM

.4 The geotextile curtain shall be provided in a minimum width of 4 metres.

2.6 ANCHOR BLOCKS

.1 Concrete for ballast blocks: conform to OPSS 1350 within minimum 28-day strength of 35 MPa. Concrete blocks shall be sized to allow for 15% entrapped air inside pipe. Pad material between the concrete block and pipe shall be 6 mm thick black or red rubber sheet or 6 mm neoprene sponge paddings with a width of 50 mm plus the width of the block. Reinforcement and lifting lugs are to be part of design of block and all bolts, nuts, etc. on block shall be hot dipped galvanized.

2.7 BEDDING AND PIPE SURROUND

.1 50mm Clear Stone Type II to OPSS MUNI 1004.

.2 19mm Clear Stone Type II to OPSS MUNI 1004.

2.8 RIP RAP

.1 Rip Rap as per OPSS MUNI 1004

PART 3 EXECUTION

3.1 PERMITS

.1 Notify all ministries having jurisdiction with respect to this work including but not limited to, MNRF, MECP, Oceans and Fisheries, Canadian Coast Guard, etc. 3 weeks prior to construction start up and obtain all necessary permits and approvals that apply to the construction of the works. Any construction permits, notifications or approvals required must also be obtained prior to construction start up.

3.2 SCHEDULE OF CONSTRUCTION

.1 Prepare detailed schedule of operation, indicating working hours, and numbers of days for each operation.

.2 Construction of the outfall structure will not be permitted between April 1 and July 15th of any year.

.3 Construction should be done during optimal conditions (i.e. no rain, limited wave action and less than 5 knot winds and currents of less than 0.5 m/s).

.4 Duration on in-water construction should be kept to a minimum and shall not exceed a maximum period of three consecutive days at one time.

3.3 LAYOUT

.1 Buoys and markers shall be placed around dredging/outfall site.

.2 Contractor shall be responsible for the accuracy of the work and shall provide and maintain electronic position and measuring equipment, laser transit and such other equipment normally required for accurate dredging control.

3.4 DREDGING & EXCAVATION

.1 The excavation of areas indicated on drawings will be done using a solid, closed top no teeth clamp type of bucket. Spoil material will be placed in watertight containers on barges and transported to an on-site dewatering disposal site. Dredged materials will be disposed of off-site and in accordance with regulations with the MECP. Contractor must haul material to approved site and pay all associated cost for dumping fees, permits, etc.

3.5 SILT CURTAINS

.1 Silt curtains are to be used in areas where the depth of water is less than 3 metres. Sediment curtains shall be securely anchored at sufficient intervals to maintain their integrity.

.2 Silt Curtains shall remain secured in place until the construction activities in the water have been completed and when directed by the Contract Administrator.

.3 The silt curtain should be located a minimum of 5 metres beyond the work area.

.4 The silt curtain depth should be 450 mm deeper than the water depth.

.5 Anchoring shall provide positioning to ensure the silt curtain will not be dislocated.

.6 Anchors are to be mushroom or kedge anchors for firm mud bottoms or self burying Danforth anchors for sandy bottoms.

.7 Silt curtain ballast shall be 8 or 10 mm steel chain.

.8 Flotation shall have sufficient buoyancy to provide continuous support and a minimum 50 mm freeboard. Typical flotation should be minimum 100 mm diameter.

.9 Silt curtain load lines shall be 8 mm steel cable or 19 mm nylon or polypropylene rope.

3.6 UNDERWATER INSPECTION

.1 Provide divers and equipment to inspect and videotape each stage of installation throughout the length of the outfall for compliance to design and inspection.

.2 Inspections will be undertaken immediately after completion of:

.1 Dredging operation

.2 Placement of bedding

.3 Sinking of outfall and ballast

.4 Placement of backfill

.5 Placement of scour protection

.3 All diving must be performed in accordance to Occupational Health and Safety Act Ontario Regulation 634/56 and as amended by Ontario Regulation 514/92.

3.7 GRANULAR BEDDING

.1 Granular bedding to be placed to the limits and extend specified in contract drawing.

.2 Granular material to be placed by mechanical means such that there is not more than 1 metre free fall of granular.

3.8 CONCRETE BALLAST

.1 Concrete weights shall be place at not more than 3 m o/c spacing.

.2 Concrete ballast may be installed on shore.

.3 Protective wrapping will be placed between concrete and pipe material.

3.9 PIPE COVER

.1 Granular materials to be placed as per contract drawings.

.2 Granular material to be place by mechanical equipment such that there is not more than 1 metre free fall of granular material.

3.10 RIP RAP

.1 Rip Rap shall be placed as per contract (Scour Protection) drawings.

.2 Type B and C bedding details require 150 mm of 50 mm clear stone on downstream side of berm

3.11 LAUNCHING AND SINKING OF PIPE

.1 Take all necessary measures when launching of outfall pipe to protect it from gouges and cuts.

.2 Effluent outfall shall be sealed prior to launching to prevent river water from entering pipe.

.3 Pipe and ballast shall be moved into water with suitable equipment to lift pipe into water. At no time will contractor be allowed to pull pipe from land into water.

.4 Sinking of pipeline will be done such that the pipeline has time to adjust to the bottom profile of excavation and to prevent bridging. Sinking rate shall not exceed 100 metres/30 minutes.

.5 Wherever possible, the polyethylene pipe should be joined by the method of thermal butt fusion, as outlined in ASTM D 2657, Heat Joining Polyolefin Pipe and Fittings. Butt fusion joining of pipe and fittings shall be performed in accordance with the procedures recommended by the manufacturer. The temperature of the heater plate should not exceed 210 °C (410 F) and the joining pressure should not exceed 25 pounds per square inch of projected end area, excluding an allowance for friction.

.6 The polyethylene pipe may be adapted to fittings or other system be means of an assembly consisting of a polyethylene stub at the end, butt fused to the pipe, a back up flange of ductile iron, made to Class 150, ANSI B16.1/B16.5 dimensional standards with exceptions, bolts of compatible material and a gasket of suitable neoprene, red rubber or asbestos-rubber compound cut to fit the joint. In all cases the bolts shall be drawn up evenly and in line.

3.12 TESTING

.1 Effluent outfall will be hydrostatically tested at 275 kPa for a period of 2 hours. Provide all necessary flanges, bulkheads, equipment, etc. to perform testing.

END OF SECTION

PIPE CULVERTS

PART 1 GENERAL

1.1 SECTION INCLUDES

.1 Materials and installation for pipe culverts.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 61 00 - Common Product Requirements.

.3 Section 31 05 16 - Aggregate Materials.

.4 Section 31 23 33 - Excavating, Trenching and Backfilling.

1.3 REFERENCES

.1 American Society for Testing and Materials International, (ASTM)

.1 ASTM C117, Standard Test Method for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.

.2 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.3 ASTM D698, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3)).

.4 ASTM D 1751, Standard for Specification for Performed Expansion joint Filler for Concrete Paving and Structure Construction (Non-extruding and Resilient Bituminous Types).

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-8.1, Sieves, Testing, Woven Wire, Inch Series.

.2 CAN/CGSB-8.2, Sieves, Testing, Woven Wire, Metric.

.3 Canadian Standards Association (CSA International)

.1 CSA B1800 Series, Thermoplastic Non-pressure Piping Compendium.

.2 CSA A3000, Cementitious Materials Compendium.

.4 Ontario Provincial Standard Specifications (OPSS);

.1 OPSS 421 – Pipe Culvert Installation in Open Cut

1.4 SUBMITTALS

.1 Inform Contract Administrator at least 4 weeks prior to commencing work, of proposed source of bedding materials and provide access for sampling.

.2 Submit manufacturer's test data and certification at least 4 weeks prior to beginning work.

.3 Certification to be marked on pipe.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

PART 2 PRODUCTS

2.1 PIPE

.1 Corrugated Steel Pipe (CSP)

.1 68 x 13 x 2mm to CSA Standard G401 with galvanized, aluminized type 2 coating.

.2 High Density Polyethylene Pipe (HDPE):

.1 Watertight HDPE pipe with a minimum pipe stiffness of 320 kPa manufactured to CSA B 182.8.

.3 Each pipe shall be marked CSA approved as outlined in respective OPSS sections.

2.2 GRANULAR BEDDING, SURROUND, AND COVER

.1 Type 1 (Granular ‘A’) material in accordance with Section 31 23 33 – Excavating, Trenching, and Backfilling.

2.3 BACKFILL MATERIAL

.1 Type 3 (Select Subgrade Material), in accordance with Section 31 23 33 - Excavating, Trenching and Backfilling.

PART 3 EXECUTION

3.1 TRENCHING

.1 Do trenching Work in accordance with Section 31 23 33 - Excavating Trenching and Backfilling.

.2 Obtain Contract Administrator's approval of trench line and depth prior to placing bedding material or pipe.

3.2 BEDDING

.1 Dewater excavation, as necessary, to allow placement of culvert bedding in dry condition.

.2 Place minimum thickness of 200 mm of approved granular material on bottom of excavation and compact to minimum 95% of corrected maximum dry density.

.3 Shape bedding to fit lower segment of pipe exterior so that width of at least 50% of pipe diameter is in close contact with bedding and to camber as indicated or as directed by Contract Administrator, free from sags or high points.

.4 Place bedding in unfrozen condition.

3.3 LAYING CULVERTS

.1 Commence pipe placing at downstream end.

.2 Ensure bottom of pipe is in contact with shaped bed or compacted fill throughout its length.

.3 Do not allow water to flow through pipes during construction except as permitted by Contract Administrator.

3.4 JOINTS

.1 Corrugated steel pipe:

.1 Match corrugations or indentations of coupler with pipe sections before tightening.

.2 Tap couplers firmly as they are being tightened, to take up slack and ensure snug fit.

.3 Insert and tighten bolts.

.4 Repair spots where damage has occurred to spelter coating by applying two coats of asphalt paint approved by Contract Administrator or two coats of zinc rich paint.

.2 High Density Polyethylene Pipe:

.1 Install gaskets in accordance with manufacturer's recommendations.

.2 Maintain pipe joints free from mud, silt, gravel and other foreign material.

.3 Avoid displacing gasket or contaminating with dirt or other foreign material. Gaskets so disturbed shall be removed, cleaned and lubricated and replaced before joining is attempted.

.4 Complete each joint before laying next length of pipe.

.5 Minimize joint deflection after joint has been made to avoid joint damage.

.6 At rigid structures, install pipe joints not more than 1.2 m from side of structure.

.7 Apply sufficient pressure in making joints to ensure that joint is complete as outlined in manufacturer's recommendations.

3.5 PIPE SURROUND AND COVER

.1 Place surround material in unfrozen condition.

.2 Upon completion of pipe laying, and after Contract Administrator has inspected pipe joints, surround and cover pipes as indicated.

.3 Place surround material in uniform layers not exceeding 200 mm compacted thickness as indicated

.4 Place layers uniformly and simultaneously on each side of pipe.

.5 Compact each layer from pipe invert to spring line of pipe to at least 95% of corrected maximum dry density.

.6 Compact each layer from spring line of pipe to underside of top of cover (300mm above pipe obvert) to at least 100% of corrected maximum dry density.

3.6 BACKFILL

.1 Place backfill material in unfrozen condition.

.2 Place backfill material, above pipe surround in uniform layers not exceeding 300 mm compacted thickness up to grades as indicated. Backfill material is to be compacted to at least 95% of corrected maximum dry density.

.3 Protect installed culvert with minimum 600 mm cover of compacted fill before heavy equipment is permitted to cross. During construction, width of fill, at its top, to be at least twice diameter or span of pipe and with slopes not steeper than 1:2.

.4 Place backfill in unfrozen condition.

END OF SECTION

FOUNDATION AND UNDERSLAB DRAINAGE

PART 1 GENERAL

1.1 SECTION INCLUDES

.1 Materials and installation for foundation and underslab drainage.

1.2 RELATED SECTIONS

.1 Section 03 10 00 – Concrete Forms and Accessories.

.2 Section 31 05 16 - Aggregate Materials.

.3 Section 31 23 33 - Excavating, Trenching and Backfilling.

1.3 REFERENCES

.1 Canadian General Standards (CSA International).

.1 CSA –A23.1/A23.,Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.

.2 CSA B1800, Plastic Non-pressure Pipe Compendium - B1800 Series (Consists of B181.1, B181.2, B181.3, B181.5, B182.1, B182.2, B182.4, B182.6, B182.7, B182.8 and B182.11).

.1 CSA B182.2-02, PVC Sewer Pipe and Fittings (PSM Type).

.2 American Society for Testing and Materials International, (ASTM).

.1 ASTM D698, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3)

.3 Ontario Provincial Standard Specifications (OPSS);

.1 OPSS 1004, 1860

1.4 SITE CONDITIONS

.1 Examine geotechnical investigation report.

1.5 SUBMITTALS

.1 Submit manufacturer’s test data and certification at least 2 weeks prior to commencing work.

.1 Certification to be marked on pipe.

.2 Submit manufacturer’s information data sheets and instructions.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 – Common Product Requirements.

PART 2 PRODUCTS

2.1 BEDDING AND SURROUND MATERIALS

.1 Bedding and surround material is to be 19mm Clear Stone per OPSS MUNI 1004, extending a minimum of 300mm both above and below subdrain pipe.

.2 Subdrain pipe is to be perforated polyethylene pipe per OPSS 1840, minimum 320 kPa stiffness, covered with a knitted geotextile sock per OPSS 1860.

.3 Filter fabric is to be Class II non-woven geotextile per OPSS 1860.

2.2 BACKFILL MATERIAL

.1 Type 2, in accordance with Section 31 23 33 - Excavating, Trenching and Backfilling.

.2 Excavated or graded material existing on site may be suitable to use if approved by Contract Administrator.

PART 3 EXECUTION

3.1 EXAMINATION

.1 Ensure graded base conforms with required drainage pattern before placing bedding material.

.2 Ensure improper slopes, unstable areas, areas requiring additional compaction or other unsatisfactory conditions are corrected to approval of Contract Administrator.

.3 Ensure foundation wall and waterproofing have been installed and approved by Contract Administrator before placing bedding material.

3.2 BEDDING PREPARATION

.1 Cut trenches in base and place bedding material in uniform layers not exceeding 150 mm compacted thickness to depth as indicated.

.2 Shape bed true to grade and to provide continuous, uniform bearing surface for pipe.

3.3 PIPE INSTALLATION

.1 Ensure pipe interior and coupling surfaces are clean before laying.

.2 Lay perforated pipe tubing level minimum to slope of 1:100. Face perforations and coupling slots downward.

.3 Lay non-perforated pipe to slope of 1:50 from perforated pipe to disposal area. Make joints watertight.

.4 Grade bedding to establish pipe slope.

.5 Install end plugs at ends of collector drains to protect pipe tubing ends from damage and ingress of foreign material.

.6 Install end plugs at ends of collector drains.

.7 Lay perforated pipe around perimeter of the tanks as indicated.

.8 Connect subdrain to outlet swale at elevation indicated on contract drawings

3.4 BACKFILL MATERIAL

.1 Place backfill material above pipe surround in uniform layers not exceeding 200 mm compacted thickness up to grades as indicated.

.2 Under paving and walks, compact backfill to at least 95% corrected maximum dry density. In other areas, compact to at least 90% corrected maximum dry density.

END OF SECTION

CONCRETE ENCASED DUCT BANKS AND MANHOLES

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 03 10 00 – Concrete Forming and Accessories.

.4 Section 03 20 00 – Concrete Reinforcing.

.5 Section 03 33 00 – Cast-in-Place Concrete.

.6 Section 26 05 00 – Common Work Results - Electrical.

.7 Section 26 05 27 – Grounding – Primary.

.8 Section 31 23 33 - Excavating, Trenching and Backfilling.

1.2 REFERENCES

.1 Canadian Standards Association (CSA),

.1 CAN/CSA-A3000, Cementitious Materials Compendium. Includes:

.1 CAN/CSA-A5, Portland Cement

.2 CSA A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.

.3 CSA G30.3, Cold-Drawn Steel Wire for Concrete Reinforcement.

.4 CSA G30.5, Welded Steel Wire Fabric for Concrete Reinforcement.

.5 CSA-G30.18, Billet-Steel Bars for Concrete Reinforcement.

.2 American Society for Testing and Materials (ASTM),

.1 ASTM D1056, Specification for Flexible Cellular Materials – Sponge or Expanded Rubber.

.3 Ontario Provincial Standard Specifications (OPSS);

.1 OPSS 603 – Installation of Ducts

1.3 SUBMITTALS

.1 Submit manufacturer’s test data and certification at least 2 weeks prior to commencing work.

.2 Submit manufacturer’s information data sheets and instructions.

.3 Submit shop drawings for precast manholes.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 – Common Product Requirements.

1.5 RECORD DRAWINGS

.1 Provide record drawings, including details of pipe and duct bank materials, maintenance and operating instructions in accordance with Section 01 78 00 – Closeout Submittals.

PART 2 PRODUCTS

2.1 PVC DUCTS AND FITTINGS

.1 Rigid PVC duct to CSA C22.2 No. 211.1, Type DB2, with 50mm thick concrete topping as shown on drawings.

.2 Rigid PVC bends, couplings, reducers, bell end fittings, plugs, caps, adaptors same product material as duct, to make complete installation.

.3 Rigid PVC 90º and 45º bends.

.4 Rigid PVC 5º angle couplings.

.5 Expansion joints as required.

.6 Use epoxy coated galvanized steel conduit for sections extending above finished grade.

2.2 SOLVENT WELD COMPOUND

.1 Solvent cement for PVC duct joints.

2.3 RIGID EPOXY COATED CONDUIT

.1 Rigid epoxy coated galvanized steel conduit with zinc coating and corrosion resistant epoxy finish inside and outside. Use for sections extending above finished grade as indicated on drawings.

.2 Factory “ells” where 90° bends are required for 27 mm and larger conduits.

2.4 PRECAST CONCRETE MANHOLES

.1 Precast concrete manholes and auxiliary sections fabricated in steel forms. Precast manholes to ASTM C 478/C 478M with manhole ladder rung spacing of 450mm (maximum).

.2 Aggregates: to CSA A23.1/A23.2.

.3 Portland cement: to CAN/CSA-A3001.

.4 Steel welded wire fabric mesh reinforcing: to CSA G30.18.

.5 Pulling inserts and bolts for racks integrally cast in concrete.

.6 Neoprene gasket seals between manhole sections: to ASTM D1056.

2.5 MANHOLE FRAMES AND COVERS

.1 Cast iron manhole frames and covers. Covers are to be 762mm diameter and bolted on to prevent unauthorized entry.

2.6 GROUNDING

.1 Ground rods in accordance with Section 26 05 27 - Grounding - Primary for Cable Rack Grounding.

2.7 CABLE RACKS

.1 Hot dipped galvanized cable racks and supports.

.2 12 x 100 mm pre-set inserts for rack mounting.

2.8 CABLE PULLING EQUIPMENT

.1 Pulling iron: galvanized steel rods, size and shape as indicated.

.2 Pull rope: 6 mm stranded nylon polypropylene, tensile strength 5 kN, continuous throughout each duct run with 3 m spare rope at each end.

2.9 CONCRETE & REINFORCEMENT

.1 Concrete per OPSS 1350 (minimum 28-day compressive strength of 30 mPa) and reinforcement per OPSS 1440 and as shown on electrical drawings. Refer to Division 3-Concrete.

2.10 MARKERS

.1 Provide 75 mm wide, 4 mil, polyethylene marker tape in all trenches. Use red colored tape with repeating black lettering “Caution – Buried Electrical Line” or similar message. Install at depth as per drawings.

PART 3 EXECUTION

3.1 INSTALLATION GENERAL

.1 Install underground duct banks and manholes including formwork.

.2 Build duct bank and manholes on undisturbed soil or on well compacted granular fill not less than 150 mm thick, compacted to 95% of corrected maximum dry density.

.3 Open trench completely between manholes to be connected before ducts are laid and ensure that no obstructions will necessitate change in grade of ducts.

.4 Install ducts at elevations and with slope as indicated and minimum slope of 400H:1V.

.5 Install base spacers at maximum intervals of 1.5m levelled to grades indicated for bottom layer of ducts.

.6 Lay PVC ducts with configuration as indicated with preformed interlocking, rigid plastic intermediate spacers to maintain spacing between ducts at not less than 60 mm horizontally and vertically. Stagger joints in adjacent layers at least 50 mm and make joints watertight. Encase duct bank with 50 mm thick concrete cover. Use epoxy coated galvanized steel conduit (i.e. corroguard) for sections extending above finished grade level.

.7 Make transpositions, offsets and changes in direction using 5 degree bend sections, do not exceed a total of 20 degree with duct offset.

.8 Use bell ends at duct terminations in manholes or buildings.

.9 Use conduit to duct adapters when connecting to conduits.

.10 Terminate duct runs with duct coupling set flush with end of concrete envelope when dead ending duct bank for future extension.

.11 Cut, ream and taper end of ducts in field in accordance with manufacturer's recommendations, so that duct ends are fully equal to factory-made ends.

.12 Allow concrete to attain 50% of its specified strength before backfilling.

.13 Use anchors, ties and trench jacks as required to secure ducts and prevent moving during placing of concrete. Tie ducts to spacers with twine or other non-metallic material. Remove weights or wood braces before concrete has set and fill voids.

.14 Clean ducts before laying. Cap ends of ducts during construction and after installation to prevent entrance of foreign materials.

.15 Immediately after placing of concrete, pull through each duct wooden mandrel not less than 300 mm long and of diameter 6 mm less than internal diameter of duct, followed by stiff bristle brush to remove sand, earth and other foreign matter. Avoid disturbing or damaging ducts where concrete has not set completely. Pull stiff bristle brush through each duct immediately before pulling-in cables.

.16 Install four 3 m lengths of 15M reinforcing rods, one in each corner of duct bank when connecting duct to manholes or buildings. Wire rods to 10M dowels at manhole or building and support from duct spacers. Protect existing cables and equipment when breaking into existing manholes. Place concrete down sides of duct bank filling space under and around ducts. Rod concrete with flat bar between vertical rows filling voids.

.17 In each duct install pull rope continuous throughout each duct run with 3 m spare rope at each end.

3.2 MANHOLES

.1 Install pre-cast manholes.

.2 Provide 115 mm deep window to facilitate cable bends in wall at each duct connection. Terminate ducts in bell-end fitting flush with window face. Provide four 10M steel dowels at each duct run connection to anchor duct run. On runs of 16 ducts and over, support concrete duct encasement on a 700 mm wide by 75 mm thick concrete pier poured against manhole wall between slab and bottom of duct run, provide dowels for anchoring.

.3 Alternately connect large duct runs by leaving square opening in wall, later pouring duct run and wall opening in one pour, and install 10M x 3m reinforcing rods in duct run at manhole connection.

.4 Precast manhole shall be fabricated to ensure that the manhole top is level with finished grade in paved areas and 40 mm above grade in unpaved areas. Shop drawings are to illustrate this.

.5 Install manhole frames and covers for each manhole. Set frames in concrete grout onto manhole neck.

.6 Install cable racks, anchor bolts and pulling irons as indicated.

.7 Grout frames of manholes. Cement grout to consist of two parts sand and one part cement and sufficient water to form a plastic slurry.

.8 Ensure filling of voids in joint being sealed. Plaster with cement grout, walls, ceiling and neck.

.9 Spray paint "X" on ceiling of manhole above floor drain or sump pit.

3.3 INSPECTIONS

.1 Inspection of duct will be carried out by Contract Administrator prior to placing.

END OF SECTION

DIRECT BURY UNDERGROUND CABLE DUCTS

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 26 05 00 – Common Work Results - Electrical.

.4 Section 31 23 33 – Excavating, Trenching and Backfilling.

.5 Section 33 65 73 – Concrete Encased Duct Banks and Manholes.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CSA C22.2 No. 211.1, Rigid Types EBI and DB2/ES2 PVC Conduit.

.2 CSA C22.2 No. 211.3, Reinforced Thermosetting Resin Conduit RTRC and Fittings (Bi-national standard, with UL 1684).

.2 Ontario Provincial Standard Specifications (OPSS)

.1 OPSS Section 603 – Installation of Ducts

.2 OPSS Section 604 – Installation of Cable

1.3 SUBMITTALS

.1 Submit WHMIS MSDS - Material Safety Data Sheets acceptable to Labour Canada, and Health and Welfare Canada for solvent cement. Indicate VOC content.

.2 Submit manufacturer’s data and certification at least 2 weeks prior to commencing work.

.3 Submit manufacturer’s information data sheets and instructions.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and Handle materials in accordance with Section 01 61 00 – Common Product Requirements.

1.5 RECORD DRAWINGS

.1 Provide record drawings, including details of pipe and cable duct materials, maintenance and operating instructions.

PART 2 PRODUCTS

2.1 PVC DUCTS AND FITTINGS

.1 Rigid PVC duct: to CSA C22.2 No. 211.1 Type DB2, for direct burial with minimum wall thickness at any point of 2.8 mm. Nominal length: 3.0 m plus or minus 12 mm.

.2 Rigid PVC split ducts as required.

.3 Rigid PVC bends, couplings, reducers, bell end fittings, plugs, caps, adaptors same product material as duct, to make complete installation.

.4 Rigid PVC 90^{o} and 45^{o} bends as required.

.5 Rigid PVC 5^{o} angle couplings as required.

.6 Expansion joints every 50m (minimum).

.7 Use epoxy coated galvanized steel conduit for sections extending above finished grade.

2.2 SOLVENT WELD COMPOUND

.1 Solvent cement for PVC duct joints.

2.3 CABLE PULLING EQUIPMENT

.1 Use 6 mm stranded nylon pull rope tensile strength 5 kN.

2.4 MARKERS

.1 75 mm wide, 4 mil, polyethylene marker tape in all trenches. Use red colored tap with repeated black lettering “Caution – Buried Electrical Line”. Install at depth as per drawings.

2.5 BEDDING, COVER AND SURROUND MATERIALS

.1 All materials as per Specification Section 31 23 33 – Excavating, Trenching, and Backfilling.

.2 Type 1 (Granular ‘A’) and Type 2 (Granular ‘B’) Type II) material.

.3 Sandfill as per Specification 31 23 33 for electrical/communications trenches

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install duct in accordance with manufacturer's instructions.

.2 Clean inside of ducts before laying.

.3 Ensure full, even support every 1.5 m throughout duct length.

.4 Slope ducts with 1 to 400 minimum slope.

.5 During construction, cap ends of ducts to prevent entrance of foreign materials.

.6 Pull through each duct wooden mandrel not less than 300 mm long and of diameter 6 mm less than internal diameter of duct, followed by stiff bristle brush to remove sand, earth and other foreign matter. Pull stiff bristle brush through each duct immediately before pulling-in cables.

.7 In each duct install pull rope continuous throughout each duct run with 3 m spare rope at each end.

.8 Install markers as required.

END OF SECTION

UNDERGROUND ELECTRICAL SERVICE

PART 1 GENERAL

1.1 SECTION INCLUDES

.1 Provision of rigid conduit and concrete – encased underground service ducts.

1.2 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

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

.3 Section 26 05 00 – Common Work Results – Electrical.

.4 Section 26 05 27 – Grounding – Primary.

.5 Section 26 05 28 – Grounding – Secondary.

.6 Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings.

.7 Section 26 05 43 – Installation of Cables in Trenches and in Ducts.

.8 Section 33 65 76 – Direct Buried Underground Cable Ducts.

1.3 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CSA A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.

.2 Ontario Provincial Standard Specifications (OPSS);

.1 OPSS Sections 604, 609

1.4 REGULATORY REQUIREMENTS

.1 Co-ordinate and meet requirements of power supply authority. Ensure availability of power when required.

.2 Perform work to comply with relevant provincial/territorial regulations.

1.5 SUBMITTALS

.1 Provide submittals in accordance with Section 01-33-00 – Submittal Procedures and Section 26 05 00 – Common Work Results for Electrical.

.2 Product Data;

.1 Submit manufacturers printed product literature, specifications, and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Underground ducts: to Section 33 65 76 – Direct Buried Underground Cable Ducts, rigid PVC type, size as indicated and Section 33 65 73 – Concrete Encased Duct Banks.

.2 Epoxy coated rigid steel galvanized conduit and fittings: to Division 26. Use for sections extending above finished grade.

.3 Conductors: copper, type RWU-90, to Section 26 05 21 – Wires and Cables (0 - 600v), size and number of conductors as indicated.

.4 Meter socket: weatherproof, to Section 26 09 23.01 – Metering and Switchboard Instruments.

.5 Pole mounted outdoor load break switch as per Section 26 28 13.02 – Outdoor Load Break Switches and Fuses.

.6 Concrete: to CSA A23.1/A23.2 and Division 3 – Concrete.

.7 Ground at terminal pole enclosure as per Section 26 05 27 – Grounding – Primary.

.8 Bedding, Cover and Surround Materials

.1 All materials as per Specification Section 31 23 33 – Excavating, Trenching, and Backfilling.

.2 Type 1 (Granular ‘A’) and Type 2 (Granular ‘B’) Type II) material

.3 Sandfill as per Specification 31 23 33 for electrical/communications trenches.

.9 Pulling Iron:

.1 22 mm diameter hot dipped galvanized steel bar with exposed triangular shaped opening.

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 cables in trenches and in ducts in accordance with Section 26 05 43 – Installation of Cables in Trenches and in Ducts.

.2 Allow adequate conductor length for connection to supply by power supply authority.

.3 Install meter socket and conduit.

.4 Install pole mounted load break switch as indicated.

.5 Allow adequate conductor length for connection to service equipment.

.6 Make grounding connections in accordance with Section 26 05 28 – Grounding – Secondary.

.7 Provide concrete encasement in accordance with CSA A23.1 and as indicated on drawings.

.8 Install pulling irons as required.

.9 Seal ducts and conduits at building entrance location after installation of cable.

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 – Common Work Results – Electrical and Section 01 91 13 – General Commissioning (Cx) Requirements.

.2 Perform additional tests as required by authority having jurisdiction.

.3 Submit written test results for review and approval.

3.4 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

DIVISION 44 INDEX

PROCESS GENERAL REQUIREMENTS

PART 1 GENERAL

1.1 SUMMARY

.1 Section includes supply, installation, testing and commissioning of mechanical equipment in Divisions 44 and 25 supplemented by details shown or specified in respective Sections. All costs associated with these services are to be included in the price(s) quoted.

1.2 GENERAL CLAUSES

.1 Comply with Division 01.

.2 Unless there are more restrictive requirements in respective Sections, provisions of this Section apply.

.3 Ensure that control panels and/or components provided as part of packaged equipment conform to requirements of the Specifications, Division 25 through 28 and Drawings.

.4 For control and electrical elements, use this Section in conjunction with the Drawings for conformance to style, quality, and product demonstrated and selected. Provide instrumentation and control devices as detailed in the Specifications and shown on the Drawings, including the Electrical Divisions 25 through 28.

.5 All equipment and controls to be CSA compliant and identified as such.

.6 Comply with laws, ordinances, rules, regulations, codes, and orders of authorities having jurisdiction relating to work.

.7 It is the Contractor’s responsibility to ascertain from each Supplier the extent of work required for the complete installation of each piece of equipment, and to ensure that each Supplier has full knowledge of the required duty of the equipment to be installed.

.8 Be fully acquainted with all work under this Contract. At no time will any claim be considered due to misunderstanding of the work involved.

.9 Immediately upon receipt of the Start Work Order, issue a Purchase Order or Sub-Contract for designated equipment. Submit a copy of the Purchase Order or agreement to the Contact Administrator. Failure to order equipment in a timely fashion will not be considered as a reason to extend the Contract schedule.

1.3 SYSTEM DESCRIPTION

.1 It is the intent of all Sections of these Specifications to specify a complete and operating system that will perform its intended function(s). All devices, fittings,

valves and other appurtenances required to perform this function shall be considered as part of the Specifications, even if not explicitly identified.

.2 Design requirements:

.1 Provide heavy-duty mechanical equipment designed for continuous operation.

.2 Maximum vibration velocity (measured at equipment bearings): 1 mm/s.

.3 Co-ordination requirements:

.1 Equipment, such as pressure switches, may be shown on Process, Mechanical and/or Instrumentation Drawings. They may also be shown on Electrical Drawings due to wiring requirements. Provide these devices under Division 25, 26, and 44, respectively. Equipment and devices are wired according to the Electrical Drawings and Specifications.

.2 Coordinate requirements of equipment supplied with piping, structural supports, ventilation/cooling, electrical service, instrumentation and control interface, and other ancillaries specified in other Divisions.

1.4 REFERENCES

.1 Standards:

.1 AFBMA Std 9, Load Ratings and Fatigue Life for Ball Bearings.

.2 AFBMA Std 11, Load Ratings and Fatigue Life for Roller Bearings.

.3 ANSI/ASME, Boiler and Pressure Vessel Code, Section VIII, Division 1.

.4 ANSI B1.1, Unified Screw Threads.

.5 ANSI B1.20.1, Pipe Threads, General Purpose.

.6 ANSI B16.1, Cast Iron Pipe Flanges and Flanged Fittings Class 25, 125, 250 and 800.

.7 ANSI B16.5, Pipe Flanges and Flanged Fittings, Steel, Nickel Alloy and Other Special Alloys.

.8 ANSI B18.2.1, Square and Hex Bolts and Screws, Including Askew Head Bolts, Hex Cap Screws, and Log Screws.

.9 ANSI B18.2.2, Square and Hex Nuts.

.10 ANSI/ASME B31.1, Power Piping.

.11 ANSI/ASME B31.3,Chemical Piping.

.12 ANSI/ASME B31.9, Building Services Piping.

.13 ANSI B32.1, Metal Products.

.14 ANSI B46.1, Surface Texture.

.15 ANSI/ASME B1.20.1, General Purpose Pipe Threads.

.16 ASTM A 48, Specification for Gray Iron Castings.

.17 ASTM A307, Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.

.18 ASTM A320, Alloy-Steel Bolting Materials for Low Temperature Service.

.19 CSA CAN3-S16.1-M, Steel Structures for Buildings (Limit State Design).

.20 CSA C59-M, Welded Steel Construction (Metal Arch Welding).

.21 CSA S244, Welded Aluminum Design and workmanship (Inert Gas Shielded Arch Processes).

.22 CSA W47.1, Certification of Companies for Fusion Welding of Steel Structures.

.23 CSA W47.22-M, Certification of Companies for Fusion Welding of Aluminum.

.24 Canadian Electrical Code (CEC), Safety Standard for Electrical Installations.

.25 ANSI/CSA B149.6-15 Code for Digester Gas, Landfill Gas and Biogas Generation and Utilization Published 2015, as amended.

.26 TSSA Digester, Landfill & Biogas Approval Code TSSA-DLB-2016, as amended.

.2 Certificates:

.1 Shop finished metal: Certify that shop finished metal components received specified protective coating system.

.2 Welding aluminum: Certify that companies welding aluminum components are CSA-approved (CSA W47.2).

1.5 SHOP DRAWINGS AND SAMPLES

.1 The following shall be submitted in compliance with Section 01 33 00:

.1 Manufacturer's product data including catalogue cuts.

.2 Equipment name, identification number and specification numbers.

.3 Shop drawings showing details, dimensions, anchorage details, and installation of equipment with all special fittings, appurtenances and required clearances.

.4 Shipping weights.

.5 Calculations of equipment anchorage forces and anchorage details.

.6 Certification that the single manufacturer accepts the indicated unit responsibilities.

.7 Parts list with materials of construction by ASTM reference and grade.

.8 List of at least 5 installations and telephone numbers, where identical equipment has been used.

.9 Documentation of experience of specialist who will perform torsional and vibration analysis.

.10 Torsional and lateral vibration analysis reports.

1.6 SERVICES OF MANUFACTURER

.1 Provide Inspection, Start-up, and Field Adjustment services in accordance with the requirements of Division 01 using an authorized service representative of the

manufacturer. At a minimum, the authorized service representative shall visit the site and witness the following:

.1 Installation of equipment.

.2 Inspection, checking and adjusting the equipment

.3 Start-up and field testing for proper operation.

.4 Perform field adjustment to ensure that the equipment installation and operation comply with the Specifications.

.5 Allow one (1) full working day on site per visit.

1.7 TRAINING

.1 Provide training to Owner in accordance with Section 01 91 41 – Commissioning Training.

1.8 FACTORY TESTING

.1 Provide the following services for factory testing, unless otherwise indicated:

.1 Test product at factory for compliance with specified requirements.

.2 Statically and dynamically balance rotating elements of equipment at factory prior to final assembly to provide smooth operation. Provide Contract Administrator with 10 business days advance notice of factory test.

.3 Contract Administrator may witness factory test.

.4 Do not deliver equipment to site until equipment has met specific requirements of factory tests.

1.9 COORDINATION

.1 The Contractor shall coordinate with the system and equipment manufacturers, the Vendor's installation and supply scope or work because the Contractor shall be responsible for the entire installation and commissioning.

.2 If there is a discrepancy for the Vendor's supply scope or work shown on the process drawings, the Contractor shall provide all required piping, power cables and communication cables for the complete commissioning and controls.

.3 Fully coordinate the work of all related specification sections. Use equipment specifications together with all sitework, concrete, building, electrical and controls specifications as necessary in order to produce a fully coordinated product meeting all necessary specifications.

.4 When manufacturers field services are provided by the equipment manufacturer, the Contractor shall coordinate the services with the equipment manufacturer. The Contractor shall give the Contract Administrator written notice at least 30 days prior to the need for manufacturer's field services furnished by others.

1.10 PRODUCTS DELIVERY, STORAGE AND HANDLING

.1 Unless otherwise indicated in the respective Sections, the Contractor is to be responsible for unloading any equipment upon delivery to site. Unloading to be done carefully and according to the Manufacturer's recommended practices.

.2 Deliver, store and handle equipment in accordance with Section 01 61 00 and the following additional requirements:

.1 Deliver material to site in original, unbroken packages, containers or bundles bearing name of manufacturer.

.2 Box, crate or otherwise protect equipment from damage and moisture during shipping, handling and storage.

.3 Protect bearings, seals and glands from grit and foreign matter.

.4 Protect equipment from exposure to corrosive fumes.

.5 Arrange for delivery of equipment to site to meet applicable dates in progress schedule.

.6 Arrange for delivery of anchor bolts, templates, embedded miscellaneous metals, and other similar items to site as required during construction.

.7 Do not arrange for delivery to site of equipment until suitable storage space exists within the storage facility on site so that equipment can be protected from weather, construction debris, and dust.

.8 Keep equipment dry at all times.

.9 Store equipment at site prior to installation in temporary weathertight, heated storage facilities free from dust, moisture, and other conditions that could damage equipment.

.10 Do not use plastic wrappers to prevent accumulation of condensate in gears and bearings, if equipment is stored for extended period.

.11 Remove rejected equipment damaged during shipment, storage or installation and replace with new identical equipment.

.12 Improperly stored equipment will be rejected from site.

1.11 UNIT RESPONSIBILITY

.1 Equipment systems made up of two or more components shall be provided as a unit by the manufacturer of the driven equipment. The manufacturer of the driven equipment shall assume the unit responsibility. Unless otherwise indicated, the Contractor shall cause each system component to be furnished by the manufacturer with unit responsibility. The extent of the manufacturer's responsibilities shall include engineering the specified equipment, preparation of all submittal materials, coordinating manufacture and procurement, compatibility and shipment of all specified components, design of all equipment supports, providing installation and testing specialists to assist the Contractor in completing the installation and commissioning the equipment, furnishing factory certified specialists to train the Owner's staff, and the production and submission of specified operation and maintenance manuals. The Contractor is responsible to the Owner for performance of all systems as indicated. The Contractor shall

ensure the submittal of a Certificate of Unit Responsibility signed by the manufacturer with unit responsibility.

1.12 SPECIAL TOOL

.1 Provide one complete set of special tools recommended by manufacturer for maintenance and repair of each separate type of equipment.

.2 Store special tools in tool boxes.

.3 Identify tool box with equipment number with stainless steel or solid plastic name tags attached to box.

1.13 SPARE PARTS

.1 Provide spare parts recommended by manufacturer with equipment where specified in respective Sections.

.2 Include in any submittals a list of the Manufacturer’s recommended spare parts.

.3 Tag spare parts by Project equipment number and identified as to part number, equipment manufacturer and sub-assembly component (if appropriate).

.4 Protect spare parts subject to deterioration such as ferrous metal items and electrical components with lubricants or desiccants. Encapsulate spare parts in hermetically sealed plastic wrapping.

.5 Store spare parts in wooden boxes with hinged cover and locking hasp if spare part weighs less than 50 pounds. Provide strap type hinges. Paint and identify box with stencilled lettering stating name of equipment, equipment numbers and words "Spare Parts". Provide neatly typed inventory of spare parts on underside of cover.

1.14 ALTERNATE EQUIPMENT

.1 The Contractor shall base his tender price on quotations received from the equipment suppliers as hereinafter specified, unless otherwise noted. Should the contractor wish to propose an alternate, after the tender closing and award of the contract, the alternate may be considered if there is a financial and quality incentive provided for consideration.

PART 2 PRODUCTS

2.1 GENERAL

.1 Provide equipment as follows:

.1 Specified products meeting specified requirements.

.2 New products from current and specified manufacturer.

.3 Suitable for intended purposes, of high quality and free of defects.

.4 Equipment to operate at highest efficiency possible for that equipment type.

.5 Products and materials recommended by specified manufacturer for intended service.

.6 All working parts to be standard sizes such that parts will be interchangeable between like units and that the Owner be able to obtain replacement and repair parts at any time in the future.

2.2 EQUIPMENT GENERAL REQUIREMENTS

.1 Provide equipment designed for:

.1 Service factor: Use minimum service factor of 1.25 in selection and design of mechanical power transmission components unless otherwise specified in various Sections.

.2 Welding: Except as otherwise indicated, welding shall comply with ANSI/AWWA D100 AND AWWA C206 and the following:

.1 Composite fabricated steel assemblies which are to be erected or installed inside a hydraulic structure, including any fixed or movable structural components of mechanical equipment, shall have continuous seal welds and shall prevent entrance of air or moisture.

.2 Welding shall be by the metal-arc method or gas-shielded arc method described in the American Welding Society's "Welding Handbook" as supplemented by other AWS standards.

.3 Qualification of welders shall comply with AWS Standards.

.4 In assembly and during welding, the component parts shall be clamped, supported, and restrained to minimize distortion and for control of dimensions. Weld reinforcement shall comply with the AWS code. Upon completion of welding, weld splatter, flux, slag, and burrs left by attachments shall be removed. Welds shall be repaired to produce a workmanlike appearance with uniform weld contours and dimensions. Sharp corners of material which is to be painted or coated shall be ground to a minimum of 1/32-inch on the flat.

.5 All austenitic Stainless Steel welds shall be cleaned in accordance with ASTM A380-88 Section 6.2.11. The acid solution is as defined in ASTM A380 Table A2.1 Annex A2. Materials shall receive a final rinse using ordinary industrial or potable water and passivated in conformance with ASTM A380 Section 8.3.

.3 Equipment identification: Legible identifying mark corresponding to equipment number indicated.

.4 Shop fabrication: In accordance with shop drawings.

.5 Tolerances: Maximum variation in length of members without machine finished ends that are framed is 1.59 mm for members 9.1 m or less, maximum 3.175 mm for members over 9.1 m in length.

.6 Vibration Level: Except as otherwise indicated, equipment subject to vibration shall be provided with restrained spring-type vibration isolators or pads complying with the manufacturer's written recommendations.

.7 Seismic Design: The seismic design of equipment and equipment supports shall be based on the horizontal peak ground acceleration indicated in the Geotechnical Report or in the Ontario Building Code requirements for Post Disaster Buildings.

2.3 PIPE HANGERS, SUPPORTS AND GUIDES

.1 Pipe connections to equipment shall be supported, anchored, and guided to minimize stresses and loads on equipment flanges and equipment. Supports and hangers shall comply with the requirements of Section 44 05 50.

2.4 BEARINGS

.1 Bearings for rotating equipment:

.1 Design: B-10 life expectancy to Anti-Friction Bearing Manufacturers Association Inc. (AFBMA) at rated conditions of service for minimum 100,000 working hours, unless otherwise specified.

.2 Grease fittings for bearing lubrication.

.3 Bearing selection based on following criteria: Fitting practice, mounting, lubrication, sealing, static rating, and housing strength.

.4 Lubricated-for-life bearings: Factory lubricate with manufacturer's best recommended grease to insure maximum bearing life and best performance.

.5 Re-lubricatable type bearings: Grease nipple for loading and capped vent to relieve aged grease.

.6 Equip oil lubricated bearings with either pressure lubricating system or separate oil reservoir type system.

.7 Design oil lubrication systems of sufficient size to absorb heat energy generated in bearing under maximum ambient temperature of 40°C. Provide filler pipe and external level indicator gauge.

.8 Bearing housings: Cast iron or steel, unless otherwise specified.

.9 Bearing mounting arrangement: to published standards of manufacturer.

.10 Electric motors: Design bearings so no grease or oil can escape.

2.5 SHAFTING

.1 Continuous shafting between bearings.

.2 Size shafting to transmit power required.

.3 Provide keyways in accordance with manufacturer's standard practice.

.4 Select materials for shafting for type of service, torque transmitted, and effect of corrosive gases, moisture, and fluids used in service.

.5 Materials:

.1 Low carbon cold-rolled steel shafting: ASTM A 108, Grade 1018.

.2 Medium carbon cold-rolled shafting: ASTM A 108, Grade 1045.

.3 Corrosion resistant shafting: stainless steel or Monel, whichever is most suitable for service.

2.6 GEARS AND GEAR DRIVES

.1 Except as otherwise indicated, gears shall be of the helical or spiral-bevel type, designed and manufactured in accordance with AGMA Standards, with a minimum service factor of 1.7, a minimumL-10 bearing life of 60,000 hours at the worst combination of specified operating conditions, in accordance with ABMA 9 or 11, and a minimum efficiency of 94 percent. Worm gears shall not be used.

.2 Gear speed reducers or increasers shall be of the enclosed type, oil- or grease-lubricated and fully sealed, with a breather to allow air to escape but keep dust and dirt out. The casing shall be of cast iron or heavy duty steel construction with lifting lugs and an inspection cover for each gear train. An oil level sight glass and an oil flow indicator shall be provided and installed for easy reading.

.3 Gears and gear drives as part of an equipment assembly shall be shipped fully assembled for field installation.

.4 Material selections shall comply with AGMA values and the manufacturer's recommendations. Input and output shafts shall be properly designed for the service and load requirements. Gears shall be computer-matched for minimum tolerance variation. The output shaft shall have 2 positive seals to prevent oil leakage.

.5 Oil level and drain location shall be readily accessible. Oil coolers or heat exchangers with all required appurtenances shall be included where indicated.

.6 Where gear drive input or output shafts connect to couplings or sprockets, the gear drive manufacturer shall supply matching key.

2.7 DRIVE CHAINS

.1 Power drive chains shall be commercial type roller chains complying with ANSI standards and of materials best suited for the process fluid.

.2 A chain take-up or tightener shall be provided in every chain drive arrangement.

.3 A minimum of one connecting or coupler link shall be provided with each length of roller chain.

2.8 EQUIPMENT GUARDS

.1 All equipment to be guarded in compliance with Ontario Health and Safety Act (OHSA) requirements and any other applicable regulations.

.2 Without limiting clause 2.8.1 above, provide equipment guards for couplings, belts, chain drives, extended shafts, and exposed moving or rotating parts:

.1 Securely mounted guards.

.2 Reinforced, minimum 2.8 mm thick sheet steel or expanded sheet metal.

.3 Smooth edges and corners with borders neatly welded to perforated sheet.

.4 Hinged, latched and lockable access doors.

.5 Hot-dip galvanize steel guards after fabrication.

.6 Guards designed to totally enclose couplings, belts, chain drives, extended shafts, and exposed moving or rotating parts.

.7 Paint guards to same standard as parent equipment.

.8 Removable type guards to facilitate maintenance of moving parts.

.9 Make provision to extend grease fittings through guards to an accessible area.

2.9 CAUTION SIGNS

.1 Use vinyl stick-on type decals placed onto clean, smooth surface of equipment to be posted.

.2 Where insufficient space exists, use decal applied to galvanized mild steel, fibreglass, or plastic sheet fastened to equipment.

.3 Provide signs that read “CAUTION - AUTOMATIC EQUIPMENT MAY START AT ANY TIME”.

.4 Letters: 25 mm in height, red, on yellow background.

.5 Mounting posts and hardware. Mount close to guarded moving parts.

.6 Sufficiently sized taps to avoid plugging and to permit instruments to be installed.

2.10 EQUIPMENT NOISE LEVELS

.1 Design equipment for quiet operation.

.2 Overall noise level at equipment to be maximum 85 decibels measured on "A" weighting network using survey and field methods conforming to ANSI S1.13 and CSA Z107.2, unless otherwise specified.

.3 If hearing protection is required, Contractor shall install signs as directed at each door entering the area where hearing protection is required.

2.11 EQUIPMENT IDENTIFICATION

.1 Nameplates for equipment:

.1 Securely attached in suitable location.

.2 Nameplate material: Corrosion-resistant metal.

.3 Impressed type lettering on equipment.

.4 Provide a minimum of the following information on nameplate (units to be metric):

.1 Model number.

.2 Serial number.

.3 Capacities.

.4 Efficiency.

.5 Brake horsepower.

.6 Other information required to uniquely identify equipment.

2.12 ELECTRICAL CONTROL AND INSTRUMENTATION

.1 Provide CSA approved instrumentation, control, and electrical devices that bear CSA approvals sticker.

.2 Electrical equipment shall bear CSA labels and/or ULC where applicable per the Canadian Electrical Code and the Electrical Safety Authority. Conform to the requirements of the Canadian Electrical Code, Ontario Building Code, local, municipal and provincial authorities. Equipment not complying with the above approvals shall have on-site inspection by ESA, and the Contractor shall provide all necessary work to satisfy ESA requirements in order to obtain approval. All associated fees, cost of material and labour shall be provided by the Contractor. All necessary application or documentation required shall be provided by Contractor. Substantial Completion will not be awarded until all ESA permits and approvals are provided to the Contract Administrator for operation of the equipment and facilities.

.3 Indicating Lights: Use oil-tight transformer type indicating lights with low voltage lamps and push-to-test features, with coloured lenses in accordance with the specifications and Electrical Drawings.

.4 Disconnect Switches: Disconnect switches in accordance with the specifications and Electrical Drawings.

.5 Cables: Cables in accordance with the specifications and Electrical Drawings.

.6 Conduits: Conduits, conduit fastenings, and fittings in accordance with the specifications and Electrical Drawings.

.7 Grounding: Grounding in accordance with the specifications and Electrical Drawings.

.8 Programming: All computer/control programs required for the intended operation of supplied equipment, as designed and as shown on the Contract Drawings and in the Specifications, shall be considered an essential component of that equipment. Such programs are to be delivered as part of the shop drawing review, and no delivery of equipment shall occur until all required programs have been approved by the Contract Administrator.

.9 Pilot Devices:

.1 Electrical pilot devices including switches, relays, and contacts: Use heavy-duty industrial quality devices in accordance with the specifications and Electrical Drawings.

.2 Contacts that provide alarm, malfunction or control to external systems must be rated for minimum 10 Amps continuous at 120 Volts AC, except for pressure switches and temperature switches rated minimum 5 Amps continuous at 120 Volts AC.

2.13 OVERLOAD PROTECTION

.1 General: Where indicated, mechanical or electronic overload protection devices shall be installed on equipment.

.2 Mechanical System: The overload protection shall be a mechanical device designed to provide reliable protection in the event of excessive overload. It shall be a ball detent type designed for long term repeatability and life. It shall be infinitely adjustable by a single adjusting nut which shall be tamper proof, and incorporate a torque monitoring and control system. It shall activate an alarm set for 85 percent, and a motor cut-out switch set for 100 percent of maximum continuous running torque. A visual torque indicator shall be provided and oriented so that it may be read from the walkway. The dial shall be calibrated from 0 to 100 percent of maximum continuous running torque. The design of the torque limiter should initiate the mechanical disengagement of the drive upon overload. Each unit shall be suitable for outdoor and corrosive environments with a protective finish, corrosion inhibiting lubricants and a stainless steel cover.

.3 Electronic System: Overload protection may bean Electronic Torque Monitoring Control System capable of displaying torque, rpm's, one level of overload, and two levels of overload of the drive system. It shall incorporate a time-delay for start up and a voltage monitoring and compensation circuit for up to ±15 percent variation.

The overload device shall have an enclosure suitable for outdoor installation at temperatures of 0-70 °C, and relative humidity up to 95 percent. A visual torque dial shall be provided and oriented so that it can be easily read from the walkway.

The torque monitoring system shall be calibrated to include: alarm and shut down the system in the event the torque drops to 50 percent of normal running; alarm at 85 percent of maximum continuous running torque and shut down the motor at maximum continuous running torque of the equipment. The system shall be calibrated at the factory of the equipment manufacturer, and it shall be capable of monitoring twice the maximum continuous running torque of the equipment.

.4 Maximum Continuous Running Torque shall be defined as the lesser of: the motor continuous running torque rating, the gear drive continuous running torque rating, or the driven mechanism continuous running torque rating, not exceeding a service factor of 1.0.

2.14 PUDDLE FLANGES AND PIPE SLEEVES

.1 Provide Puddle Flanges and Pipe Sleeves: at points where pipes pass through masonry, concrete, fire rated assemblies, floors/grating, and as indicated. All of these products are to be cast-in-place in coordination with Division 03, coring will not be accepted where puddle flanges or pipe sleeves are shown. Refer to Section 44 05 50 for detail requirements.

2.15 ANCHOR BOLTS, NUTS AND WASHERS

.1 Unless otherwise indicated, anchor bolts, nuts and washers for anchoring equipment to foundations and connecting bolts for equipment assemblies supported by other assemblies shall conform to the requirements of Division 05. Unless otherwise specified, the Contractor shall provide Type 316 stainless steel anchor bolts and washers, and Type 416 stainless steel or other corrosion resistant, non-galling alloy nuts . In ferrous chloride and ferric chloride containment areas, unless otherwise specified, provide Hastelloy C or Alloy 276 anchor bolts, nuts, washers and connecting bolts.

2.16 SPROCKETS

.1 General: Sprockets shall be used in conjunction with chain drives and chain-type material handling equipment.

.2 Materials: Except as otherwise indicated, sprockets shall comply with the following:

.1 Sprockets with 25 teeth or less, normally used as a driver, shall be medium carbon steel in the 0.40 to 0.45 percent carbon range.

.2 Type A and B sprockets with 26 teeth or more, normally used as driven sprockets, shall be minimum 0.20 percent carbon steel.

.3 Large diameter sprockets with Type C hub shall be cast iron conforming to ASTM A 48, Class 30.

.4 Sprockets shall be accurately machined to ANSI Standards. Sprockets shall have deep hardness penetration in tooth sections.

.5 Finish bored sprockets shall be provided complete with keyseat and set screws.

.6 Sprockets shall be of the split type or shall be provided with taper-lock bushings.

.7 Idler sprockets shall be provided with brass or Babbitt bushings, complete with oil hole and axial or circumferential grooving. Steel collars with set screws in both sides of the hub shall be provided.

PART 3 EXECUTION

3.1 FINISHES

.1 Finish equipment to following quality:

.1 Welds: free of slag, ground and buffed.

.2 Surfaces of castings: ground smooth.

.3 Corners and edges on sheet metal work: rounded.

.4 Materials and equipment: free of dents.

.5 Machined surfaces finished: to specified tolerances.

3.2 PUMP TESTING

.1 The Contractor with Supplier shall perform the pump testing.

.2 Comply with ANSI/HI 14.6-2016, Rotodynamic Pumps for Hydraulic Performance Acceptance Tests.

.3 Comply with ANSI/HI 11.6-2017, Rotodynamic Submersible Pumps: for Hydraulic Performance, Hydrostatic Pressure, Mechanical and Electrical Acceptance Tests

.4 Complete a factory hydrostatic pressure tests and submit the test reports.

.5 The standard tests shall be carried out on a combination of a pump and associated valves and fittings at the final site installation.

.6 Comply with ISO 10816-3, API 610 and other standards for the vibration limits.

.1 An acceptable vibration level would be below 0.16 in/sec (pk) or 2.8 mm/sec (rms) as per ISO 10816-3.

.2 Based on the API 610 requirement the overall vibration for overhung pump shall be less than 3 mm/s (0.12 in/s) for overall frequency and 2 mm/s (0.08 in/s) for discrete frequency.

.7 For the mechanical test on the non-submersible pumps, the flow at the inlet and outlet of the whole combination shall comply with the following requirements:

.1 Testing operating conditions and procedure in accordance with ANSI/HI 14.6-2016.

.2 Dry-run test for 10 seconds

.3 Vibration at the pump bearing housing in two directions perpendicular to the shaft and in the axial direction.

.1 Vibration instruments can be either handheld or rigidly attached to the pump. For pumps with speeds above 600 rpm, the measurement instrumentation should be capable of measuring the RMS vibration velocity.

.2 Refer to ANSI/HI 9.6.4 Rotodynamic Pumps for Vibration Measurements and Allowable Values for Vibration Test Requirements, including Instrumentation.

.3 The planes of measurement shall be horizontal, perpendicular to the pump shaft (x), vertical (y) and at 90° to the above planes, parallel to the shaft for horizontal pumps and perpendicular for vertical pumps (z).

.4 Temperature of both bearings or bearing housings.

.1 Temperature instruments can be any recognized temperature sensor, such as pyrometers, thermometers, thermo-couples, and the like.

.2 They should be capable of measuring the metal temperature on the outside of the housing of both bearings and may be handheld.

.5 Leakage from mechanical seals, gaskets and bearing lubricant. Visual observation is sufficient for all leakage.

.6 Oil temperature when oil sump is used.

.8 Submit the test records or reports with the following data:

.1 The manufacturer’s serial number, pump type and size

.2 Acceptance criteria

.3 Vibration levels with measurement locations

.4 Noise levels

.5 Bearing temperature

.6 Ambient temperature

.7 Leakage

.8 Free-running rotating parts

.9 Date of test

3.3 BLOWER TESTING

.1 Comply with ISO 5389:2005, PTC 10-1997, IS 1940/1, ASME PTC 10-997, ASME PTC 19.5 and ISO 5801 First Edition 1997-06-01.

.2 Complete a factory performance, overspeed spin, balance and vibration tests, noise level tests, power draw tests and submit the test reports.

.3 On-site vibration and surge test

.1 The standard tests shall be carried out on a combination of blower (s) and associated valves and fittings at the final site installation.

.2 Submit the test records or reports with the vibration limits/levels and noise levels.

3.4 PAINTING AND CLEANING OF STAINLESS STEEL

.1 If specified in various Sections, prepare surfaces, shop prime and factory finish equipment to Division 05 and Division 09 for priming and painting of steel.

.2 If exposed surfaces of equipment are not specified to be factory painted in various Sections, prepare surfaces, and shop prime equipment in accordance with Division 09. Field painting to be done after equipment is installed and successfully tested.

.3 All stainless steel shall be cleaned following completion of the commissioning process and prior the issuance of the certificate of substantial completion according to the following:

.1 The supplied welded stainless steel assemblies are to be cleaned in accordance with ASTM A380-88 Section 6.2.11. The acid solution is as defined in ASTM A380 Table A2.1 Annex A2. Materials have a final rinse using ordinary industrial or potable water and are dried in conformance with ASTM A380 Section 8.3.

.2 Welds shall be acid passivated. Pickling paste (AVESTA 101 or equivalent) shall be brushed on all welds and overlap into the heat affected zones (HAZ). Paste shall be left on for 1-2 hours before water flush and neutralization with a soda ash solution. Contractor is responsible for all clean up.

.3 All surface blemishes and weld tacks shall be blended smooth using Walters (or equiv.) blender disc (80 grit). The complete surface shall be glass bead polished to uniform finish using # 6 glass bead. After polishing, the surface shall be rinsed then passivated using citric acid solution. Solution shall be mixed at a ratio of 4 parts water to 1 part dry citric acid powder (by volume). Solution shall be sprayed onto surface and left for 30 minutes before water flushing the complete surface.

3.5 EQUIPMENT INSTALLATION – GENERAL

.1 Install equipment components as follows:

.1 Couplings: To manufacturer's and onsite representative’s installation instructions.

.2 Insulating connections: To manufacturer's installation instructions.

.3 Packaged equipment: Co-ordinate space and structural requirements, clearance, utility connections, signals, outputs and features required by manufacturer including safety interlocks.

3.6 EQUIPMENT PREPARATION

.1 Prior to equipment installation, inspect and field measure to ensure that previous work is not prejudicial to successful installation of equipment.

.2 Provide required notices, submit drawings, obtain permits, licenses and certificates and pay fees required for work.

.3 Make minor modifications to suit piping and other installed equipment and structural element locations and elevations.

3.7 EQUIPMENT INSTALLATION

.1 Provide labour and materials to install equipment. Employ only skilled tradesmen licensed in the Province of Ontario, for all work requiring tradesmen including but not limited to welders, pipefitters and red seal plumbers.

.2 Install equipment at locations indicated on Drawings.

.3 Minimum installation standards: To manufacturer's written instructions and in accordance with shop drawings.

.4 Install piping and miscellaneous items supplied as part of equipment including sensors and wiring, lubrication piping, pressure gauge tubing, pressure gauges, pressure switches, transmitters, pneumatic valve operator tubing, and other similar items.

.5 Dimensions where shown in Drawings for equipment bases, piping connections, and similar items are approximate and must be allowed for in installation of equipment to suit actual equipment supplied.

.6 Make necessary modifications to piping connections or to pipe work to suit equipment supplied.

.7 Use only new bolts, nuts and gaskets for any pipe joint or mechanical connection that is made during the installation/re-installation of any equipment.

.8 Place equipment base template at appropriate location.

.9 Supply necessary shims, gaskets and other similar items and necessary lifting and loading equipment and tools required to complete installation.

.10 Level equipment using stainless steel shims. Levelling nuts are not allowed.

.11 Where equipment is supplied with plate steel base, provide access holes in top of plate and grout base in accordance with Division 03 00 00 requirements. Neatly form, bevel, and trim finished grout.

.12 Refer to manufacturers' recommendations included in shop drawing submittal to determine sequence of installation.

.13 Demonstrate final alignment (hot or cold as applicable) to Contract Administrator and manufacturer, with no soft foot and no pipe strain.

.14 Do not tighten pipes until grout is set. Tighten so that there are no excessive stresses placed on flanges due to misalignment.

.15 Lubrication:

.1 Extend inaccessible lubrication points and lubricant drains to convenient locations.

.2 Remove storage lubricant and provide initial fill of new lubricants for equipment.

.3 Lubricant grade as recommended by equipment manufacturer.

.16 On machined bases without shims: provide minimum 1.5 mm brass shim stock under drive.

.17 Install equipment on foundation with suitably sized anchor bolts. Ensure true alignment of parts, especially pumps and drives.

.18 Install equipment level and plumb. Use of "pipe springing" and "Dutchmen" to correct misalignment and misfitting is not permitted.

.19 Equipment drains: pipe to floor drains, or funnel floor drains in a neat and tidy manner are confirmed by the Contract Administrator. All equipment drains shall be located at the low points and at section isolating valves unless otherwise specified.

.20 Supply and install all necessary vibration control dampeners.

3.8 EQUIPMENT ALIGNMENT

.1 Align equipment after plates are shimmed at anchor bolts.

.2 Recheck alignment after securing equipment to foundation before grouting plates in place.

.3 Recheck alignment of equipment handling hot fluids during initial operation.

3.9 EQUIPMENT FIELD TESTS

.1 Field Test equipment for compliance with Specifications.

.2 Field test in accordance with Section 01 91 13 and Division 44.

.3 Provide advance notice of tests to Contract Administrator as specified in Section 01 91 13 and Division 44.

.4 Contract Administrator may witness field tests.

.5 Calibrate, test, start-up, adjust, and commission equipment in accordance with manufacturer's written instructions and under supervision of equipment manufacturer if specified under respective Sections.

.6 Include in inspection:

.1 Soundness (without cracked or otherwise damaged parts).

.2 Completeness of installation as specified and as recommended by manufacturer.

.3 Correctness of settings, alignment and relative arrangement of various parts of system.

.7 Check controls and safety devices.

.8 Check equipment is level and drive is aligned.

.9 Modify or replace equipment failing tests.

.10 Perform additional tests due to material changes requested by Supplier that were approved by Contract Administrator or due to failure of materials of construction to meet Specifications.

.11 Provide copies of manufacturer's site report to Contract Administrator in accordance with requirements of Section 01 91 13.

.12 Manufacturer's report to include:

.1 Description of inspection, tests, adjustments made, quantitative results and suggestions for precautions to be taken to ensure proper maintenance.

.2 Verification that equipment conforms to Specifications for service intended and is ready for permanent operation.

.13 Equipment will be accepted after successful start-up, receipt of manufacturer's report and completion of the commissioning process.

3.10 GUARANTEES AND WARRANTY

.1 Unless otherwise indicated in the specific Sections contained herein, all equipment and services supplied under this Division shall be guaranteed by the Contractor to be free from all defects, in manufacture or installation, and wear for a period of at least one (1) year from the date of Substantial Completion.

.2 This guarantee will allow for the repair or replacement of improperly operating equipment at the Owner’s discretion. The Contractor shall provide temporary equipment of equal capacity for the duration of any period in which the equipment is non-functional at no additional cost to the Owner.

.3 The length of this warranty period shall be extended to one (1) year from the date that any repaired or replaced equipment is returned to service, for that equipment only.

.4 If the Contractor obtains a guarantee from the Manufacturer, the signature of an authorized representative of the Manufacturer must accompany that guarantee and the Owner must be listed on the guarantee.

3.11 FORMS

.1 Forms listed below are required to complete the installation and start-up procedures:

.1 Manufacturer's Installation Certification Form.

.2 Pre-Commissioning Certification Form.

END OF SECTION

IDENTIFICATION

PART 1 GENERAL

1.1 SUMMARY

.1 This section includes the provision of mechanical labelling and identifying materials for the following items:

.1 Process Piping, new and existing

.2 Buried Piping (Division 33)

.3 Equipment and Process Vessels, Tanks, Valves, Actuators and all specialized equipment supplied under Division 44

.4 Control Panels and Instrumentation required under Division 22, 25, 26 and 44.

1.2 RELATED SECTIONS

.1 The following Sections applies to the work of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of the scope listed herein.

.1 Conform with Division 01, 22, 25 and 26

.2 Conform with Division 22

1.3 CODES AND STANDARDS

.1 This section shall comply with the current editions of the following codes:

.1 CAN/CGSB-24.3-92 Identification of Piping Systems.

.2 MOE Standard for Pipe Identification in Water and Wastewater Treatment Plants in Ontario.

.3 Ministry of Labour Workplace Hazardous Material Information System (WHMIS) Policy.

1.4 SUBMITTALS

.1 Shop Drawings:

.1 The following shall be submitted in compliance with Section 01 33 00:

.2 Provide a list of all piping, valves and actuators, tanks, control panels, instruments and equipment which will be labelled and/or tagged with the following:

.1 Pipe/Valve/Instrument or Equipment number

.2 Service

.3 Valve Type

.4 Drawing No.

.3 Provide samples containing the nameplates, pipe markings/labels and tags.

PART 2 PRODUCTS

2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES

.1 Metal 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, matte finish, with square corners, letters accurately aligned and machine engraved into core.

.3 Sizes:

.1 Conform to the following table:

Size #	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

.3 For all tanks, vessels and equipment: Use size # 9

2.3 EXISTING IDENTIFICATION SYSTEMS

.1 Apply existing identification system to new work, if a standardize system is present and in place.

.1 Where existing identification system does not cover for new work, use identification system specified this section.

.2 Before starting work, obtain written approval of identification system from Contract Administrator.

2.4 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 and MOE Standard for Pipe Identification in Water and Wastewater Treatment Plants in Ontario except where specified otherwise. Coordinate the pipe marker piping naming and colour list with the Contract Administrator.

.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.

.2 Pipe diameter shall determine the appropriate marker and test sizes as per the following table. The minimum height is 13 mm, for pipes less than 25 mm diameter provide tagging.

Outside Diameter of Piping or Insulation Covering	Minimum Letter/Number Height
19 – 32 mm	13 mm
38 – 51 mm	19 mm
64 – 150 mm	32 mm
200 – 250 mm	64 mm
Over 250 mm	89 mm

.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 vinyl with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100%RH and continuous operating temperature of 50°C.

.7 Colours and Legends:

.1 Where not listed, obtain direction from Contract Administrator.

.2 Colours for legends, arrows: To following table:

Background Colour	Legend, Arrows
Yellow	Black
Green	White
Red	White

.8 Background colour marking and legends for piping systems shall be green.

2.5 VALVES, CONTROLLERS

.1 Galvanized aluminum tags with 12 mm stamped identification data filled with black paint.

.1 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.

2.6 LANGUAGE

.1 Identification to be in English.

.2 Use one nameplate, label, etc. for each language.

PART 3 EXECUTION

3.1 TIMING

.1 Provide identification only after all painting specified Section 09 91 10 - Interior Painting has been completed.

3.2 INSTALLATION

.1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.

.2 Provide ULC and or CSA registration plates as required by respective agency.

3.3 NAMEPLATES

.1 Locations:

.1 In conspicuous location to facilitate easy reading and identification from operating floor.

.2 Protection

.1 Do not paint, insulate or cover in any way.

3.4 LOCATION OF IDENTIFICATION ON PIPING

.1 Pipe markers should be positioned so that they can be easily seen from the normal angle of approach, below the centerline of the pipe if the pipe is overhead, and above the centerline if the pipe is below eye level. Markers are required at the following locations:

.1 On long straight runs in open areas, equipment rooms, galleries, tunnels: at no more than 6.0m intervals 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 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.

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

3.5 VALVES AND 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 Contract Administrator. Provide one copy (reduced in size if required) in each operating and maintenance manual.

.3 Number valves in each system consecutively.

END OF SECTION

FIELD PRESSURE TESTING OF PROCESS PIPE

PART 1 GENERAL

1.1 SCOPE

.1 This specification covers hydrostatic testing and pneumatic testing of piping after erection and prior to initial operation.

.2 References

.1 All references to codes and standards shall be to the latest edition of the following including addenda.

.1 American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME) B31.1 – Power Piping and B31.3 Process Piping.

.3 Applicable codes including ANSI/ASME B31.1, B31.3, and standards shall apply. All references to codes and standards shall be to the latest issue of the same.

.4 In the event repairs or additions are made following the pressure tests, the affected piping shall be retested, using the test procedures applied to the original system.

.5 All piping shall be hydrostatic tested.

.6 All piping shall be tested as required by the T.S.S.A.

.7 Acceptance of system under test shall follow Section 44 01 28 - Piping System Acceptance.

1.2 RESPONSIBILITY AND RECORDS

.1 Contractor shall be responsible for all testing. Contractor shall see that all required tests are made in accordance with this specification and shall arrange for tests to be witnessed by Contract Administrator.

.2 The Contractor shall see that adequate records are maintained. These shall include test pressure, temperature, duration, date and time of day test fluid, and signatures of Contract Administrator and Contractor's representatives who witnessed the test, identification of piping system tested. Contractor shall provide a test plan and schedule to Contract Administrator at start of work. The format of these records shall be approved by the Contract Administrator before field pressure testing begins.

.3 It shall be the responsibility of the Contractor, in accordance with the Contract Administrator's instructions, to ensure that no equipment or piping is subjected to a higher pressure than indicated in the test requirement documents furnished by the Contract Administrator.

.4 Test procedures shall be reviewed with Contract Administrator as part of the normal safety review.

PART 2 PRODUCTS

2.1 TEST EQUIPMENT

.1 All necessary connections between the piping to be tested and the water source, together with pumping equipment, water meter, pressure gauges, and all other equipment, materials, and facilities required to perform the specified tests, shall be provided. All required flanges, valves, bulkheads, bracing, blocking, and other sectionalizing devices shall also be provided. All temporary sectionalizing devices shall be removed upon completion of testing. Vents shall be provided in test bulkheads where necessary to expel air from the piping to be tested.

.2 Water meters and pressure gauges shall be accurately calibrated and shall be subject to review and acceptance by the Contract Administrator.

.3 Permanent gauge connections shall be installed at each location where test gauges are connected to the piping during the required tests. Drilling and tapping of pipe walls will be permitted as required. Upon completion of testing, each gauge connection shall be fitted with a removable plug or cap acceptable to the Contract Administrator.

PART 3 EXECUTION

3.1 PREPARATION FOR TESTING

.1 Piping that is not to be tested shall be isolated. If isolation is impractical, the test conditions shall be determined by agreement with the Contract Administrator representative.

.2 Lines (not intended to carry liquids) which are spring or counterweight supported shall be temporarily blocked up if hydrostatic tested, in order to sustain the weight of test fluid. Blocks shall be removed immediately after the system is drained.

.3 All valves within the system to be tested, except as described in Paragraphs 3.1.4, and 3.1.6, shall be in an open position.

.4 Shut-off valves in instrument lead lines from process lines and equipment shall be closed and instruments disconnected.

.5 All dirt, debris or loose foreign materials shall be removed by flushing from piping prior to hydrostatic testing.

.6 Relief valves and safety valves shall be blanked off at the inlet flange of the valves. Screwed relief and safety valves shall be removed and replaced with plugs or caps.

.7 All flanges, threaded joints and field welds shall be left bare of insulation and free of all visual obstructions. All underground pipe joints, except those encased in concrete anchors, if any, shall be left exposed. Underground lines shall be adequately shored to prevent pull-out of joints.

.8 The Contractor shall supply all materials (blanks, plugs, vents, gaskets and drain valves) necessary for testing. Blank flanges, blank plates, etc., shall be selected to withstand the test pressure. After tests the materials shall remain the property of Contractor, except drain valves which shall remain in place.

.9 Blank flanges, blank plates, etc., shall have handles painted a bright color to make them readily identifiable for removal prior to start-up operations.

.10 After testing is completed, piping shall be blown out with air to remove all debris.

.11 All welded attachments (such as pipe supports and hangers) shall be made before testing.

.12 Piping and equipment shall be thoroughly vented of air before the final hydrostatic test pressure is applied. Vent connections shall be located at high points of system.

.13 Insulation is not to be applied over any joints in the piping prior to completion of test.

.14 All instrument floats not rated for the test pressure shall be removed before hydrostatic testing.

.15 Control valves not resistant to the test pressure shall be removed from the piping system prior to test.

.16 Expansion joints shall be provided with restraints to withstand the added pressure load under test, or shall be removed or isolated from the test.

.17 Precautions shall be taken by opening vents or by other means to prevent building up excessive pressure in equipment adjacent to portions of the piping under tests.

.18 Restrictions to flow, such as orifice plates and mixing nozzles, shall not be installed or shall be removed. Where necessary, items removed shall be replaced with temporary spool pieces provided by Contractor.

.19 Lines containing check valves shall have the source of pressure on the upstream side of the valve. If this is impossible, the check valve shall be blanked off or removed.

.20 If the test fluid in the system is subject to thermal expansion, precautions shall be taken to avoid excessive pressure.

.21 All pipe runs and interconnecting branch lines subject to the same test conditions shall preferably be tested at the same time. Equipment shall be isolated from testing unless authorized by the Contract Administrator.

3.2 HYDROSTATIC TEST PRESSURE

.1 The hydrostatic test pressure shall meet the ASME/ANSI B31.1 Piping Code Requirements. Other piping systems hydrostatic test pressures shall be in accordance with ASME B31.3 for Normal Fluid Service.

.2 Generally, the hydrostatic test pressure shall be determined within the following guidelines:

.1 1½ times the pressure class of the piping and flanges (i.e. 1034KPa system - test pressure = 1550KPa).

.2 Non-metallic piping shall be tested as required by ASME B31.3 but within manufacturers' limitations.

3.3 ALTERNATE TESTS

.1 When pressure testing is not feasible, (examples are large diameter lines not designed to withstand the weight of the water and refractory lined piping) an alternative test may be considered with the approval of the Contract Administrator. The alternatives are as follows:

.1 A combination of 100% radiography plus liquid penetrant examination plus a sensitive leak test.

.2 A combination of 100% radiography plus magnetic particle examination plus a sensitive leak test.

3.4 TEST PROCEDURE

.1 All testing must be scheduled and coordinated with Contract Administrator representative.

.2 Hydrostatic pressure shall be applied by means of a suitable test pump which shall not be connected to the pipeline until ready to test. An approved operator shall constantly attend to the pump whenever it is connected to the pipeline. The pump shall be disconnected whenever the pump operator or the inspector leaves the pump or test site for any reason.

.3 The pump shall be disconnected or suitable block and bleed valves operated during the period the test pressure is being held.

.4 At least two indicating test gauges shall be provided, one on the pump or air source and one on the piping to be tested. The gages are to be checked frequently against a "standard" gage or dead weight tester and should read between 1½ times (min) to 3 times (max) the test pressure.

.5 The piping under test shall be held at full test pressure for at least ½ hour without leaks.

.6 Clean water shall be used as the testing medium when hydrostatic testing materials other than stainless steel. Other liquids may be used when necessary and upon approval by Owner.

.7 Hydrostatic testing of austenitic stainless steel shall be performed using potable water. Test water in stainless steel piping shall be immediately drained after test and all residual water removed.

.8 When water is used in cold weather, it shall be heated or protected by inhibited antifreeze to avoid freezing. Water temperature during testing shall be a minimum of 15.5°C. Prior approval shall be obtained from the Contract Administrator representative for the use of antifreeze.

.9 Retesting of lines after repair shall be done at pressures originally specified for the test.

.10 Underground pressure lines shall be tested before backfilling.

.11 Instruments shall be tested in accordance with the recommendations of the Contract Administrator's Instrument Engineer.

3.5 DRAINING AFTER HYDROSTATIC TESTING

.1 All lines shall be drained after the hydrostatic test.

.2 After pump suction and discharge lines have been drained, the piping shall be reassembled. It is imperative that a temporary strainer be installed in the pump suction at this time.

3.6 PRESSURE TESTING REQUIREMENTS FOR WATER, SLUDGE AND AIR PIPING

.1 All specified tests shall be made by and at the expense of the Contractor in the presence, and to the satisfaction, of the Contract Administrator. Piping shall be tested at the following pressures:

Service	Material	Test Medium	Test Pressure
Water Supply (Potable and non-potable water)	SS, Steel, DI and PVC	Water	1379 kPa (200 Psig)
Process / Channel Mixing Air	SS	Compressed air with 100 percent of all oil 0.025 micron and larger removed	100 kPa (14.5 Psig)

Service	Material	Test Medium	Test Pressure
Blowers Discharge Piping	SS	Compressed air with 100 percent of all oil 0.025 micron and larger removed	67 kPa (9.7 Psig)
Process Piping, designed to contain liquid	SS	Water	675 kPa (100 Psig)
Other System			As per the manufacturer's recommendations

3.7 FINAL PROCEDURES AFTER PRESSURE TESTING

.1 Replace all control valves and check valve action for proper direction.

.2 Remove all temporary blocks from spring or counter-weight supported pipelines.

.3 Replace all orifice plates and mixing nozzles, and other in-line instrumentation.

.4 Connect all instruments removed for the testing operation.

.5 Remove all temporary blanks and blinds.

.6 Use all new gaskets when replacing control valves, orifice plates, blanks, blinds, etc.

.7 Valves which were closed for pressure testing and/or draining shall be returned to the proper position.

.8 Temporary piping supports shall be removed.

.9 Replace all relief valves and safety valves.

.10 Remove any restraints that may have been provided for expansion joints.

.11 Disconnect test equipment, test pump, test gages and test safety valves.

END OF SECTION

PROCESS PIPING SYSTEM ACCEPTANCE

PART 1 GENERAL

1.1 SCOPE

.1 This specification defines the requirements for testing and acceptance of construction of piping systems.

1.2 PURPOSE

.1 A procedure for inspecting, testing and accepting completed process, utility, and other miscellaneous piping systems after installation by a construction Contractor.

.2 The procedure develops the essential features based on the three phases of a testing program, namely:

.1 Pretest requirements
.2 Test requirements
.3 Post-test requirements

.3 An organization routing from inception to acceptance is also described.

1.3 APPLICABLE SPECIFICATION SECTIONS

.1 This procedure is to be used with the following specification sections which establish the design criteria for the tests.

Section 44 40 00 – Process Piping

PART 2 MATERIALS

2.1 NOT APPLICABLE

.1 Not Applicable.

PART 3 EXECUTION

3.1 PIPING TESTING PROCEDURE

.1 The focal point is the pipe test package, which is an accumulation of information about the pipeline system to be tested. For each test made, there is a particular package describing, through drawings and specifications, what is required to make that piping system complete. The pipe test package is separated into three phases, defined as follows:

Pretest - Pipeline system completed to the point that is physically ready for a test and that each component in the system can withstand potentially greater than

normal weights and pressures of the test. All radiographic examinations are complete and documented.

Test - The piping system is filled with test media, pressurized, tested to specific requirements and witnessed.

Post-Test - Test blinds and test medium have been removed and all items have been installed. The piping is now ready for precommissioning.

The exceptions to this system are "in-service" tests where the basic elements of this total procedure are followed, except that the proposed pressure test is deferred until after the service has been turned on.

3.2 DOCUMENTATION

.1 Pipe inspection, testing and acceptance require the preparation of a master testing plan for the systems. Piping test numbers are assigned, and these documents are cross referenced to insure that all pipe lines to be constructed are included within the pipe test master plan.

.2 The Contractor shall assemble individual test packages containing:

.1 P&ID - P&ID highlights the pipelines to be included in the test system and establishes the in-line devices, line and equipment isolation that must be accomplished prior to the initiation of the test.

.2 Piping Inspection and Acceptance Record - This form provides the pipe test descriptions. Sign-off locations are provided for pre-test inspection approval, hydrotest witness and post test acceptance.

.3 Inspection Punch list Sheet - Used to highlight incomplete and/or incorrect installation found during inspection. Same sheet is used for sign-off of the inspection punch list after completion.

.3 Upon completion of the Piping Systems Acceptance Package, the Contractor shall prepare a progress tracking system based on the number of packages and the status of inspection, testing and acceptance.

3.3 ORGANIZATIONAL RESPONSIBILIES

.1 The piping test package must be routed through the organizations involved with construction and operation of the piping systems. Any change or deficiency found during the pipe test and inspection process is best located and identified as soon as possible. Then the change or deficiency can be corrected without an additional and costly hydrostatic test.

.2 The following outline shows the flow of the test package throughout the construction organization.

.1 Pre-Test

a. Contractor prepares pipeline master testing plan.

b. Contractor assembles test packages.

c. Inspection by Contractor and sign-off of pre-test mechanical inspection or preparation of a punchlist list and correction before submitting to Contract Administrator.

.2 Contract Administrator Inspection Activities

a. Inspection by Engineer's Construction & Operations Group(s) and preparation of a punchlist.

b. Engineer's Construction Group identifies punchlist items requiring completion prior to test. Returns punctilist list to Contractor. Contractor completes critical punch list items and returns to Engineer's Construction Group.

c. Engineer's Construction Group then checks that all punchlist items have been completed prior to signing the approval for test.

.3 Contractor Activities

a. Works off punchlist list items and resubmits to Engineer for approval for hydrotest.

b. Prepares for test.

.4 Test

.1 Contractor Activities

a. Fills system to be tested with water or other test medium as noted on line list.

b. Applies test procedure according to line list or as amended by Engineer's Construction Group.

c. Tightens lines as needed.

d. Holds pressure for at least one-half hour before calling Engineer to witness.

.5 Engineer's Construction Activities

a. Witness hydrotest.

b. Sign-off test inspection portion of Piping Inspection and acceptance Record.

.6 Contractor Activities (when applicable)

a. Route copy of signed test package to mechanical, electrical, instrumentation, insulation and painting Contractors as a signal that pipeline system is now cleared for other work to proceed; i.e., final alignment of pumps, prime painting of welds, topcoating coating of insulated and uninsulated lines.

.3 Post-Test

.1 Contractor Activities

a. Vent lines

Remove blinds

Plug vents and drains

Replace instruments and specialty items

Remove temporary supports

Check off and sign post-test check list

b. Rechecks the pipeline system to be sure line is mechanically complete.

.2 Engineer's Construction Activities

a. Engineer's Construction Group shall reinspect the pipeline system to make sure that all elements are complete except for heat tracing and insulation.

b. Engineer's Construction Group then submits a post-test punchlist list or signs-off as complete and accepted.

.4 Final Disposition

.1 Contractor Activities

a. The Contractor transmits test packages to Engineer's Construction Group after each package is accepted by Engineer.

b. Punchlist list items preventing completion of a test package due to material deliveries are considered complete if those punchlist list items are transferred to the master project punchlist list.

END OF SECTION

PIPE WELDING

PART 1 GENERAL

1.1 GENERAL

.1 This Section applies to all process and building mechanical pipe welding.

.2 Do all work associated with the welding process, such as procedure qualification, welder qualification, line-up, welding, and weld inspection, examination and testing, in accordance with the latest edition of ANSI/ASME B31.3 Category D fluid service, except when the terms of this standard are added to or modified by these specifications.

1.2 RELATED SECTIONS

.1 Division 1 – General Requirements

.2 Section 11116 – Piping, Valves and Fittings

1.3 REFERENCE STANDARDS

.1 ANSI/ASME B31.3 Process Piping Code (ASME B31.3)

.2 ASME Boiler and Pressure Vessel Code (ASME BPVC):

.1 Section V, Nondestructive Examination

.2 Section IX, Welding and Brazing Qualifications

.3 CAN/CSA W48, Filler Metals and Allied Materials for Metal Arc Welding:

.1 Note: CSA W48.3 (Low Alloy Steel Covered Electrodes) has been substituted by CAN/CSA W48, which also includes additional five previous W48.x Standards.

.4 CSA W178.1, Certification of Welding Inspection Organizations

.5 CSA W178.2, Certification of Welding Inspectors

.6 CAN/CGSB 48.9712, Non-destructive Testing: Qualification and Certification of Personnel.

PART 2 PRODUCTS

2.1 STAINLESS STEEL PIPING AND FITTINGS

.1 Details as described in the contract drawings and Section 44 05 50 Process Piping.

2.2 FILLER MATERIAL

.1 Shielded metal arch electrodes (manual welding) to conform to CSA W48. Grade to be of tensile strength equivalent to or greater than the ultimate tensile strength of the parent metal, and to be suitable for the electric current characteristics, position of welding, and other conditions of intended use.

2.3 END BEVELS

.1 Provide pipe ends with mill bevels. Bevels to be 30° with a vertical lip of 1.60 mm unless specified otherwise. Field bevels to be reasonably smooth and uniform, and dimensions shall be in accordance with the qualified welding procedure.

2.4 EQUIPMENT

.1 Welding equipment to be 200 A or larger DC machines, and to be designed and maintained in an acceptable condition to obtain the specified results.

PART 3 EXECUTION

3.1 GENERAL

.1 Welding to be performed using procedures qualified to ASME B31.3. Surfaces to be welded shall be smooth, uniform, free of fins, lamination, tears, slag, grease, paint, and other deleterious conditions which might adversely affect welding. All aspects of the process as outlined in ASME B31.3 shall conform to the welding procedure specification.

.2 Contractor to submit five (5) copies of proposed welding procedure to the Contract Administrator using the forms provided at the end of this section. Procedure to be used to prepare the test joints required for qualification.

3.2 WELDER QUALIFICATION

.1 Welders engaged on the work to possess valid certificates of qualification from the appropriate governing authority for pipeline welding in the flat, vertical, and overhead positions. Certificates to be for the shielded metal arc method of welding. Provide copies of certificates to the Contract Administrator when qualification test results are submitted.

.2 Welders to qualify under ASME BPVC Section IX, American Welding Society (AWS) or Canadian Welding Bureau (CWB).

.3 A record shall be made of the test given to each welder and of the detailed results of each test. Record to be maintained by Contractor and a list of qualified welders and procedures in which they are qualified to be provided to the Contract Administrator. Welders may be required to requalify if there is a question about their ability.

3.3 QUALIFICATION OF THE WELDING PROCEDURE

.1 Contractor to prepare test joints in accordance with the proposed welding specification and as stated in the proposed welding procedure submitted to the Contract Administrator. Contractor to give the Contract Administrator written notice of when and where the welding of the test joints will take place so that the Contract Administrator can be present. Test joints to be tested at Owner's expense, and in accordance with ASME B31.3. Upon qualification, no change in the procedure will be permitted without the Contract Administrator's written approval.

3.4 WEATHER CONDITIONS (FIELD WELDING)

.1 Welding shall not be done when the quality of the completed weld would be impaired by prevailing weather conditions, including but not limited to moisture, blowing sands, high winds, or low temperatures. Windshields may make conditions for welding satisfactory.

.2 If, in the opinion of the Contract Administrator, protection from prevailing weather conditions is necessary, then welding shall cease until this protection has been placed correctly. The Contractor will not be compensated for "downtime" delays of this nature.

.3 Metal surfaces in and adjacent to the welding groove to be dry before welding commences and while welding is in progress.

.4 When ambient temperature is below 0oC, welding operations to cease, unless an appropriate welding procedure has been qualified.

3.5 PRODUCTION WELDING

.1 Production welding to conform to the following stipulations:

.2 No pup (intermediated pull-up piece of pipe) shorter than 1m or 3 pipe diameters, whichever dimension is greater to be installed in the line. There shall be at least 1 full joint of pipe installed between pups which are shorter than 5m. All pups must be moved ahead on a current basis and installed in the line.

.3 No two weld beads shall be started or stopped in the same location. Each weld pass shall be visually examined and any defects (i.e., pin holes, slag inclusions, gas pockets, and undercutting, etc.) shall be repaired prior to welding the next pass.

.4 Striking the arc on the pipe at any point other than the welding groove shall not be allowed. Any section of pipe which has been arc burned may, at the Contract Administrator's discretion, be cut out and replaced at the Contractor's expense.

.5 No weld to be subjected to sudden variations in temperature and no welded sections to be subjected to stresses, due to movement of pipe, loading on pipe, etc., until the welds have cooled below 38oC. Damage caused by the welded pipe being

subjected to stresses before complete cooling of welds to be corrected at the Contractor's expense.

.6 All temperatures to be measured by pyrometric crayons or other suitable devices approved by the Contract Administrator.

.7 All passes to have no more than 5 minutes elapse between the previous pass termination and the commencement of the next pass. When ambient temperature is below 0oC, maximum lapse time allowable is 4 minutes.

.8 Use inert gas backing for stainless steel welding. Solar flux prohibited for liquid commodity piping.

.9 For stainless steel pipes carrying solids-containing liquids or slurries pickle all joints and heat affected zones on interior and exterior. Use of pickling paste subject to the Contract Administrator's review. Observe regulatory requirements for disposal of acid.

.10 Passivate exterior of all stainless-steel welds after completion. Neutralize and rinse joints.

.11 For pickling and passivation detail refer to ASTM A380 or Section 15200, Line Code H1.

3.6 LINEUP CLAMPS

.1 Internal lineup clamps to be used whenever practicable and when used shall not be removed until root bead is complete. External lineup clamps may be used only when use of internal lineup clamps is not practicable. Root bead segments used in connection with external lineup clamps to be uniformly spaced around the circumference of the pipe, and to have an accumulative length of not less than 50% of the pipe circumference before the clamp may be removed. Pipe to remain supported and stationary until root bead is completed.

3.7 CLEARANCE

.1 When the pipe is welded in a trench, bell hole to be of sufficient size to provide the welder or welders ready access to the joint so that their skill is not impaired. When pipe is welded above ground, the working clearance around the pipe at the weld shall be not less than 400 mm.

3.8 PIPE HANDLING

.1 Extreme care to be exercised to prevent damage to pipe. Damage to be repaired as directed by the Contract Administrator and at the expense of the Contractor. Bevel ends to be repaired if damaged.

.2 All dents in the pipe deeper than 3.2mm to be removed by cutting dented portion of the pipe out, re-bevelling the cut ends, welding, and recoating.

3.9 INSPECTION

.1 After completion of the welding operation, pipe to be left uncoated for a period sufficient to permit the independent third-party Inspector approved by the Owner to carry out inspection (as defined by ASME B31.3, section 340.1) on the welds. Contractor to allow a reasonable time for the Inspector to conduct examination of the tie-in welds.

.2 Work performed will be rigidly inspected. Such inspection shall not relieve Contractor of responsibility for performing work in conformance with the specifications. Contractor to notify the Inspector in advance of performing any work in order that inspection may be arranged. The Inspector may reject any work that does not comply with the specified requirements. Contractor to furnish the Inspector with reasonable facilities and space for inspection and obtaining any information the Inspector desires respecting the character of material used and progress and condition of the work.

.3 The Inspector may use any method of examination necessary to establish quality control and ensure adherence to welding procedures. The Inspector has the right to accept or reject any weld not meeting the approved procedures and/or specified requirements.

.4 Specified percentage of welds is subject to visual examination, liquid penetrant examination, and random radiographic examination, the cost of which will be borne by the Contractor. Radiographic inspection to be carried out by operators certified in conformance with CSA W178.

.5 Non-destructive examination standards specified in Section V of ASME BPVC to be used as basis for examination procedures.

3.10 REPAIR OR REMOVAL OF WELD DEFECTS

.1 Repair or removal of weld defects to be in accordance with Section IX of ASME BPVC. Back welding is not allowed without qualification of the welding procedure used.

.2 Repair of welds shall follow ASME B31.3, Section 328.6, Weld Repair.

.3 All costs for repairing defective welds, including radiographic and other examination of the corrected work, shall be borne by the Contractor.

3.11 COATED PIPE PROTECTION AND FIELD COATING

.1 Protect and prepare for field welding all carbon steel pipe which has been previously coated.

.2 After field welding, pipe coating of welded joints to be completed as follows:

.1 Coating of welded joints in the field to be done in accordance with AWWA (American Water Works Association) C210, Section 3.5. Primer and field

coating of bare surfaces to be the same materials as used for shop coating of pipe.

.3 If damage of the coating occurs in the field, repair damaged portions in accordance with AWWA C210, Section 3.4.

3.12 SPECIALIST INSPECTION, EXAMINATION AND TESTING

.1 Examination by the manufacturer, fabricator, or erector (as defined by ASME B31.3, section 341.1) shall follow section 341.4.2 of that code for Category D Fluid Service. Examination methods shall follow Table 341.3.2 for Category D Fluid Service. The Contractor shall keep a record of weld numbers that were examined. Where applicable, different welds shall be examined by different methods. The cost of this examination shall be borne by the Contractor.

.2 In addition to the above Contractor examination, the Inspector shall visually examine not less than 15% of all welds. In addition, not less than 10% of fillet welds shall be examined by liquid penetrant. In addition to this, not less than 10% of circumferential butt welds shall be examined by random radiography. The cost of this examination shall be borne by the Contractor.

.3 The Inspector shall keep a record of weld numbers that were visually examined, of welds that were examined by liquid penetrant, and of welds examined by random radiography. Different welds shall be examined by different methods.

.4 Examination procedures:

.1 Perform examinations by specialist qualified in accordance with CSA 178.1 and CSA 178.2 and approved by the Contract Administrator,

.2 And according to ASME BPVC, Section V, CAN/CGSB 48.9712, and authority having jurisdiction.

.5 Visual examination: include entire circumference of all welds externally.

.6 Failure of examinations:

.1 Upon failure of any weld by visual examination, the Inspector shall perform additional visual examination as directed by the Contract Administrator of a total of 20% of all welds, selected at random by the Contract Administrator. The cost of this examination shall be borne by the Contractor.

.2 Upon failure of any weld by penetrant examination, the Inspector shall perform additional penetrant examination as directed by the Contract Administrator of a total of 15% of all welds, selected at random by the Contract Administrator. The cost of this examination shall be borne by the Contractor.

.3 Upon failure of any weld by random radiography, the Inspector shall perform additional radiography as directed by the Contract Administrator of a total of 15% of all welds selected at random by the Contract Administrator. The cost of this examination shall be borne by the Contractor.

.7 For leak (pressure) testing refer to ASME B31.3, sections 345.2.2 (duration; however, use double the time), 345.4.2 (pressure) and 345.7 (alternative).

3.13 DEFECTS CAUSING REJECTION

.1 Acceptance criteria for welds shall follow ASME B31.3, section 341.3.2, Table 341.3.2 in particular, for Category D Fluid Service.

.2 Any rejected welds shall be repaired or replaced.

3.14 PRESSURE TESTING

.1 For additional pressure testing of completed sections of pipe refer to Detailed Piping Specifications.

END OF SECTION

PIPE WELDING

PROPOSED WELDING PROCEDURE

DATE _____

JOB TITLE _____

ASSOCIATED ENGINEERING PROJECT NO. _____

CLASSIFICATION OF PIPE _____

MAXIMUM TENSILE STRENGTH _____

MAXIMUM YIELD STRENGTH _____

PERCENTAGE ELONGATION IN 50 mm _____

MILL TEST FORWARDED TO ASSOCIATED ENGINEERING (YES/NO) _____

LADLE ANALYSIS FORWARDED TO ASSOCIATED ENGINEERING (YES/NO) _____

CARBON CONTENT _____

CARBON EQUIVALENT _____

EXTERNAL COATING _____

INTERNAL COATING _____

PROCESS _____

DIAMETER AND WALL THICKNESS _____

JOINT DESIGN _____

PIPE WELDING

FILLER METAL

Pass	Size	AWS Classification	Voltage	Amperage	Polarity	Brand
1						
2						
3						
4						
5						

POSITION _____

DIRECTION OF WELDING _____

NUMBER OF WELDERS _____

TIME LAPSE BETWEEN PASSES _____

INTER-PASS HEATING (IF REQUIRED) _____

METHOD OF HEATING _____

CLEANING BETWEEN PASSES _____

_____

_____

PREHEAT _____

MINIMUM AMBIENT TEMPERATURE

_____

FIELD ENGINEERED PROCESS PIPE SUPPORTS

PART 1 GENERAL

1.1 INTENT OF SECTION

.1 This Section covers the design, furnishing and installation of pipe hangers, brackets, and supports. Pipe supports shall be furnished complete with all necessary inserts, bolts, nuts, rods, washers, and other accessories.

.2 This section also covers the spacing of expansion joints in piping systems. Expansion joint products and materials are covered in the respective piping sections.

.3 Concrete and fabricated steel supports shall be as indicated on the drawings, as specified in other sections, or, in the absence of such requirements, as permitted by Contract Administrator.

.4 Contractor shall retain a Professional Engineer specialized in piping systems to design all pipe supports based on standard supports, piping design and layout on the Contract Drawings in accordance with the requirements specified herein.

1.2 SCOPE

.1 This standard covers the fabrication and installation procedures for engineered pipe supports. This generally applies to piping 65mm diameter and larger, unless noted otherwise.

.2 Refer to line list on P&ID drawing for lines which require engineered pipe supports.

1.3 CODES

.1 Standards and Specification Sheets: The codes, standards, and specification/data sheets listed shall be the latest edition.

.1	CAN3-S16.1	Steel Structures for Buildings
.2	ASME B31.1	Power Piping
.3	MSS-SP-58	Pipe Hanger and Support - Materials, Design and Manufacture
.4	MSS-SP-69	Pipe Hangers and Supports - Selection and Application
.5	MSS-SP-89	Pipe Hangers and Supports - Fabrication and Installation Practices
.6	ANSI B18.2.1	Square and Hex Bolts and Screws
.7	ANSI B18.2.2	Square and Hex Nuts
.8	ANSI B1.1	Unified Screw Threads (UN and UNR Thread Forms)
.9	ANSI/ASME	Pipe Threads, General Purpose B1.20.1
.10	CSA W47.1	Certification of Companies for Fusion Welding of Steel Structures.

.11 ASME B31.3 Process Piping

1.4 PIPE SUPPORT DESIGN

.1 Contractor shall engineer and design pipe support systems for piping of 65mm dia and larger in accordance with ASME B31.3 for Normal Fluid Service. Pipe supports shall be engineered and certified by a Professional Engineer licensed to practice in Ontario.

.2 Contractor shall submit to Contract Administrator for review all support details.

.3 Operating and installation loads, direction and amount of movement shall be shown on the detail drawings.

.4 Supplementary steel required for attachment to roof, wall or floor structure shall be engineered and supplied by the Contractor. Supplementary steel for rod hangers shall be engineered and supplied by the Contractor. All supports and supplementary steel shall be hot dipped galvanized after fabrication. All supports and supplementary steel submerged in tanks shall be type 336L stainless steel.

.5 All field welds and shop welds of non-catalog items will be indicated on the detail drawing using American Welding Society standard welding symbols.

.6 The location of a particular support assemblies shall be shown on the drawings issued to Contract Administrator for review.

.7 Support loads shall not exceed building elements design loadings. Contractor shall review with structural Engineer building loads and shall space, or design supports so that building elements design loads are not exceeded.

.8 Provide bracing of piping in accordance with Section 44 02 41 Seismic Restraint.

.9 Construct pipe hanger and support to manufacturer's recommendations utilizing equipment manufacturer's regular production components, parts and assemblies.

.10 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.

.11 Provide for vertical adjustments after erection and during commissioning.

.12 Ensure that supports, guides, anchors do not transmit excessive quantities of stress or heat to building structure.

.13 Maximum rod length to be 1.5m. Pipes requiring supports with rod lengths greater then 1.5m shall have supplementary steel attached to structure to reduce rod length to less than 1.5m.

.14 Main blower and pump suction/discharge headers shall be supported from below utilizing supplementary steel support racks which have base plates secured to floor.

.15 All supports to be arranged to provide maximum access to valves and other equipment requiring access.

.16 Do not weld directly to stainless steel pipes with steel supports. Provide clamps with bondable Teflon sheet between clamp and stainless-steel pipe.

1.5 DIMENSIONAL TOLERANCES

.1 This section covers maximum tolerances in fabricated pipe supports except for cast or forged products.

.2 Tolerances for raw materials such as strip, sheet, bar, plate, pipe, tubing, structural and bar size shapes shall be in accordance with recognized standards and specifications. Tolerances for casting and forgings shall be in the individual manufacturer's standards.

.3 Manufacturing Tolerances:

- .1 Cut Lengths - Linear
  - .1 Hanger rods ± 12mm
  - .2 Structural shapes, pipe, tubing ± 3mm.
  - .3 Plates & bars ± 3mm
- .2 Threads:
  - .1 Screw threads to ANSI B1.1, Class 1A, 2A and 2B
  - .2 Pipe threads to ANSI/ASME B1.20.1
- .3 Weld Sizes - All welds plus only, no minus
- .4 Angularity - all manufacturing methods to ± 4 degrees
- .5 Holes - Drilled or Punched Only
  - .1 Location - center to edge, or center to center, ± 1.6mm
  - .2 Diameter - plus .2 times metal thickness or minus 0.8mm

1.6 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittals.

.2 Complete data and catalog cuts or drawings covering fabricated pipe supports, fabricated inserts, and stainless steel, galvanized, and copper and plastic-coated pipe supports shall be submitted in accordance with Section 01 33 00 – Submittals.

.3 The Contractor shall provide the detailed piping layout. Coordinate with the expansion manufacturer coupling installation with the coupling manufacturer. Present the fixed and sliding pipe supports locations with couplings on the layout.

Data shall include a listing of the intended use and general location of each item submitted.

.4 Submit shop drawings stamped by a Professional Engineer in the Province of Ontario for review. Where required, include pipe stress analysis output including design inputs, support locations, deflections and reaction forces at each support location on supporting structures.

.5 Prior to the first shop drawing submittal, provide a 4-hour workshop with the Owner and Consultant to demonstrate the pipe support stamping Engineer's design approach and how it meets all design criteria listed in the contract documents. Incorporate comments from the Owner and Consultant for items including but not limited to support location requests for improved accessibility into pipe support design.

.6 A formal request must be made in advance of any shop drawing submittals, if the pipe support stamping Engineer would like to deviate from any of the design criteria provided in the contract documents. Approval of this request shall be at the full discretion of the Owner and Consultant.

1.7 QUALIFICATIONS OF WORKMANSHIP

.1 Use organizations approved under the Canadian Welding Bureau to the requirements of CSA W47.1, Division 2, to undertake welding operations using welders qualified to perform the type of welds required.

PART 2 PRODUCTS

2.1 GENERAL

.1 In certain locations, pipe supports, anchors, and expansion joints have been indicated on the drawings, but no attempt has been made to indicate every pipe/valve support, anchor, and expansion joint. Unless otherwise specified, it shall be Contractor's responsibility to provide a complete system of supports, to provide expansion joints, and to anchor all piping, in accordance with the requirements specified herein. Additional pipe supports may be required adjacent to expansion joints, couplings, valves and scum piping.

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

.3 Support from structural members, where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members. Do not suspend from metal deck. Anchoring of piping and equipment shall be to manufacturers recommendations. Submit anchorage system, arrangement and type of hanger supports with calculations for review. Supplemental steel to be galvanized after fabrication.

.4 Finishes:

.1 Hangers and supports: galvanized after manufacturer.

.2 Use electro-plating galvanizing process.

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

.5 Provide seismic bracing of piping in accordance with Section 44 02 41, Seismic Restraints.

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

.7 Steel sections (except tube sections) and plates: to CSA G40.21, type 300W.

.8 Welding Materials: to CSA W59.1.

.9 All metals submerged in water or in corrosive environments shall be type 316L stainless steel.

.10 All metals exposed to weather shall be type 316L stainless steel or 6061-T6 aluminum.

.11 Unless otherwise specified, the pipe supports shown on the Contract Drawings are typical details and are meant to show general arrangements only for the purposes of base bid pricing. It is the Contractor's responsibility to finalize member sizes, connections and anchorage to the structure. The Contractor may modify the supports and hangers for wall or HSS anchorage based on the typical ones on the Contract Drawings and herein, but the Contract Administrator's approval shall be required.

.12 Pipe hangers or guides shall not be used for a fixed-point pipe support.

.13 Unless otherwise specified, Provide hangers for valves with horizontal installation for 350 mm or larger pipe sizes. Submit the valve weight data and hangers with required design load.

.14 Unless otherwise specified, Pipe stress analysis shall be performed on the piping system to finalize location and design of pipe supports, couplings and expansion joints. Analysis to include environmental loads including wind, ice and seismic loads, thermal effects, pipe operating and test pressures, and dead loads from insulation.

.15 Wherever indicated, the contractor shall not delete or relocate the supports, expansion joints or couplings shown on the drawings without the Contract Administrator's written approval. The contractor is required to follow exactly the details as shown on these drawings. Pipe stress analysis is not required in this case.

.16 Coordinate pipe support locations with coupling and expansion joint requirements.

.17 The absence of pipe supports and details on the Drawings shall not relieve the Contractor of responsibility for sizing and providing supports throughout all pipelines.

.18 After installation a professional engineer, retained by the Contractor and licensed in the Province of Ontario, shall complete a Site review and then submit a letter, sealed and signed, stating that the pipe supports and anchorage are designed and installed to the requirements of post-disaster facility as per the Ontario Building Code Division B, Part 4, Article 4.1.8.18 for post-disaster structure as well as the pipe stress analysis report.

2.2 UPPER ATTACHMENTS

.1 Concrete:

.1 Hollow core block concrete: Adhesive material applied with screen tube.

.1 Acceptable material: Hilti Hit Adhesive Anchors, HY-20.

.2 Coordinate minimum embedment of adhesive anchors with anchor manufacturer.

.3 Submit anchor manufacturer's recommendations for anchoring to structural engineer prior to drilling for supports.

.2 Solid cast in place concrete or hollow core slabs: Adhesive material fastened into solid base.

.1 Acceptable material: Hilti Hit Adhesive Anchors, HY150.

.2 Coordinate anchor locations with precast slab supplier so that anchor locations provide adequate concrete thickness.

.3 Coordinate spacing of hangers with precast slab supplier so that support loads do not exceed slab capacities. Provide supplementary steel as required so that supports can be placed where required if adequate bearing does not exist.

.4 Coordinate minimum embedment of adhesive anchors with anchor manufacturer.

.5 Submit anchor manufacturer's embedment and precast slab suppliers' recommendations for anchoring to structural engineer prior to drilling for supports.

.2 Steel beam (bottom flange):

.1 Cold piping NPS 2 and under: malleable iron C clamp to MSS-SP-58, type 19. ULC listed.

.1 Standard of Acceptance: Anvil fig.61.

.2 Cold piping NPS 2½ and larger and all hot piping: malleable iron beam clamp to MSS-SP-58, type 28 or 29. ULC listed.

.1 Standard of Acceptance: Anvil fig.229.

.3 Steel beam (top):

.1 Cold piping NPS 2 and under: malleable iron "top of beam" C clamp to MSS-SP-58, type 19. ULC listed.

.1 Standard of acceptance; Anvil fig.61.

.2 Cold piping NPS 2½ and larger and all hot piping: steel jaw, hook rod with nut, spring washer and plain washer, to MSS-SP-58, type 25. ULC listed.

.1 Standard of Acceptance: Anvil fig.227.

.4 Steel joist:

.1 Cold piping NPS 2 and under: steel washer plate with double locking nuts.

.1 Standard of Acceptance: Anvil fig.60.

.2 Cold piping NPS 2½ and larger and all hot piping: steel washer plates with double locking nut, carbon steel clevis and malleable iron socket.

.1 Standard of Acceptance: Anvil: washer plate fig.60; clevis, fig.66; eye nut, fig.290.

.5 Steel channel or angle (bottom):

.1 Cold piping NPS 2 and under; malleable iron C clamp to MSS-SP-58, type 23. ULC listed.

.1 Standard of Acceptance: Anvil fig.86.

.2 Cold piping NPS 2½ and larger and all hot piping; universal channel clamp. ULC listed.

.1 Standard of Acceptance: Anvil fig.226.

.6 Steel channel or angle (top):

.1 Cold piping NPS 2 and under; malleable iron "top of beam" C clamp to MSS-SP-58, type 19. ULC listed.

.1 Standard of Acceptance: Anvil fig.61.

.2 Cold piping NPS 2½ and larger and all hot piping: steel jaw, hook rod with nut, spring washer and plain washer, to MSS-SP-58, type 25. ULC listed.

.1 Standard of Acceptance: Anvil fig.227.

2.3 MIDDLE ATTACHMENT (ROD)

.1 Carbon steel threaded rod electro-galvanized finish.

.1 Standard of Acceptance: Anvil fig.146.

.2 Ensure that hanger rods are subject to tensile loading only.

.3 Provide linkages where lateral or axial movement of pipework is anticipated.

2.4 PIPE ATTACHMENT

.1 Cold piping, steel or cast iron: hot piping steel, with less than 25mm horizontal movement; adjustable clevis to MSS-SP-58, type 1. ULC listed. Galvanized finish.

.1 Standard of Acceptance: Anvil fig.260.

.2 Uninsulated Cold copper piping; uninsulated hot copper piping with less than 25mm horizontal movement; adjustable clevis to MSS-SP-58, type 1. Copper plated.

.1 Standard of Acceptance: Anvil fig.CT-65.

.3 Suspended hot piping, steel and copper, with horizontal movement in excess of 25mm; pipe roller to MSS-SP-58, type 43. Galvanized finish.

.1 Standard of Acceptance: Anvil fig.174 and fig.171.

.4 Bottom supported hot piping, steel and copper: pipe roller stand to MSS-SP-58, type 45.

.1 Standard of Acceptance: Anvil fig.271.

.5 Pipe hangers and supports on all cold pipework and hot pipework above NPS 1 must be oversized to accommodate thermal insulation and to avoid penetrating the vapour barrier.

.6 Do not weld supports directly to stainless steel pipes. Provide clamps welded to support plates. Provide bondable Teflon sheet between clamps and stainless steel pipes.

2.5 RISER CLAMPS

.1 Steel or cast-iron pipe: galvanized carbon steel to MSS-SP-58, type 42. ULC listed.

.1 Standard of Acceptance: Anvil fig.261.

.2 Copper pipe: carbon steel copper finished to MSS-SP-58, type 42.

.1 Standard of Acceptance: Anvil fig.CT-121.

.3 Provide bondable 1.5mm thick teflon sheet between clamps and stainless steel pipes. Overlap min. 10mm either side of support.

2.6 SADDLES AND SHIELDS

.1 Cold and hot piping NPS 1¼ and over: protection shield with high density insulation (25.4mm thick polyisocyanurate) under shield with uninterrupted vapour barrier.

.1 Standard of Acceptance: Anvil fig.167.

.2 Hot piping NPS 1¼ and over: protective saddle with insulation under saddle.

.1 Standard of Acceptance: Anvil fig.160 to 166.

.2 Tack weld protective saddle to carbon steel pipe.

PART 3 EXECUTION

3.1 APPLICATION

.1 Anchorage shall be provided to resist thrust due to temperature changes, changes in diameter or direction, or dead ending. Anchors shall be located as specified to force expansion and contraction movement to occur at expansion joints, loops, or elbows, and as needed to prevent excessive bending stresses and opening of mechanical couplings. Anchorage for temperature changes shall be centered between elbows and mechanical joints used as expansion joints.

.2 Unless otherwise specified, when expansion joints are required, pipe guides or sliding support shall be provided adjacent to expansion joints. Guides will not be required where mechanical couplings are permitted as expansion joints. Guides shall be located on both sides of expansion joints, except where anchors are adjacent to the joint. Unless otherwise indicated on the drawings or by the manufacturer, one guide shall be within four pipe diameters from the joint and a second guide within 14 pipe diameters from the first guide. Pipe guides shall not be used for support.

.3 Pipe supports for insulated cold piping systems shall be sized for the outside diameter of the insulated pipe, and an insulation protection shield shall be installed between the support and the insulation. Rigid insulation inserts shall be installed between the pipe and the insulation shields for piping larger than 2 inches [50mm] or when needed to prevent crushing of the insulation. Inserts shall be of the same thickness as the adjacent insulation and shall be vapor sealed.

3.2 FABRICATION

.1 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1, B31.3 and MSS-SP-58.

.2 This section covers fabrication of pipe support components and assemblies.

.1 Material of construction shall be CSA G40.21, type 300W unless otherwise noted. Plates, rods, bars, etc. which are used for the fabrication of support assemblies may be cut to shape or size by shearing, sawing, machining, grinding or thermal cutting.

.2 Thermal cutting processes shall be suitable for the material to which it is applied. After thermal cutting, slag shall be removed prior to further fabrication or use. Discolouration remaining on the flame cut surface is not considered to be detrimental oxidation.

.3 Drilling and punching shall be performed as required by drawings and specifications.

.4 Screw threads shall be in conformance with ANSI B1.1 Class 1A, 2A and 2B for coarse thread series and Class 2A & 2B for the eight thread series.

.5 Pipe threads shall be in accordance with ANSI/ASME B1.20.1 either straight or tapered as required.

.6 All threaded rod shall be hot-dip galvanized

.7 Welding shall be performed where indicated on the detail drawings in accordance with the welded joint requirements specified in the CAN3-S16.1. When welding any attachment to a pressure pipe, such welding shall to the specific applicable welding procedures which have been qualified in accordance with Section IX of the ASME Boiler & Pressure Vessel Code and T.S.S.A. Pressure Vessels branch requirements. A copy of the fabricator's procedures and weld qualification record shall be submitted for owner review and record.

.8 Fabricate supports in accordance with ASME B31.1, Power Piping.

3.3 INSPECTION

.1 There will be an inspection program to ensure that all aspects of work performed comply fully with specified requirements. The owner may elect to conduct inspection during fabrication.

3.4 MARKING

.1 When pipe supports are to be shop fabricated, each pipe support shall have its identifying mark number painted on with water-proof paint in letters at least 20mm high.

3.5 PIPE SUPPORT INSTALLATION

.1 Engineered pipe supports shall be located in strict accordance with the pipe support location drawing supplied by the Contractor and certified. Relocation and reorientation of any pipe support from the specified location shall not be permitted without written permission of the Contractors design engineer.

.2 Installed pipe supports shall be used only for their intended purpose. They shall not be used for rigging or erection purposes.

.3 The contractor is responsible for developing an installation sequence giving priority to major components and groups of piping closest to the supporting structure.

.4 Prior to connecting pumping units or other equipment to pipe sections, support complete piping assembly and anchor in perfect alignment with pumping units and sleeves to prevent movement of piping assembly and strain on pumping units or equipment.

.5 Support all valves and risers so that weight of valve or valve assembly is not carried by adjacent horizontal pipe sections.

.6 Provide heavy rubber material between pipe and galvanized supports.

.7 Provide plastic hose material over all threaded rods used as part of pipe clamps.

.8 All material in contact with the supported pipe shall be of the same material unless separated by suitable means.

.9 All material welded to the supported pipe shall be of the same material as the pipe.

.10 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.

.5 Provide bondable Teflon sheet between clamps and stainless steel pipes.

.11 Use approved constant support type hangers where:

.1 vertical movement of pipework is 13mm or more, transfer of load to adjacent hangers or connected equipment is not permitted.

.12 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.

.13 Provide support within 300mm (12") of each horizontal elbow.

.14 Space supports for non-metallic pipe as per manufacturer's instructions.

3.6 MAXIMUM PIPE SUPPORT SPACINGS

.1 The maximum pipe support spacings shall be as follows:

Type of Pipe	Pipe Support Max Spacing	Max Run Without Expansion Joint, Loop, or Bend	Expansion Joint Max Spacing
	m [ft]	m [ft]	m [ft]
Stainless steel			
31 mm [1-1/4 inch] and smaller	2.4 [8]	9.1 [30]	30.5 [100]
38 to 100 mm [1-1/2 to 4 inches]	3.6 [12]	9.1 [30]	30.5 [100]
100 to 250 mm [4 to 10 inches]	4.5 [15]	24.4 [80]	24.4 [80]
Over 250 mm [10 inch]	5.5 [18]	24.4 [80]	24.4 [80]

Type of Pipe	Pipe Support Max Spacing	Max Run Without Expansion Joint, Loop, or Bend	Expansion Joint Max Spacing
	m [ft]	m [ft]	m [ft]
PVC, HDPE & FRP Pipe Maximum Spacings: 1. Provide all pipe supports shown on the Contract Drawings. 2. Contractor shall provide the pipe support maximum spacing as per the manufacturer's recommendations with calculations. 3. The calculations shall include the input data with the pipe type, maximum deflection, max temperature, wind/seismic effects, specific gravity and correction factors, etc.			

.2 Unless otherwise specified, provide a pipe expansion joint with two pipe supports on both side of expansion joints to account for each structural expansion joint. The spacing between two supports shall not be more than 1.0m.

.3 Unless otherwise specified, one of sliding supports between fixed supports shall be a pipe guide as per Process Details in the Contract Drawings.

.4 Unless otherwise specified, provide one (1) flexible coupling at every 90-degree bends to allow for deflection.

3.7 HANGER INSTALLATION

.1 Install hanger so that rod is vertical under operating conditions.

.2 Adjust hangers to equalize load.

.3 Do not suspend from metal deck.

3.8 HORIZONTAL MOVEMENT

.1 Angularity of rod hanger resulting from horizontal movement of pipework form cold to hot position not to exceed 4° from vertical.

.2 Where horizontal pipe movement is less than 13mm (½") offset pipe hanger and support so that rod hanger is vertical in the hot position.

3.9 FINAL ADJUSTMENT

.1 Adjust hangers and supports.

.1 Ensure that rod is vertical under operating conditions.

.2 Equalize loads.

.2 Adjustable clevis:

.1 Tighten hanger load nut securely to ensure proper hanger performance.

.2 Tighten upper nut after adjustment.

.3 C-clamps:

.1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.

.4 Beam clamps:

.1 Hammer jaw firmly against underside of beam.

3.10 SEISMIC RESTRAINT

.1 Provide seismic restraint of systems in accordance with Section 44 02 41 - Seismic Restraint.

END OF SECTION

FIELD PAINTING REQUIREMENTS

PART 1 GENERAL

1.1 SCOPE

.1 This specification outlines the requirements for field surface preparation and field painting of metallic surfaces.

1.2 GENERAL REQUIREMENTS

.1 The Contractor shall provide all supervision, labor, tools, equipment (including but not limited to compressors, scaffolding, brushes, mixers and spray devices) drop cloths, protective covers and filters and materials necessary to prepare and paint surfaces.

.2 Clean-up, debris removal and disposal according to all applicable laws and regulations are the responsibility of the Contractor unless the Contract Administrator provides a written exemption.

.3 The following items, although galvanized, shall be painted when colour coding or additional corrosion protection is necessary.

.1 Bolting and associated hardware for painted structural steel and painted steel piping.

.2 Painted pipe clevis and other painted pipe supports.

1.3 SURFACE CLASSIFICATION

.1 The following surfaces have been cleaned and primed by others (unless otherwise noted in Contract Documents).

.1 Shop fabricated equipment including items supplied with manufacturer's standard paints such as pumps, motors, agitators, compressors, etc.

.2 All in-line carbon steel instruments and valves.

.2 The following surfaces shall not be painted, unless otherwise specified.

.1 Plastics and rubber.

.2 Aluminum and copper materials.

.3 Galvanized surfaces (except for touch-up of damaged galvanizing, bolting and pipe supports).

.4 Insulation, except where bituminous insulation mastic covering is utilized.

.5 Stainless steel piping and piping components.

.3 The following surfaces shall not be painted but shall be protected during surface preparation and paint application:

.1 Instrument and electrical panel boards, push buttons, controls, switches, fuse boxes, valve operators, or valve controllers.

.2 Sprinkler heads.

.3 Fire extinguishers.

.4 Glass parts of all instruments and gauges.

.5 Valve stems and PSV's.

.6 Machined surfaces of moving parts.

.7 Gasket surfaces.

.8 Identification nameplate and pipeline identification marks (except to renew).

.9 Removable signs shall be removed during surface preparation and paint application. After acceptance of painting activity signs shall be securely reinstalled.

.10 Electrical light fixtures, light bulbs, power connections.

.11 Concrete floors.

.12 Coatings on existing equipment and piping (outside the scope of project).

.13 Equipment nameplates.

.14 Stainless steel valves. (Unless valves are not insulated, and piping identification painting is specified).

.4 Any paint spilled, splashed, or misapplied on items listed in Paragraph 1.3.2 or 1.3.3 must be removed before the job is accepted as complete. Items listed in Paragraph 1.2.3 that are damaged or would be damaged by restoring the surface shall be replaced by the Contractor.

.5 The items and surfaces to be field painted and paint systems to be used are listed in the Painting Schedule. This typically includes:

.1 Uninsulated surfaces of carbon steel.

.2 Exposed carbon steel of uninsulated and insulated piping including back-up flanges, valves, bolting, supports and attachments.

.3 Exposed carbon steel parts of alloy or non-metallic equipment.

.4 Exposed stainless steel piping and valves for identification purposes.

.5 Refer to Section 13075 – Mechanical Identification for colour schedule for exposed piping painted for identification purposes.

.6 Engineer supplied equipment have been painted by the manufacturer and requires no further painting. Touch up any damaged surfaces to match manufacturer's paint system.

.7 Galvanized steel supports and galvanized steel building components damaged due to welding and other operations shall be touched up in accordance with Section 09 91 23.

MATERIALS

1.4 PAINTING SCHEDULE – CARBON STEEL

TYPE ITEM	TEMPERATURE RANGE °C (2)	SURFACE PREPARATION	PRIME COAT & APPLICABLE SPECIFICATION SECTION	INTERMEDIATE COAT & APPLICABLE SPECIFICATION SECTION	FINISH COAT & APPLICABLE SPECIFICATION SECTION
Piping (3)					
Insulated	-28°C to 150°C	Near-White Blast	Epoxy Phenolic Specification 44 01 48	None	None
Un-Insulated Indoor	-28°C to 93°C	Near-White Blast	Enamel primer as per item 2.7	Enamel finish coat as per item 2.8	Enamel finish coat as per item 2.8
Un-Insulated Outdoor	-28°C to 93°C	Near-White Blast	Enamel primer as per item 2.7	Enamel finish coat as per item 2.8	Enamel finish coat as per item 2.8
Pipe Supports – See Note 1					

Note:

(1) The supports touching the pipe (i.e. shoes, saddles, hangers, etc.) shall be painted as per the requirements for the pipe and all the pipe support touching hot piping above 150ºC shall be painted as per the requirements for the pipe. All structural steel supports shall be hot dipped galvanized. Galvanized steel supports and galvanized steel building components damaged due to welding and other operations shall be touched up in accordance with Section 44 01 52.

(2) To determine which temperature range a pipe to be painted falls into, refer to operating temperature of line, listed in Line List on P & ID drawings.

(3) Piping colours are provided in Section 44 00 90.

1.5

Inorganic zinc and zinc-rich organic primed items should be aged (weathered) for 24 hours at 21ºC and for 48 hours when the temperature is 10ºC or less prior to topcoating with high build topcoats. By field topcoating shop primed items, the open, porous surface of these primers generally have sufficient time to fill with carbonates and sulfates and, therefore, the risk of blistering and/or pinholing of topcoats is minimized. Shop application of topcoats over freshly applied primers should be avoided.

1.6

Near-white blast surface preparation shall be in accordance with Steel Structures Painting Council (SSPC) and National Association of Corrosion Engineers (NACE) Standard SSPC-SP-10 (NACE-2), "Near White Metal Abrasive Blast". Removal of at least 95% of all surface matter leaving the area free of all visible residues.

1.7

All carbon steel surfaces shall be solvent cleaned as per SSPC-SP-1, "Solvent Cleaning" to remove all oil, grease and similar contaminates prior to near white blast surface preparation.

1.8 PAINTING SCHEDULE – AUSTENITIC STAINLESS STEEL

Paint piping only when required for identification purposes as noted in Section 44 00 90.

TYPE ITEM	TEMPERATURE RANGE °C	SURFACE PREPARATION	COATING	NOTES
Equipment & Piping	60°C to 150°C	Solvent Clean & Brush Blast	Epoxy Phenolic Specification 44 01 48	(2)

NOTES

.1 Always protect austenitic stainless steel from zinc coating.

.2 Associated carbon steel surfaces shall have surface preparation, primer, and topcoat designated in Specification 44 01 48.

1.9 PAINTING OF GALVANIZED PIPING AND SUPPORTS

.1 Galvanized piping and supports shall receive one coat of vinyl wash primer, one coat Moore's Retardo Rust Inhibitive Paint and two coats of Satin Impervo Enamel.

.2 Prepare surfaces and apply paint in accordance with manufacturer's recommendations.

.3 Paint galvanized piping only when required for identification purposes as noted in Section 44 00 90.

1.10 ENAMEL PRIMER

.1 Enamel Primer to be Benjamin Moore's Rust Inhibitive paint, or equivalent.

.2 Preparation of Surfaces:

.1 Where conventional primer is used touch up shop paint primer on steel with CAN/CGSB-1.40-M89 to CGSB 85-GP-14M.

.3 Application:

.1 Sand and dust between each coat to remove defects visible from distance up to 1.5m using No.00 sandpaper.

.2 Apply paint by brush; rollers may be used elsewhere. Spray paint only when requested or approved by Contract Administrator.

.3 Use only unadulterated paint. Thin as specified by manufacturer.

.4 Do not paint caulked joints except as directed by the Contract Administrator.

.5 Touch up visible suction spots on dried primer and ensure that they are sealed before application of second coat. Repeat on second coat if still visible.

1.11 ENAMEL INTERMEDIATE AND FINISH COATS

.1 Enamel Intermediate and finish coat to be Benjamin Moores satin Impervo Enamel, or equivalent.

.2 Preparation of Surfaces:

.1 Where conventional primer is used touch up shop paint primer on steel with CAN/CGSB-1.40-M89 to CGSB 85-GP-14M.

.3 Application:

.1 Sand and dust between each coat to remove defects visible from distance up to 1.5m using No.00 sandpaper.

.2 Apply paint by brush; rollers may be used elsewhere. Spray paint only when requested or approved by Contract Administrator.

.3 Use only unadulterated paint. Thin as specified by manufacturer.

.4 Do not paint caulked joints except as directed by the Contract Administrator.

.5 Touch up visible suction spots on dried primer and ensure that they are sealed before application of second coat. Repeat on second coat if still visible.

EXECUTION

1.12 PAINTING

.1 Prior to applying any coating, all previously applied paints shall be sufficiently dried or cured to permit topcoating. All surfaces shall be unscarred, in good condition and free of oils, greases, excessive gloss, dust or other contaminants.

.2 Surfaces which have been primed or painted shall not be handled, worked on or otherwise disturbed until primer or paint is completely dry and/or set.

.3 Surface preparation, cleaning and painting operations shall be scheduled so that contamination of freshly applied paint is prevented.

1.13 MATERIALS

.1 The paint materials, their solvents and catalysts shall be supplied by the same paint manufacturer.

.2 All materials shall be delivered and stored in their original packages with their labels intact and seals unbroken.

.3 All paint materials shall be stored under cover in a dry place and protected from freezing temperatures and excessive heat. The paint materials shall be stored in accordance with paint manufacturer's instructions.

.4 Material substitutions are not allowed without prior written approval of owner.

.5 Compressed air used for blast cleaning, for removal of abrasives on blasted surfaces and for spray application shall be oil and moisture-free.

1.14 TOUCH-UP AND REPAIR

.1 Items painted with manufacturer's standard coating and operating shall be touched-up (where required) with paint of equal type. If the paint film is extensively damaged or is of unknown generic type, the item shall be solvent, hand or power tool cleaned and fully coated with primer and finish coat of equal type.

.2 All primed areas that have been damaged (by welding, scarring, etc.) shall be spot cleaned and touched up prior to applying the subsequent coats. These areas shall be cleaned, using solvent and power tools to remove all loose paint, heat degraded paint, rust bloom, scale, dirt, grease, oils or other foreign contaminant and to develop adequate anchor patterns. Adherent primer at edge of damaged area shall be roughened and feathered back from cleared area. After cleaning, reapply coating to cleaned areas to meet dry film requirements in referenced specification.

.3 Primed surfaces that are damaged and require greater than 30% touch-up shall have complete surface preparation and have full prime coat application to meet dry film requirements in reference specifications.

.4 Where existing steel surfaces finish coating have been damaged from welding or other operations; Contractor shall power wire brush the damaged area and then paint as per specifications for pipe supports.

1.15 COLOURS

.1 Final paint coat colour selection shall be made at the job site by the Contract Administrator using standard colours of approved paint suppliers according to the following General Colour Guide:

.1 The selected colours shall be supplied from single batch lots (to avoid colour variation). For large order of paints, minimum number of batch lots shall be supplied.

.2 Final topcoat colour section shall result in colour contract between coats.

.3 Failure to provide contrasting colours (unless prior written approval is granted by Contract Administrator), incorrect colour, varying colour (because of use of multiple lots of coating) shall be grounds for rejection.

.4 Areas rejected because of items listed above shall be repaired/replaced to Contract Administrator's satisfaction at the Contractor's expense.

.5 Colours must be cut in a neat straight line where two colours meet.

.6 Where colours are selected to meet plant or governmental safety requirements, colour tones and wavelength characteristics shall comply with these requirements.

.7 Contractor may utilize additional finish coat(s) of the same finish material or different generic system (i.e. aliphatic urethane) to meet special or safety colour requirements, provided that:

.1 Prior written Contract Administrator approval is granted.

.2 Coating is an approved product from an approved supplier per the appropriate Specification.

.3 Coating will be at least as chemically and ultraviolet resistant as the specified topcoat.

.4 Film build requirement of the selected topcoat system is satisfied.

1.16 FIELD SURFACE PREPARATION AND PAINTING PRIOR TO ERECTION

.1 Copper slags and high chloride bearing abrasives shall not be used as abrasive blast media.

.2 Unless otherwise prohibited, Contractor may request permission to set up a surface preparation and/or painting area to:

.1 Satisfy "shop" abrasive blast cleaning and "shop" priming requirements.

.2 Conduct "field" or in-situ abrasive blasting, surface preparation, primings or intermediate topcoating. Finish coating shall only be conducted after erection, unless written approval to do otherwise is granted by the Contract Administrator.

.3 Contractor may conduct surface preparation and/or painting in conjunction with Paragraph 3.5.2 if the following additional requirements are satisfied:

.1 Temperature and humidity criteria for application are not exceeded.

.2 Abrasive from blast cleaning does not damage or interfere with function of Engineer equipment.

.3 Stands or supports used to facilitate surface preparation and/or painting are of sufficient height from ground to prevent contamination of prepared and/or painted surfaces.

.4 Degree of handling damage is not excessive or would not require full recoating.

.5 Touch-up of damaged painting will not create an unsightly appearance when coating application is completed.

1.17 SAFETY AND EQUIPMENT PROTECTION

.1 Contractor should take into account possible wind shifts, exhaust fan drafts, high personnel traffic areas, and the proximity of instruments, controls, rotating equipment or other equipment susceptible to damage from particulate matter or painting.

.2 Personnel safety is of key importance. Areas to have surface preparation and/or painting shall be cordoned off with warning signs or safety ribbons. Walkways in the vicinity of blast cleaning are to be cordoned off with visqueen or tarps to help isolate the effects of sandblasting.

.3 Filter presses, pumps, motors, turbines, compressors and other rotating equipment are highly susceptible to damage from particulate matter. Therefore, it is of utmost importance that this type of equipment be protected and that protection is maintained for the duration of the work. Details of protection methods are outlined in the “Application” section of this procedure.

.4 The work shall be conducted in such a manner as not to damage any existing buildings, structures, insulation, piping, equipment, etc. Any such damage shall be required by Contractor at its expense, unless Contractor is directed otherwise by the Contract Administrator in writing.

.5 “Safe Work” permits are required for grinding, chipping, blast cleaning and painting. In addition to the “Safe Work” permits, “Hot Work” permits are required if there is a source of ignition for flammable materials in the area. Dry abrasive blasting, welding, cutting, electrical devices, needle guns, and grinding equipment are representative of this type of work.

.6 “Safe Work” and “Hot Work” permits are issued by the General Contractor group for the area in which work is to be done. These permits are in written form and must be obtained prior to commencing work and shall be good only for the time and work indicated on the permit. They will not be issued until the procedures for equipment and personnel protection are complete and approved by the Contract Administrator.

.7 Protective coverings are to be checked prior to each shift to be sure they are intact. The Contractor should periodically tour his area to be sure that the protection is maintained. If equipment has been exposed, it is the responsibility of the

Contractor that this be corrected immediately, even if it means stopping on-going work.

.8 It is the responsibility of the Contractor to protect plant personnel and equipment. Should the Contract Administrator deem that the Contractor is not adequately maintaining the protection of equipment and personnel, all work may be stopped until the protection of equipment is corrected.

.9 Contractor Equipment

.1 All equipment required by the Contractor shall be operated safely and be in a safe condition. The Contract Administrator reserves the right to forbid the use of any equipment which the Contract Administrator believes to be unsafe.

.2 All pressurized equipment shall have pressure gauges and regulators, as recommended by equipment manufacturer and shall meet all applicable Local, Provincial and Federal Regulations. The pressure device shall be maintained in safe working order. All pressurized equipment shall meet all applicable laws and regulations.

.10 The safety rules for Contractors are to be followed. They will be strictly enforced; failure to comply can lead to expulsion from the site.

.11 Electric motors, compressors, turbines, tank vents, etc., are to have foam filter material (equal to Preciation Air Filters, Part No. FR-52530) over any air intakes, with no openings to allow sand or paint chips to enter. The filters shall be a minimum of 20mm thick.

.12 Motor shaft seals, couplings, gear boxes and bearings are to be enclosed with visqueen or other suitable material and sealed in a manner that will prevent particulate damage.

.13 Piping, equipment, insulation, and other items near surfaces which are to be cleaned and painted shall be protected from over blast damage and overspray with visqueen, tarps, rubber, or other suitable material approved by the Contract Administrator.

.14 Drains and drainage trenches shall be covered to prevent sand or debris from entering. This also includes safety shower drains and eyewash stations. Drain covers are to be removed at the end of the project. The painting contractor must remove any debris or sand that could possibly wash into the drains. The Contractor shall be liable for the cost of cleaning drains that become plugged as a result of his work.

.15 Instrumentation, tubing, wiring and gauges are to be wrapped with visqueen and taped to keep debris out and wrapped with rubber sheeting if there is the possibility of damage from overblast or overspray.

.16 Unless Contract Administrator indicates otherwise, all work associated with protection of plant equipment and personnel shall be performed by Contractor.

1.18 INSPECTION

.1 Contractor shall provide Contract Administrator with full access to all items being prepared, cleaned and/or painted.

.2 Contractor, at the request of Contract Administrator's inspector, shall place one handful from each bag of abrasives into a bucket of clean water to detect clays, oils or other objectionable foreign matter. Typically, these materials float on water surface.

.3 Contractor is to utilize and provide for Contract Administrator's use all testing tools and equipment to ensure compliance with humidity and temperature criteria and to inspect all phases of surface preparation, materials and paint application/cure. All testing tools and equipment shall be calibrated and in good working condition.

.4 Contractor shall repair at his expense, all rejected surface preparation and coating application to Contract Administrator's satisfaction.

.5 Contractor is to provide, in writing, details to Contract Administrator of all corrective action on rejected surface preparation, materials and applications.

END OF SECTION

TOUCH UP OF GALVANIZED STEEL

PART 1 GENERAL

1.1 SCOPE

.1 This specification outlines a paint system using a one component zinc rich primer for field touch-up of galvanized steel surfaces operating below 660C.

1.2 SHOP DRAWINGS

.1 Submit shop drawings in accordance with the Section 44 00 10 - Process General Requirements and Section 01 33 00.

PART 2 MATERIALS

2.1 THE ACCEPTABLE PRIMERS ARE:

.1 Galvanox Type I, Subox Division, Carboline Co., 40 Burlews Ct., Hackensack, NJ 07901.

.2 Z.R.C. Cold Galvanizing Compound, ZRC Chemical Products Co., 21 Newport Avenue, Quincy, MA 02171.

.3 Galvicon, Southern Coatings, P.O. Box 460, Slidell, LA 70459.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

.1 Weld areas and small areas of damaged galvanizing shall be hand or power tool cleaned in accordance with Steel Structures Painting Council SSPC-SP-2 or 3, latest editions.

.2 If large areas of damaged galvanized are to be cleaned, use brush blast cleaning per Steel Structures Painting Council SSPC-SP-5, latest edition.

.3 All grease, oils or other foreign matter shall be removed in accordance with solvent cleaning SSPC-SP-I, latest edition and per manufacturer's recommended practice.

.4 Clean all exposed carbon steel per above and adjacent adherent galvanized for a distance of 12mm minimum.

3.2 APPLICATION

.1 The specific manufacturer’s instructions must be followed for handling, mixing, curing, application, thinning, equipment, re-coat time, cleaning of equipment, and storage.

.2 Primer shall not be applied when the metal surface or ambient air temperature is below 4.4°C or is expected to drop to 1.7°C before the primer has dried. The relative humidity of the surrounding air shall not exceed 90% at the time of application. Primer shall not be applied when metal surface or ambient temperature is greater than 38°C.

.3 Primer shall not be applied when the surface temperature is less than 15°C above the dew point of the surrounding air.

.4 Primer shall not be applied to damp surfaces or in rain, fog or mist.

.5 Surfaces to be primed shall be dry and free of atmospheric contamination, dust, grease, abrasives, and other foreign matter.

.6 The steel shall be primed within eight hours of surface preparation.

.7 The primer may be applied by brush or spray. For brush application, do not mix to prevent settling of zinc pigment. For brush application, fully load brush and apply smoothly onto surface to be coated (do not brush over primer).

.8 Apply two coats of primer to a total dry film build between 3 and 4 mils.

3.3 INSPECTION

.1 All phases of surface preparation may be checked by the Contract Administrator. The latest NACE Visual Standards for Blast Cleaned Surfaces will be used to determine compliance with standard. All primer materials and all phases of application are subject to inspection by the Contract Administrator.

.2 Insufficient dry film thickness, bleeding, holidays, blisters, runs, sags, improper cure, dry spray, or extensive blemishes are causes for rejection.

.3 All materials, application and workmanship not meeting this standard or manufacturer's instructions shall be repaired or replaced at the Contractor's expense.

3.4 SAFETY

.1 In addition to safety requirements in contract documents, the pint formulator’s safety recommendations shall be used.

.2 Contractor’s safety procurers, including the ventilation requirements of .3 below, must be discussed with the Contract Administrator before work can begin. These procedures must conform to all applicable laws and regulations.

.3 When applying primer in enclosed area, ventilation shall be provided during the time of application and three hours thereafter. Ventilation procedures must ensure that the air quality does not endanger the health of workers inside an enclosed area. The Contractor shall follow all applicable laws and regulations. In addition,

the contractor must also ensure that the air content inside any confined space never exceeds the permissible exposure limit (PEL) and one half the lower explosive limit (LEL) of any constituent of the paint system.

.4 All smoking materials, matches, flames, and spark producing tools and equipment are prohibited within 15m of the application area.

.5 Only portable lighting fixtures which are specifically approved as a complete assembly for use in a Class I, Division I location shall be used in enclosed areas when applying any part of a primer system. Supply voltage for lighting shall not exceed 32 volts.

END OF SECTION

SEISMIC RESTRAINTS

PART 1 GENERAL

1.1 SUMMARY

.1 This section specifies seismic restraints for bracing all piping systems and equipment specified in Division 44. This Section does not include seismic restraints for fire sprinkler systems.

.2 The contractor will retain a design engineer to review the installed piping system and equipment and design a seismic restraint system, including calculations as per the Ontario Building Code. The design, calculations and details shall be prepared and sealed by a professional engineer licenced in the Province of Ontario. The seismic design basis shall be for a Post Disaster Building.

.3 Definitions

.1 Longitudinal direction - direction parallel to the pipe axis (X orientation).

.2 Lateral direction - direction perpendicular to the pipe axis Y and Z orientations).

.4 Operating Conditions

.1 The seismic restraints specified in this section are provided to resist pipe movements and loads occurring as a result of an earthquake or other seismic event.

.2 Unless otherwise specified, all piping shall have bracing to resist seismic loading caused by forces applied at the individual pipe's center of gravity. Seismic loading shall be 1.0 g acting in the lateral and longitudinal directions and 0.5 g acting simultaneously in the vertical directions.

.5 Restraint Selection

.1 Unless otherwise specified, the contractor shall design, supply and install all seismic restraints for piping in accordance with the contract documents.

.2 The Contractor shall review the piping layout in relation to the surrounding structure and adjacent piping and equipment before designing the restraint to be used at each point.

.3 Piping systems shall not be braced to dissimilar parts of a building or to dissimilar building systems that may respond in a different mode during an earthquake. Examples: wall and a roof; solid concrete wall and a metal deck with lightweight concrete fill.

.4 Restraints shall be sized to fit the outside diameter of the pipe, tubing, or, where specified, the outside diameter of insulation.

.5 There shall be no contact between a pipe and restraint component of dissimilar metals. The contractor shall prevent contact between dissimilar metals when restraining piping and equipment by the use of copper-plated, rubber, plastic or vinyl coated, or stainless steel restraint components.

.6 Branch lines shall not be used to brace main lines.

.7 Seismic bracing shall not limit the expansion and contraction of the piping system.

1.2 QUALITY ASSURANCE

.1 References:

.1 This section contains references to the following documents. They are a part of this section as specified and modified. In case of a conflict between the requirements of this Section and those of the listed documents, the requirements of this section shall prevail.

.1 The Ontario Building Code for Post Disaster Buildings

.2 ANSI A58.1 Minimum Design Loads for Buildings and Other Structures

.3 AISC Manual of Steel Construction American Institute of Steel Construction, Manual of Steel Construction, Allowable Stress Design -9th Edition

.4 MSS SP-58 Pipe Hangers and Supports - Materials, Design and Manufacture

.5 MSS SP-69 Pipe Hangers and Supports - Selection and Application

.2 Approval: Seismic restraint load calculations required by this section shall be reviewed and signed by a structural engineer registered in the Province of Ontario.

1.3 SUBMITTALS

.1 Shop Drawings:

.1 The following shall be submitted in compliance with Section 01 33 00:

.2 Submit the design review, calculations, and installation details signed and sealed by a Professional Engineer registered in the Province of Ontario.

PART 2 PRODUCTS

2.1 ACCEPTABLE PRODUCTS

.1 Standard pipe restraints and components shall be manufactured by Carpenter & Patterson, B-Line, Kin-Line, Anvil, Michigan, Pipe Shields Incorporated, Superstrut, Unistrut, or equal. Pipe restraint materials shall conform to the requirements of MSS SP-58 and MFMA-1.

2.2 MATERIALS

.1 Unless otherwise specified, restraints, including braces, pipe and structural attachments, shall be hot-dip galvanized after fabrication except those within 2.0m of the top water level of any water bearing vessel/tank or reactor. Nuts, bolts and washers, fittings and accessories, may be mechanically zinc-coated except for

those subject to moisture or corrosive atmosphere or within 2.0m of the top water level of any water bear vessel/tank or reactor, which shall be type 304 stainless steel.

2.3 EXECUTION

.1 Provide equipment supports and anchoring devices to withstand the seismic design forces, so that when seismic design forces are applied, the equipment cannot displace, overturn, or become inoperable.

.2 Provide anchorages in conformance with recommendations of the equipment manufacturer and as shown on approved shop drawings and calculations.

.3 Construct seismic restraints and anchorage to allow for thermal expansion and contraction.

.4 Provide supports and anchoring so that, upon application of seismic forces, piping remains fully connected as operable systems which will not displace sufficiently to damage adjacent or connecting equipment or building members.

.5 Piping Connections: Provide flexible connections where pipes connect to equipment. Make the connections capable of accommodating relative differential movements between the pipe and equipment under conditions of earthquake shaking.

END OF SECTION

POWERED ACTUATORS

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittals

.2 Division 26 – Electrical

.3 Section 44 04 00 – Process Piping

1.2 SUBMITTALS

.1 Submit shop drawings and product data in accordance with Section 01 33 00 – Submittals.

.2 Provide maintenance data for incorporation into manual specified in Section 01 33 00 – Submittals. Data to include:

.1 Manufacturers name, type, model, capacity, complete model number and Serial number.

.2 Applicable operation and maintenance information as specified in section 01 33 00.

.3 Provide calculations for sizing and actuator torque calculations.

.4 Submit a completed ISA S20.50 Instrument Specification sheet for each device, with all fields completed.

.5 Installation certification form.

.6 Training Certification form.

1.3 DESCRIPTION

.1 All powered actuators shall be supplied together with the mechanical equipment (i.e. valves, gates, etc.) by the mechanical equipment supplier under Division 44.

.2 All sizing and selection of modulation and on/off control valve components shall be undertaken by the mechanical equipment supplier under Division 44.

.3 Sizing and matching of powered actuators to controlled devices shall be undertaken by the mechanical equipment supplier under Division 44 and coordinated with the work specified herein.

.4 Refer to the drawings and Valve Instrument Data sheets, attached to this section, for valve and actuator identification and specific information.

PART 2 PRODUCTS

2.1 GENERAL

.1 The actuators shall be suitable for use on a nominal three-phase, 208 Volt, 60Hz power supply with 120 Vac control transformer and are to incorporate motor, integral reversing starter, local control facilities, and terminals for remote control and indication connections. The actuator shall include a device capable of automatically correcting the phase relationship of a three-phase supply.

.2 Valves shall be capable of setting the torque level, position limits and configuration of the indication contacts without requiring the removal of any covers

.3 Actuators shall be watertight to NEMA rating specified in the Instrumentation data sheets and shall have an inner watertight and dustproof 'O' ring seal between the terminal compartment and the internal electrical elements of the actuator fully protecting the motor and all other internal electrical elements of the actuator from ingress of moisture and dust when the terminal cover is removed on site for cabling.

.4 Actuators installed in explosion/hazardous areas shall be adequately certified and suitable for use in the rated area.

.5 All external fasteners shall be of stainless steel.

.6 The enclosure of the electric actuator shall be provided with minimum 8 mil DFT epoxy coating.

2.2 ELECTRIC ACTUATORS, OPEN/CLOSE TYPE AND MODULATING TYPE

.1 The actuator shall be sized to guarantee valve closure at the specified differential pressure and with a 1.5x safety factor over the maximum required valve torque as specified by the valve manufacturer. Motor design shall ensure sufficient torque output in the event the supply voltage drops to 10% below nominal.

.2 The operating speed shall be such as to give valve closing and opening at approximately 250 to 300 mm per minute unless otherwise stated in the job specification.

.3 The actuator shall be capable of functioning in an ambient temperature ranging from -30°C to +70ºC, unless noted otherwise in the instrument data sheets attached.

.4 The electric motor shall be of a high torque, low inertia type, shall incorporate self re-setting thermostatic protection against overheating and be 15 minutes rated (minimum). The actuator shall de-energize the motor in the event of stall when attempting to unseat a jammed valve. Motors shall be equipped with Class H insulation.

.5 The actuator gearing must be totally enclosed, be of all metal construction and suitably lubricated without the use of special or exotic lubricants which may be difficult to source.

.6 A handwheel shall be provided for emergency (manual) operation and shall disengage the gear train by means of a declutching lever. Upon restoration of mainspower the actuator will automatically re-engage the motor gear train. Handwheels must not rotate whilst the actuator is operating via the motor.

.7 The handwheel size and gearing must ensure the required rim pull does not exceed 360N.

.8 Torque sensing must be through electronic means and it shall be possible to easily adjust the actuator's overall output to 40% to 100% of its rated torque.

.9 A minimum of four latching contacts shall be provided for the selection of a normally closed (NC) or normally open (NO) contact forum. Contacts should maintain and update position indication if the actuator is manually operated without main power available.

.10 The contacts shall be rated at 5A at 120V AC and can be individually designated to signal conditions such as:

- Valve opening, closing or moving
- Thermostat tripped, lost phase
- Motor tripped on torque in mid travel, motor installed.
- Actuator alarm, valve alarm, control system alarm
- Remote selected
- Actuator being operated by handwheel

.11 When requested in the instrument data sheets, the actuator must have a contactless transmitter to give a 4-20mA analog signal corresponding to valve position. The transmitter shall be auto ranging to the set actuator limits and be factory calibrated for 4-20mA (+/-1%).

.12 The actuator display shall include a dedicated numeric/symbol digital position indicator displaying valve position from fully open to fully closed in 1% increments. Red, green, and yellow lights corresponding to open, closed, and intermediate valve positions shall be included on the actuator display when power is switched on. The digital display should be maintained and updated during handwheel operation when all power to the actuator is isolated.

.13 The digital display shall be capable of indicating real time torque output and valve position during actual operating conditions.

.14 The reversing starter, control transformer, and local controls shall be integral with the valve actuator, suitably housed to prevent breathing and condensation buildup.

For On-Off service, the starter shall be an electromechanical type suitable for 60 starts per hour and of a rating appropriate to motor size.

.15 The integral transformer shall be fuse protected, have all necessary tappings and be adequately rated to provide power for the following functions:

- Energization of contactor coils
- 120 VAC output as indicated on the instrumentation data sheets for actuator remote circuits
- Supply all internal control circuits

.16 For modulating applications, actuators shall use a nominal three-phase 60Hz power source and incorporate solid state starters for optimum lifetime performance.

.17 When specified in the instrumentation data sheets, the actuator shall include for proportional analog control via 4-20mA or VDC input and as well as provide a return analog signal back to the SCADA confirming valve position. It should be possible to configure this device such that the valve will stay put, open or close upon loss of analog control signal.

.18 Integral to the actuator shall be local controls for Open, Close, and Stop, and a Local/Remote selector switch pad lockable in any one of the following three positions:

.1 Local Control Only
.2 Stop (No Electrical Operation)
.3 Remote Control plus Local Stop Only.

It shall be possible to select maintained or non-maintained local control.

.19 The terminals shall be embedded in a terminal block of high tracking resistance compound. The terminal compartment shall be separated from the inner electrical components of the actuator by means of a watertight seal. The terminal compartment of the actuator shall be provided with a minimum of three threaded cable entries. Each wire shall be clearly identified at each end.

A durable terminal identification card showing plan of terminals shall be provided attached to the inside of the terminal box cover indicating:

a) Serial Number
b) External Voltage Values
c) Wiring Diagram Number
d) Terminal Layout

This must be suitable for the contractor to inscribe cable core identification beside terminal numbers.

2.3 MANUFACTURERS

.1 Powered actuators to be supplied by Auma, Rotork or approved equivalent.

PART 3 EXECUTION

3.1 PREPARATION

.1 Prior to installation of the valve, field measure and check all equipment locations, pipe alignments, and structural installations. Ensure that sufficient space and accessibility is available for pneumatic and electric actuators.

.2 Where conflicts are identified, inform the Contract Administrator and initiate the necessary modifications at no cost to the owner.

3.2 INSTALLATION

.1 Install actuators, related panels, and the interconnecting wiring as shown in the construction drawings and as recommended by the manufacturer.

END OF SECTION

SLUICE, CHANNEL, AND WEIR GATES

PART 1 GENERAL

1.1 SUMMARY

.1 This section specifies the supply and installation of heavy duty fabricated stainless steel slide gates, channel gates and downward opening weir gates indicated on the drawings and as specified herein.

.2 Each gate shall have a clear waterway, shall consist of a gate, guides, frames, brackets, wall thimbles with mounting bolts, stems and stem guides, manual actuators, electric actuators, and all other necessary appurtenances.

.3 The contractor shall furnish all labour, materials, equipment and incidentals required to install, ready for operation and field test stainless steel gates and appurtenances as shown on the Gate Schedule and/or Contract Drawings and as specified herein.

.4 The equipment provided under this section shall be fabricated to repeatable quality build norms, assembled, factory stroked and leak tested with signed and dated results. It shall be erected and placed in proper operating condition in full conformity with the drawings, engineering data, instructions and recommendations of the equipment manufacturer.

.5 Gates and operators shall be supplied by the gate manufacturer with all necessary parts and accessories indicated on the drawings, specified or otherwise required for a complete, properly operating installation and shall be the latest standard product of a manufacturer regularly engaged in the production of fabricated gates.

.6 Except as modified or supplemented herein, all gates and operators shall confirm to the applicable requirements of AWWA C561, latest edition.

1.2 QUALITY ASSURANCE

.1 References:

.1 This section contains references to the following documents. They are a part of this section as specified and modified. In case of a conflict between the requirements of this Section and those of the listed documents, the requirements of this section shall prevail, and all references shall be the latest edition including all addenda.

.1 American Water Works Association, AWWA C 513, Open Channel Sluice Gates.

.2 All the equipment specified under this Section shall be furnished by a single manufacturer with a minimum of 25 years' experience designing and manufacturing water control gates in North America. The manufacturer shall show evidence of satisfactory operation in at least 100 installations.

.3 The manufacturer's shop welds, welding procedures and welders shall be qualified and certified in accordance with the requirement of the latest edition of ASME, Section IX. Welders' certifications and procedures shall be made available for review and acceptance. Failure of conformity will be grounds for rejection.

.4 All wall mounted, four-sided sealing gates shall be shop tested in accordance with AWWA C561 Section 5.2.1, at the manufacturer's factory prior to shipment for both leakage and proper operation. Shop testing shall confirm compliance with the minimized leakage rate as specified in Section 2.1.2 of this specification. Signed and dated leak test certificates by the manufacturer or approved reputable independent third-party agent shall be provided. The owner or its authorized agents reserve the right to witness the leakage tests and shall do so at their discretion.

.5 The torque required to obtain the low leakage sealing shall not cause damage to the operator or actuator to lose its safety factor or overheat.

.6 The manufacturer shall be ISO 9001 certified (latest edition).

1.3 WARRANTIES

.1 A minimum warranty of two (2) years from Substantial Performance must be provided for the gate, appurtenances and actuators specified. It must cover all parts and labour, as well as any regular maintenance not specified in the technical manual delivered with the equipment.

1.4 SUBMITTALS

.1 The manufacturer shall submit the following drawings and data for approval in compliance with Section 01 33 00.

.1 Certified general arrangement drawings in metric units, showing principal dimensions, details of construction, materials list and details required for installation and operation.

.2 Signed and dated factory test reports for stroke test through the complete opening and closing stroke as well and quantified leak test results in litres per minute and per perimeter of seating. Documents shall be considered a submittal requirement and shall be supplied after manufacture of gate, prior to shipment.

.3 Valves failing to meet the minimum specified leakage rates shall be considered "failed" by the factory QA/QC. They shall not be shipped. Modifications made to meet specified leakage rates shall be noted for review, shall be permanent and shall withstand the expected longevity of the installation.

.4 Certification to ISO 9001 demonstrating a repeatable building methodology to assure pre-designated quality level as well as to provide for documented procedures for any deviant occurrences.

.5 Manufacturer shall demonstrate longevity of design and provide testing results for a 25,000-abrasive media accelerated life cycle test demonstrating leakage rates are still below allowable AWWA C561 leakage rates.

.6 Signed factory validation that all gate frame materials and supports are no less than 10 mm thick

.7 The manufacture shall demonstrate the sturdiness of the gate, as well as conformance to the latest edition of AWWA C561 by providing design calculations, confirming stress and deflection of the slide, yoke, and stem. Provide a P.Eng. stamped design validation that the slide shall consist of a flat plate reinforced with formed plates or structural members to limit its deflection of 1/720 of the gate's span under the design head.

PART 2 PRODUCTS

2.1 MATERIALS AND DESIGN

.1 The gates shall be designed for the specified seating and unseating head and shall be of the highest quality both as to materials and workmanship.

.2 The gates shall meet the requirements of AWWA C561 -latest edition. Stainless steel gates shall be made of Type 316 stainless steel.

.3 All parts of gates shall be amply proportioned for all stresses which may occur during installation and operation.

.4 Each gate shall be substantially watertight and shall have zero leakage, when closed.

.5 The gates shall close by rotation of the stems or handwheels, in a clockwise direction.

.6 The gates shall have heavy self-contained frames as noted in the specifications, machined and drilled for bolting to flat surfaces.

.7 Slide gates and weir gates shall be surface mounted to concrete wall or to pipe flange as shown on the drawings. All holes for bolts and studs shall be drilled. Coring of the holes will not be permitted.

.8 All anchor bolts and fasteners shall be Type 316L stainless steel.

.9 All handcrank gear operators shall be located 900mm above the top of grating/concrete at the location shown.

.10 All weir gates are to be provided with clear graduated cylinders around the rising stem in order to allow indexing of the top of weir position.

2.2 REPLACEMENTS

.1 Make interchangeable such individual pieces of the equipment herein specified which are furnished alike in each unit. Like pieces shall conform to exact dimensions on the working drawings made by the Manufacturer, so that no fitting or adjustment will be necessary in setting up the entire equipment, other than such as is usually done in high grade standard designed apparatus.

.2 It is essential that any defective piece of equipment be easily replaced by a new piece made in accordance with the drawings.

2.3 HEAVY DUTY FABRICATED SLIDE GATE

.1 Acceptable Gate Manufacturer: B.N.W. Model 77S or Fontaine Series 20.

.2 Slide gates shall be self-contained rising stem configuration as indicated in the gate schedule.

.3 Frames

.1 The gate frame shall be constructed of structural members or formed plate welded to form a rigid one-piece frame. The frame shall be of the flange back design suitable for mounting on a concrete wall (CW), concrete wall with extra-wide flange (CWX), round manhole (RM), round manhole with extra-wide flange (RMX), a wall thimble (WT), or a standard flange (SF). The frame shall be made of 316L stainless steel.

.2 The frame configuration shall be of the flush-bottom type and shall allow the replacement of the top and side seals without removing the gate frame from the concrete or wall thimble.

.4 Guides and Seals

.1 The guides shall be of such length as to retain and support at least two thirds (2/3) of the vertical height of the slide in the fully open position.

.2 The gate seal shall consist of mechanically retained resilient rubber seal that will provide tight shutoff. The resilient seal shall be replaceable and shall be securely fastened to the gate frame to prevent pull out due to high velocities during gate closing. The top and side seal material shall be Hypalon® or Ultra high molecular weight polyethylene (UHMW PE), suitable for use in wastewater containing abrasive material. The bottom seal material shall be resilient Neoprene. The seal shall be of a raised type to minimize the chance of solids buildup.

.3 The resilient neoprene bottom seal shall be set into the bottom member of the frame and shall form a flush bottom.

.4 The slide gates shall be of proven design capable of maintenance free tight shutoff.

.5 Thrust bearings at yokes shall be grease lubricated.

.5 Wall Gasket

.1 Gasket (between frame and wall thimble) shall be Neoprene in accordance with ASTM D2000 M2 BC 503.

.6 Wall Thimble

.1 The wall thimble shall be supplied by the gate manufacturer for all slide gates. Refer to the gate schedule for type and applicable locations. Material thickness should be according to the manufacturer's recommendations and be of sufficient resistance to handle the operating forces.

.7 Slides

.1 The gate slide shall be manufactured from 316 stainless steel having a minimum thickness of 10 mm. The slide shall consist of a flat plate reinforced with formed plates or structural members to limit its deflection to 1/720 of the gate's span under the design head.

.8 Stems and Couplings

.1 Lifting stems for self-contained gates shall be one piece type 316L stainless steel of ample cross-section to prevent distortion. The threaded portion of the stem at the actuator end shall extend 50mm past the actuator nut when the gate is at the bottom of its travel.

.2 The operating stem shall be designed to transmit in compression at least 2 times the rated output of the operating manual mechanism with a 178 N effort on the crank or handwheel.

.3 Provide machine cut threads of the Acme type.

.4 Stems shall be sized so that the slenderness ratio (L/r) for the unsupported length of the stem does not exceed 200.

.5 For extended stems in more than one piece with a nominal diameter of 45mm and larger, join the sections by grooved and keyed solid Couplings of greater strength than the stem.

.6 For extended stems provide adjustable fabricated 316L stainless steel stem guides required to prevent stem deflection.

.7 No slack or looseness shall exist between each stem sections or between the stem and the gate door. Even in reverse action, every movement of 1 mm of the higher stem section shall move the gate door by the same amplitude.

.8 Each gate with rising type stems shall be provided with transparent plastic, vented pipe stem covers and caps. Provide stem covers with OPEN and CLOSED position markings and graduations in metric.

.9 Provide a threaded stainless steel stop nut on all geared and ball bearing lifts.

.9 Operator

.1 Provide lifting devices for manually operated gates and for use with a portable power lifting device.

.2 Manual lift for slide gates shall be a yoke-mounted type for self-contained gate complete with a side mounted crank with a gear ratio as required for specified operating conditions.

.3 All bearings and gears shall be totally enclosed in a weather tight housing. The pinion shaft of crank-operated mechanisms shall be constructed of stainless steel and supported by roller or needle bearings. Gears shall be yoke mounted for self-contained gates.

.4 Gate shall be equipped with a locking mechanism (passive or active), allowing it to remain opened after actuator as been removed for maintenance.

.10 Yoke

.1 Self-contained gates shall be provided with a yoke made of structural members or formed plates. The maximum deflection of the yoke shall be 1/360 of the gate's span. Yoke shall be made of 316L stainless steel.

2.4 WEIR GATES

.1 Acceptable Gate Manufacturer: B.N.W. Model 77w or Fontaine Series 40.

.2 Weir gates shall be wall mounted down-ward opening gates fabricated of 316 stainless steel and come complete with flange back frame, wall thimbles and guide etc. Gates shall meet AWWA C561 standards for materials and allowable leakage.

.3 Weir gates shall be self-contained rising stem configuration as indicated in the gate schedule.

.4 The gate seal shall be as specified in 2.3.4 above. To provide minimum leakage at intermediate gate travel positions, a second mechanically retained neoprene wipe seal shall be provided around the perimeter of the gate. When fully closed (raised) the gate shall be leak tight.

.5 Frame, guide, wall thimbles, wall gasket, gate stems, slide, operators (actuators) and yoke will all be as specified above for slide gates.

.6 Gate frame shall be constructed of structural members or formed plate welded to form a rigid one piece-frame.

2.5 CHANNEL GATES

.1 Acceptable Gate Manufacturer: B.N.W. Model 77S or Fontaine Series 25.

.2 Channel gates shall be self-contained rising stem configuration as indicated in the gate schedule.

.3 Frames

.1 The channel gate frame shall be constructed of structural members or formed plate welded to form a rigid one-piece frame. The frame shall be made of 316L stainless steel.

.2 The frame configuration shall be of the flush-bottom type and shall allow the replacement of the top and side seals without removing the gate frame from the concrete or wall thimble.

.3 Frames of the channel gates in the Headworks and UV channels shall be embedded in the channel concrete surface.

.4 Guide, wall thimbles, wall gasket, gate stems, slide, operators (including power lifting device) and yoke will all be as specified above for slide gates.

.5 Gate Seal

.1 Side: Hypalon® or Ultra high molecular weight polyethylene (UHMW PE).

.2 Bottom: Neoprene

.3 Provide double o-ring between the concrete wall surface and gate frame.

2.6 GATE SCHEDULE

.1 The gates to be provided are outlined in the attached design drawings.

PART 3 EXECUTION

3.1 SHOP FINISHES

.1 Slide gate frame and slide shall be shop blasted using a stainless steel grit to remove manufacturing impurities.

.2 All stainless steel surfaces shall be fully pickled and passivated in accordance with ASTM A380, manufacturers must provide documentation verifying their procedures.

3.2 INSTALLATION

.1 Installation shall comply with the manufacturer's written instructions.

.2 Slide Gates

.1 Set wall thimbles in the forms level and plumb. Install gates on their respective thimbles free from distortion and undue strain and truly plumb and level. Ensure wall thimble is properly oriented with the gate prior to installation.

.2 Test gates to the seating and unseating pressures specified.

.3 Reduce leakage to amount specified.

.4 Protect all exposed apparatus and equipment from mortar drippings, wet concrete or other adhering substances.

.5 After installation, clean gates and operators of all foreign matter.

.3 Weir Gates

.1 Set wall thimbles in the forms level and plumb. Install gates on their respective thimbles free from distortion and undue strain and truly plumb and level. Ensure wall thimble is properly oriented with the gate prior to installation.

.2 Set single frame square and flush to the wall opening.

.3 Fasten flange back frame to wall with 316 SS anchor bolts.

.4 Adjust gate and operator to provide smooth operation.

.5 Test gates for allowable leakage.

.4 Field Testing

.1 The gates shall be operated through two complete open/close cycles to the satisfaction of the Contract Administrator.

.2 If leakage exceeds the required criteria modifications shall be undertaken to correct the defect to the satisfaction of the Contract Administrator. All costs associated with repairs shall be borne by the Contractor.

END OF SECTION

STOP PLATE

PART 1 GENERAL

1.1 WORK OF THIS SECTION

.1 The contractor shall furnish all labor, materials, equipment and incidentals required to install, ready for operation and field test stainless steel gates and appurtenances as shown on the Gate Schedule and/or Contract Drawings and as specified herein.

.2 The equipment provided under this section shall be fabricated to repeatable quality build norms, assembled, factory stroke and leak tested with signed and dated results. It shall be erected, and placed in proper operating condition in full conformity with the drawings, specifications, engineering data, instructions and recommendations of the equipment manufacturer.

.3 Gates and operators shall be supplied by the gate manufacturer with all the necessary parts and accessories indicated on the drawings, specified or otherwise required for a complete, properly operating installation, and shall be the latest standard product of a manufacturer regularly engaged in the production of fabricated gates.

.4 Except as modified or supplemented herein, all gates and operators shall conform to the applicable requirements of AWWA C561, latest edition.

1.2 QUALITY ASSURANCE

.1 All of the equipment specified under this Section shall be furnished by a single manufacturer with a minimum of 25 years' experience designing and manufacturing water control gates in North America. The manufacturer shall show evidence of satisfactory operation in at least 100 installations.

.2 The manufacturer's shop welds, welding procedures and welders shall be qualified and certified in accordance with the requirement of the latest edition of ASME, Section IX. Welders' certifications and procedures shall be made available for review and acceptance. Failure of conformity will be grounds for rejection.

.3 All wall mounted gates shall be shop tested in accordance with AWWA C561 Section 5.2.1, at the manufacturer's factory prior to shipment for both leakage and proper operation. Shop testing shall confirm compliance with the minimized leakage rate as specified in Section 2.01 of this specification. Signed and dated compliance by the manufacturer or approved reputable independent third party agent shall be provided. The owner or its authorized agents reserve the right to witness the leakage tests and shall do so at their discretion.

.4 The torque required to obtain the low leakage sealing shall not cause the actuator to lose its safety factor or overheat.

.5 Gates supplied under this section shall be a Series 29 Stainless Steel Stop Plate as manufactured by Fontaine-Aquanox or approved equivalent.

1.3 SUBMITTALS

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

.2 The manufacturer shall submit the following drawings and data for approval by the purchaser.

.1 Certified general arrangement drawings in metric units, showing principal dimensions, details of construction, materials list, and details required for installation and operation.

.2 Manufacturer shall demonstrate longevity of design and provide testing results for a 25,000 abrasive media accelerated life cycle test demonstrating leakage rates are still 50% below allowable AWWA C561 leakage rates.

.3 Manufacturer shall demonstrate repeatable quality design at time of manufacture. They shall provide historical test results of 1000 gates within the last twelve months to demonstrate that no less than 85% of all gates meet a leakage of rate less than 25% (0.025 gallon per minute per foot (0.30 l/min per meter)) of the allowable AWWA C561 leakage rate of sealing perimeter for gates less than 20 ft head.

.4 Signed factory validation that all gate frame materials and supports are no less than ¼ inch in width.

.5 The manufacturer shall demonstrate the sturdiness of the gate and shall provide design calculations confirming stress and deflection of the slide, yoke, and stem. Provide a design validation, stamped by a Professional Engineer licensed to practice in Ontario, that the slide shall consist of a flat plate reinforced with formed plates or structural members to limit its deflection to 1/720 of the gate's span under the design head.

PART 2 PRODUCTS

2.1 GENERAL DESIGN

.1 Gates shall be non self-contained of a single piece plate/stem and handle, as indicated on the Contract drawings and / or Gate Schedule.

.2 The stop plate shall be substantially watertight under the design head conditions. Without exception, under the design seating and unseating head, the leakage shall not exceed 0.05 U.S. gallon per minute per foot (0.60 l/min per meter) of seating

perimeter. Modifications, if made, shall not affect the lift input requirements of the gate or the provided safety factor of the actuator.

.3 The sluice gates shall be designed to minimally withstand the design head shown in the schedule.

.4 The gate shall utilize maintenance free self-adjusting seals.

.5 All structural components of the frame and slide shall be fabricated of stainless steel having a minimum thickness of 1/4-inch (6.4 mm) and shall have adequate strength to prevent distortion during normal handling, during installation and while in service.

.6 Welds shall be sandblasted to remove weld burn and scale. Gates shall be thoroughly cleaned to remove any contamination prior to shipment. All iron and steel components shall be properly prepared and shop coated with a primer.

2.2 FRAME

.1 The frame shall be made of wrought stainless steel of the specified commercial grade or from commercially available structural shapes. The minimum material thickness of all members except seal retainers shall be ¼- inch. (6.4 mm) without exception. Gates with thinner materials shall be rejected. The owner reserves the right to field validate.

.1 The gate frame shall be constructed of structural members or formed plate welded to form a rigid one-piece frame. The frame shall be of the flange back design suitable for mounting on a concrete wall (CW) in front of the by-pass pipe. The guide slot shall be made of UHMWPE (ultra-high molecular weight polyethylene). Mounting style shall be as shown on the gate schedule and/or contract drawings.

.2 All wall mounted and thimble mounted gates shall be of the more robust flanged back design frame. Flat back design frames are not acceptable.

.3 All wall mounted gates shall mount with a ½" (12mm) thick resilient gasket between the gate frame and the concrete wall. The gasket shall be manufacturer supplied. The gasket shall seal the gate frame to the wall without issue with up to a 0.5 inches vertical deviation. Mounting with grout pads will not be acceptable

.4 A rigid stainless steel invert member shall be provided across the bottom of the opening. The invert member shall be of the flush bottom type on upward opening gates.

2.3 SLIDE

.1 The slide and reinforcing stiffeners shall be constructed of stainless steel plate. All structural components shall have a minimum thickness of 1/4-inch (6.4 mm)

.1 The slide shall be designed for the minimum safety factor of 4 with regard to ultimate tensile, compressive, and shear strength, and a minimum safety

factor of 2 with regard to the tensile, compressive, and shear yield strength. The slide shall consist of a flat plate reinforced with formed plates or structural members to limit its deflection to 1/720 of the gate's span under the design head.

2.4 GUIDES AND SEALS

.1 All gates shall be provided with maintenance free, self-adjusting seal system utilizing UHMWPE seals and resilient compression cord to restrict leakage without affecting the lift loads and shall be in accordance with the requirements listed in this specification.

.1 The self-adjusting seals shall be designed with a continuous compression cord to ensure contact between the UHMWPE guide and the gate in all positions.

.1 The sealing system shall maintain efficient sealing in any position of the slide and allow the water to flow only in the opened part of the gate.

.2 The guides shall be made of new virgin UHMWPE (ultra-high molecular weight polyethylene) to assure its correct mechanical properties and chemical resistance. The guide shall restrict leakage, prevent metal-to-metal contact between the frame and the slide, and provide long-term maintenance free operation. UHMWPE guides shall not be compressed by the retaining bolt to make a seal against the slide. Guides shall be self adjusting.

.3 The guides/seals shall extend to accommodate minimum 1-2/3 x the height of the slide.

.4 The top seal shall be the self-adjusting type, utilizing a cup shaped UHMWPE seal with twin contact surfaces and compression cord. The cup shaped seal with twin contact surfaces shall be designed with the outer seal acting as a wiper to remove debris from the slide when raising the gate thereby protecting the primary seal.

.5 All upward opening gates shall be provided with a resilient seal made of neoprene set into the bottom frame member to seal the bottom portion of the gate and form a flush-bottom. Gates designed with bottom seals attached to the slide shall not be acceptable.

.6 All downward opening gates shall be provided with self-adjusting type seals, utilizing a cup shaped UHMWPE seal with twin contact surfaces and compression cord. The cup shaped seal with twin contact surfaces shall be designed with the outer seal acting as a wiper to remove debris from the slide when raising the gate thereby protecting the primary seal.

.7 All UHMWPE seals must be bolted or otherwise mechanically fastened to the frame. Retaining bolts shall not act as a compression seal of the UHMWPE.

.8 As gates seals are susceptible to UV and chemical attack and degradation and premature replacement is undesirable, Gates that utilize rubber “J” seals or “P” seals are not acceptable.

2.5 LIFTING MECHANISM

.1 Manual operators of the types listed in the schedule or shown on the contract drawings shall be provided by the gate manufacturer.

.1 Operation. The gate is a manual stop plate. The stem shall consist of a stainless steel rod with handle built at the top for operator access at the operating floor elevation.

2.6 ANCHOR BOLTS

.1 Anchor bolts shall be provided by the contractor for mounting the gates and appurtenances.

.1 Quantity and location shall be determined by the gate manufacturer.

.2 If epoxy type anchor bolts are provided, the gate manufacturer shall provide the studs and nuts. Newly acquired, non-expired epoxy shall be used.

.3 Gate frame anchor bolts shall have a minimum diameter of 1/2-inch (12 mm)

2.7 MATERIALS

PART	MATERIAL
Frame, yoke, stem guides, slide, stem extension	Stainless steel ASTM A-240 type 304L
Side seals, stem guide liner	Ultra high molecular weight polyethylene (UHMWPE) ASTM D-4020
Compression cord	Nitrile ASTM D2000 M6BG 708, A14, B14, E014, E034
Bottom seal	Neoprene ASTM D2000 Grade 2 BC 510
Fasteners	ASTM F593 and F594 GR1 for type 304 and GR2 for type 316
Gasket (between frame and wall)	EPDM ASTM 1056

2.8 GATE SCHEDULE

.1 Refer to Gate Schedule located on Contract Drawing P0410.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Gates and appurtenances shall be handled and installed in accordance with the manufacturer's recommendations.

.2 Manufacturer shall furnish an authorized service technician to inspect and verify proper installation, assist with field testing, startup and commissioning. The minimum number of days/trips shall be one day.

.3 All bolts shall be tightened and all items requiring lubrication shall be lubricated. Anti seize thread lubricant shall be liberally applied to the threaded portion of stainless steel anchor bolts during installation and tightening of nuts. Excess lubricant shall be thoroughly removed following final tightening.

3.2 INSTALLATION AND COMMISSIONING

.1 Installation shall comply with the manufacturer’s installation instruction, Section 44 00 00, and this section.

.2 Following the completion of each gate installation, the gates shall be operated through at least two complete open/close cycles, readjusted and reoperated as necessary, and left in a condition acceptable to the Contract Administrator. If an electric or hydraulic operator is used, limit switches shall be adjusted following the manufacturer's instructions.

.3 Gates should be checked for leakage by the contractor (refer to section 2.01 “General Design” for approval criteria).

.4 An experienced, competent, and authorized representative of the stop plates manufacturer shall visit the site of the Work and inspect, check, adjust if necessary, and approve the equipment installation. In each case, the manufacturer's representative shall be present when the equipment is Field Leakage Tested in accordance with standard industry procedure. The manufacturer's representative shall revisit the jobsite as often as necessary until all trouble is corrected and the equipment installation and operation are satisfactory in the opinion of the Contract Administrator.

.5 Each manufacturer's representative shall furnish to Owner, through the Contract Administrator, a written report certifying that the equipment has been properly installed; is in accurate alignment; is free from any undue stress imposed by connecting hardware; and has been operated under full load conditions and that it operated satisfactorily.

.6 All costs for these services shall be included in the Contract Price.

STOP PLATE

END OF SECTION

INSULATION OF PROCESS PIPING

PART 1 GENERAL

1.1 SUMMARY

.1 This section includes providing pipe and equipment insulation for cold and hot piping, exhausts, flues, and equipment, to prevent heat loss or heat gain and injury to personnel upon contact.

1.2 RELATED SECTIONS

.1 The following Sections applies to the work of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of the scope listed herein.

.1 Divisions 09, 22 and 44

1.3 CODES, SPECIFICATIONS AND STANDARDS

.1 This section shall comply with the current editions of the following codes:

.1 National Building Code
.2 ASTM E84
.3 CAN/ULC S102
.4 MIL-I-24244C, Thermal Insulation Materials (corrosion inhibition and chloride requirements)
.5 ASTM C547 (Class 3), (Preformed Pipe Insulation)
.6 ASTM C592 (Class II) (Metal Mesh Covered Blanket Insulation)
.7 ASTM B 209 Aluminum and Aluminum Alloy Sheet and Plate
.8 ASTM C 533 Calcium Silicate Block and Pipe Thermal Insulation

1.4 SUBMITTALS

.1 Shop Drawings:

.1 The following shall be submitted in compliance with Section 01 33 00:
.2 Shop drawings of all thermal insulation, with manufacturer's data on materials, covering, jackets, and finish.

1.5 QUALIFICATIONS

.1 Installer: Authorized installer of manufacturer.

PART 2 PRODUCTS

2.1 GENERAL

.1 The contractor shall insulate all indicated surfaces.

.2 All components of the insulation, including covering, mastics and adhesives shall have a flame-spread rating of less than 25, and a smoke development rating of no greater than 50. Ratings shall be as established by tests in accordance with ASTM E 84 standards. The integrated insulation assemblies shall also conform to the above specifications. Insulation shall be applied in strict accordance with the manufacturer's instructions.

.3 Adhesive insulation materials and recovery jackets: composite fire and smoke hazard ratings shall not exceed 25 for flame spread and 50 for smoke developed. Adhesives shall be waterproof.

.4 Where heat tracing is required, the pipe shall be insulated with a complete integral conduit for the electric heat trace cable.

2.2 BASIC MATERIALS

.1 Heat tracing cable: The cable shall produce constant, predictable wattage per meter output without inrush currents. Metallic ground braiding is required for all heat tracing cable.

.2 The insulation system shall be capable of handling service temperatures from –45°C to 94 °C (In service).

.3 Where odorous air, water, sludge or chemical piping is located outside the building, but above the freezing depth (1.5m), the piping shall be insulated and heat traced as specified herein.

.4 Insulation Types:

.1 Fiberglass Pipe Insulation:

.1 Shall be applied to the hot water supply and return piping for the digester operation. The hot water operating temperature is in the range of 60°C to 100°C.

.2 Hot surface performance tested to 454°C in accordance with ASTM C411.

.3 A sufficient thickness shall be used to keep maximum surface temperature of pipe insulation below 60°C.

.4 Specification Compliance:

.1 ASTM C547 – Standard Specifications for Mineral Pipe Insulation

.2 ASTM C795, MIL-1-24244C, NRC 1.36

.3 National Fire Protection Association; NFPA 90A & 90B

.4 CGSB 51-GP.9M

.5 Fire Hazard Classification; UL 723, CAN/ULC-S102-M88, ASTM E84, NFPA 255

.5 Product Features:

.1 Water Vapour Absorption (ASTM C553): Less than 0.5% by weight

.2 Alkalinity and pH (CGSB-51-9M): Maximum alkalinity 0.5% (Na2O), pH maximum 10.0

.3 Bacteria Fungi Resistance (ASTM 665): Does not promote growth

.4 Hot Surface Performance: ASTM C411 – rated to 454°C (850°F)

.5 Linear Shrinkage (ASTM C356): Less than 2%

.6 Acceptable Fiberglass Pipe Insulation Systems:

.1 Manson Insulation, Owens Corning Canada, Johns Manville, or Agency Approved Equal

.2 Polyurethane Foam Sheet:

.1 Thermal conductivity shall not exceed 0.019 W/mK when the foam is new and cured. This value shall be based on a mean temperature of 25°C as determined in accordance with ASTM C518.

.2 Closed Cell Content 90-95% in conformance with MIL-I-24172 and ASTM C-591 completely filling the annular space between carrier pipe and jacketing.

.3 Density: 32 kg/m3 (2 pound/ft3)

.4 Hardness: 30 – 90

.5 Acceptable Suppliers:

.1 ITW Insulation Systems, Dow, or Agency Approved Equal

.3 Premolded Mineral Fiber:

.1 Rigid, sectional, sleeve type insulation with thermal conductivity (k-value) no less than 0.042 W/m°C (0.29 Btu-in./(hr·ft2·°F) forms with thermosetting binder suitable for a temperature range of 0°F to 850°F [-18°C to 454°C], and shall be provided in multiple layers. Fittings and valves shall be insulated with factory-made molded fiber fittings or built-up sections of pipe covering. The insulation shall conform to ASTM C547.

.2 Temperature Rating: 0°F to 850°F [-18°C to 454°C],

.3 Supply factory applied All Service Jacket (ASJ) vapour retarder jacket with Self-Sealing Lap (SSL) closure system

.4 Acceptable Supplier:

.1 Johns-Manville Inc., “Micro-Lok HP”

.2 Knauf Insulation GmbH, “Glass Mineral Wool”

.3 Manson Insulation Inc., “Alley K”,

.4 Owens-Corning or Agency Approved Equal

.5 PVC Jacketing:

.1 High-impact, seamless Polyvinylchloride (PVC)

.2 Class 12454-B compound conforming to ASTM

.3 1784, Type 1, Grade 1

.4 Acceptable Supplier:

.1 ITW Insulation Systems, DOW, or Agency Approved Equal

.6 Aluminum Jacket: [ASTM B209MASTM B209]:

.1 Aluminum Roll Jacketing: For straight run piping, wrought aluminum Alloy 3003, 5005, 1100, or 3105 to ASTM B209 with H-14 temper, minimum 0.4 mm thickness, with smooth mill finish. For air piping, the aluminum jacket shall have a nominal thickness of 0.6mm with an embossed finish.

.2 Fittings in insulated piping systems and equipment where indicated in the insulation schedule shall be provided with aluminum jackets of the same aluminum jacketing material as the piping systems. The jacket shall have a factory-applied moisture retarder of at least 3 mils [76 µm] permanently bonded to the interior surface and extending the full width of the jacket. The retarder shall consist of Polysurlyn or polyethylene film and kraft paper.

.3 Vapour Barrier: Provide factory applied vapour barrier, consisting of kraft paper with 1 mil thick low density polyethylene film, heat and pressure bonded to the inner surface of the aluminum jacketing.

.4 Fitting Covers: Material as for aluminum roll jacketing, premolded, one or two piece covers, which includes elbows, tee/valves, end caps, mechanical line couplings, specialty fittings, etc.

.5 Manufacturers and Products:

.1 RPR Products Inc; Insul-Mate, ITW Insulation Systems Canada Inc.- Childers., Industrial Insulation Group, LLC - Pabco., or Agency Approved Equal

PART 3 EXECUTION

3.1 PREPARATION

.1 Do not install covering before piping and equipment has been tested and approved.

.2 Ensure surface is clean, free of dirt, and dry prior to installation. Ensure insulation is dry before and during application. Finish with systems at operating conditions. To ensure a cohesive bond of foam on pipe surfaces, sandblast of apply chemical foam bonding compound if necessary.

3.2 INSULATION REQUIREMENTS SCHEDULE

.1 Piping Insulation Requirements

Service Type	Pipe Legend	Insulation Thickness	Temperature to be Maintained	Insulation	Heat Tracing	Finishing
Process and Channel Mixing Air (Blowers' suction and discharge piping within Buildings)	AA	50mm (Indoor)	10 to 50 ºC	Premolded Mineral Fiber	-	Aluminum
Potable Water & Non-Potable Water	SW, PW, NPW, HW	25mm (Indoor) & 50mm (Outdoor)	Anti-sweat (Indoor) & Above 0°C (Outdoor)	Polyurethane	3ºC Above Frostline	PVC (Indoor)
Rain Water Leader (Indoor)	RWL	25mm	Anti-sweat	Polyurethane		PVC
Sludge & Supernatant, (Outdoor, Above Frostline)		50mm	10 to 15 ºC	Fiberglass Pipe Insulation	Yes	Aluminum
Post Equalization Overflow/Bypass Pipe (Outdoor, Above Frostline)		50mm	10 to 15 ºC	Fiberglass Pipe Insulation	Yes	Aluminum

3.3 INSTALLATION

.1 General

.1 All insulation shall be installed by a qualified insulation contractor in strict accordance with the manufacturer's recommendations.

.2 Install in accordance with the manufacturer's instructions and as specified herein.

.3 Install insulation after the piping system has been pressure tested and leaks corrected.

.4 Apply insulation over clean finish painted and dry surfaces.

.5 Do not allow insulation to cover nameplates or code inspection stamps.

.6 Run insulation continuously through pipe hangers and supports, wall openings, ceiling openings, and pipe sleeves, unless otherwise shown on the Drawings.

.7 Install removable insulation sections on devices that require access for maintenance of equipment or removal, such as unions and strainer end plates.

.8 Use insulating cements, lagging adhesives, and weatherproof mastics recommended by the insulation manufacturer. All work shall be performed within the temperature ranges recommended by the insulation product manufacturer. Insulation shall be kept clean and dry and shall remain in the factory container until it is installed. Packages or factory containers shall

bear the manufacturer's stamp or label with the name of the manufacturer and description of materials.

.9 Seams of exposed insulation and jackets shall be in the least visible location.

.10 The insulation shall be installed in layers to obtain the specified thickness. Joints and seams between insulation sections or segments shall be tight and shall be staggered between layers. The insulation shall be fastened with stainless steel wire loops on 6 inch [150 mm] centers embedded into the outer layer. All cracks, voids, and depressions shall be filled with insulating cement suitable for the system operating temperatures. The surfaces to receive outer coverings shall be smooth and uniform. Flanges and expansion joints in exhaust piping shall not be insulated

.2 Connection to Existing Piping:

.1 Cut back existing insulation to remove the portion damaged by piping revisions. Install new insulation.

.3 Cold Surfaces:

.1 Provide continuous vapour seal on insulation on cold surfaces where vapour barrier jackets are used.

.4 Placement:

.1 Slip insulation on pipe or tubing before assembly, when practical, to avoid longitudinal seams.

.2 Insulate valves and fittings with sleeved or cut pieces of same material.

.3 Seal and tape joints.

.4 Insulation at Hangers and Supports: Install under piping, centered at each hanger or support.

.5 Heat Traced Piping:

.1 Apply insulation after heat-tracing Work is completed and approved.

.6 Vapour Barrier:

.1 Provide continuous vapour barrier at joints between rigid insulation and pipe insulation.

.2 Install vapour barrier jackets with pipe hangers and supports outside jacket.

.3 Do not use staples and screws to secure vapour sealed system components.

.7 Aluminum Jacket:

.1 Use a continuous friction type joint to hold jacket in place, providing a positive weatherproof seal over the entire length of the jacket. Jacketing shall be held in place with stainless steel securing bands uniformly spaced at not more than 18 inches [457 mm] to produce tight joints without "bulging". The jacket shall overlap at least 2 inches [51 mm] at longitudinal and circumferential joints. Joints shall be overlapped and sealed with caulk

to prevent moisture penetration, and longitudinal joints shall be placed to shed water. Exposed ends of pipe insulation shall be provided with covers constructed of the same material as the jacketing.

.2 Secure circumferential joints with preformed snap straps containing weatherproof sealant.

.3 On exterior piping, apply a coating over the insulation and vapour barrier to prevent damage when aluminum fitting covers are installed.

.4 Do not use screws or rivets to fasten the fitting covers.

.5 Install removable, prefabricated aluminum covers on exterior flanges and unions.

.6 Caulk and seal all exterior joints to make watertight.

.7 Elbows shall be jacketed with spirally wrapped aluminum strips or individual mitered segments or gores cut to fit the insulation.

.8 PVC Jacketing:

.1 Overlap jacketing a minimum of 50 mm. Seal and band longitudinal and circumferential joints and seams with sealing compound and pre-formed aluminum or stainless steel straps and fasteners.

.2 Make special provision, according to the manufacturer's instructions, to allow for uniform expansion on jacket to avoid joint opening on piping with a 50 mm or greater layer of insulation.

.3 Provide removable sections at inspection openings, arranged to allow removal and replacement without cutting cover or retaining system.

.4 Design covers for flanges, fittings and expansion pieces with a hinged locking arrangement to for allow removal and replacement without cutting cover or retaining system.

3.4 FIELD FINISHING

.1 Apply a coating of insulating cement where needed to obtain a smooth and continuous appearance.

.2 Where pipe labels or banding are specified for a piping system they shall be applied to the finished insulation and not to the pipe.

END OF SECTION

PROCESS PIPING

PART 1 GENERAL

1.1 SUMMARY

.1 This section includes design, supply, fabrication, installation, testing, cleaning and placing into operation process piping systems including couplings, connections, expansion pieces, ancillary systems, and fittings.

1.2 GENERAL CLAUSES

.1 Comply with Division 01.

.2 Unless there are more restrictive requirements in respective Sections, provisions of this Section apply.

.3 Ensure that control panels and/or components provided as part of packaged equipment conform to requirements of the Specifications, Division 25 through 28 and Drawings.

.4 For control and electrical elements, use this Section in conjunction with the Drawings for conformance to style, quality, and product demonstrated and selected. Provide instrumentation and control devices as detailed in the Specifications and shown on the Drawings, including the Electrical Divisions 25 through 28.

.5 All equipment and controls to be CSA compliant and identified as such.

.6 Comply with laws, ordinances, rules, regulations, codes, and orders of authorities having jurisdiction relating to work.

.7 It is the Contractor’s responsibility to ascertain from each Supplier the extent of work required for the complete installation of each piece of equipment, and to ensure that each Supplier has full knowledge of the required duty of the equipment to be installed.

.8 Be fully acquainted with all work under this Contract. At no time will any claim be considered due to misunderstanding of the work involved.

.9 Immediately upon receipt of the Start Work Order, issue a Purchase Order or Sub-Contract for designated equipment. Submit a copy of the Purchase Order or agreement to the Contact Administrator. Failure to order equipment in a timely fashion will not be considered as a reason to extend the Contract schedule.

1.3 SYSTEM DESCRIPTION

.1 It is the intent of all Sections of these Specifications to specify a complete and operating system that will perform its intended function(s). All devices, fittings,

valves and other appurtenances required to perform this function shall be considered as part of the Specifications, even if not explicitly identified.

.2 Design requirements:

.1 Provide heavy-duty mechanical equipment designed for continuous operation.

.2 Maximum vibration velocity (measured at equipment bearings): 1 mm/s.

.3 Co-ordination requirements:

.1 Equipment, such as pressure switches, may be shown on Process, Mechanical and/or Instrumentation Drawings. They may also be shown on Electrical Drawings due to wiring requirements. Provide these devices under Division 25, 26, and 44, respectively. Equipment and devices are wired according to the Electrical Drawings and Specifications.

.2 Coordinate requirements of equipment supplied with piping, structural supports, ventilation/cooling, electrical service, instrumentation and control interface, and other ancillaries specified in other Divisions.

1.4 REFERENCES

.1 American Society of Mechanical Engineers/American National Standards Institute:

.1 ASME Boiler and Pressure Vessel Code - Section VIII: Division 1.

.2 ASME B31.1 - Power Piping.

.3 ASME B31.9 - Building Services Piping.

.4 ASME/ANSI B16.1- Gray Iron Pipe Flanges and Flanged Fittings: Classes 25,125, and 250.

.5 ASME/ ANSI B16.5- Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard.

.6 ASME B31.1 and B31.3 - Power Piping and Process Piping SET (B31.1-2007 Including 2008 and 2009 Addenda, B31.3-2008).

.7 ASME B32.1 - Metal Products.

.8 ANSI S1.13 - American National Standard Methods for the Measurement of Sound Pressure Levels In Air.

.2 Anti-Friction Bearing Manufacturers Association (AFBMA)

.3 ASTM International.

.1 ASTM A194 - Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.

.2 ASTM C411- Standard Test Method for Hot-Surface Performance of

.3 High-Temperature Thermal Insulation.

.4 ASTM C335- Standard Test Method for Steady-State Heat Transfer Properties of Pipe Insulation.

.4 Canadian General Standards Board:

.1 CGSB 51-GP-52 MA-Vapour Barrier Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.

.5 Canadian Standards Association:

.1 CSA S244 - Welded Aluminum Design and workmanship (Inert Gas Shielded Arc Processes).

.2 CSA W47.1 - Certification of Companies for Fusion Welding of Steel Structures.

.3 CSA W47.22-M - Certification of Companies for Fusion Welding of Aluminum.

.4 CSA W59-M - Welded Steel Construction (Metal Arch Welding).

.5 Safety in Welding, Cutting and Allied Processes to be in accordance with CAN/CSA-W117.2.

.6 CSA Z107.56- Procedures for the Measurement of Occupational Noise Exposure.

.7 ANSI/CSA B149.6-15 Code for Digester Gas, Landfill Gas and Biogas Generation and Utilization Published 2015, as amended.

.8 ASTM A403, Wrought Austenitic Stainless Steel Piping Fittings.

.9 ASTM A312, Seamless and Welded Austenitic Stainless Steel Pipes.

.6 Manufacturer's Standardization Society

.1 MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation

.2 MSS SP-69 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.

.7 Ontario Building Code

.8 Ontario Boilers and Pressure Vessels Act

.9 Standards Council of Canada/Compressed Gas Association

.1 CAN/CGA B149.6 - 15 Code for Digester Gas and Landfill Gas Installations (as amended).

.10 Technical Standards and Safety Authority (TSSA)

.1 TSSA Digester, Landfill & Biogas Approval Code TSSA-DLB-2016, as amended.

.2 TSSA, Pressure Vessels Branch.

1.5 CERTIFICATES

.1 Welding qualifications and procedures to be in accordance with CSA B51, TSSA, B31.1 and Section IX of the ASME Boiler and Pressure Vessels Code.

.2 Use qualified and licensed welders possessing Ontario certificates (TSSA) for each procedure to be performed.

.3 Each Welder will provide qualifications to Contract Administration including identification stamp issued by TSSA as well as provide welding procedures for review.

1.6 SUBMITTALS

.1 Shop Drawings:

.1 Submit shop drawings in accordance with Section 44 00 10 – Process General Requirements and Section 01 33 00 – Submittals.

.2 Piping systems, which transport fluids in excess of 35 degrees C, require plans and sectional views, or single line dimensioned isometrics, identifying movements due to thermal expansion and contraction. Locations of the expansion pieces, guides, and anchors, sway braces shall be identified. The resultant movements due to these thermal expansions and contractions shall be shown on the Shop Drawings.

.3 Provide details of expansion pieces including list of materials.

.4 Valve schedule and identification list.

.5 Sectional details of drains, traps, valves and valve operators including list of materials and current ANSI pressure-temperature ratings for valve bodies, seats and stem seals.

.6 Provide general layout of equipment including anchor bolt locations, direction of rotation for rotating equipment and electric motor terminal box locations.

.7 Cross-sectional details of equipment with complete materials test.

.8 For pumps, certified, non-witnessed characteristic curves of capacity versus head; efficiency; net positive suction head and power expressed in kilowatts.

.9 For fans and blowers at rated rpm and 110 percent of rated rpm, certified, non-witnessed characteristic curves of capacity versus static pressure (discharge pressure); efficiency and power expressed in kilowatts, noise and noise levels on the A weighted scale.

.10 Dimensional drawings of motors and details including full output power expressed in kilowatts, rpm and slip, motor nameplate details and motor test data where required.

.11 Instrument details.

.12 Control panel layouts.

.13 Electrical control schematics and loop diagram.

.2 Test Reports and Certificates

.1 Certified shop mechanical test run results for fans 10 m^3/s and larger or 37 kW and larger.

.2 Certified shop test results for pumps.

.3 Certified shop tests for electric motors.

.4 Manufacturer's representative signed report.

.5 Field test reports for piping systems.

.6 TSSA Inspection Report indicating conformance with CGA B105.

1.7 QUALITY ASSURANCE

.1 Welding procedure for stainless steel:

.1 All piping shall be subject to the visual examination requirements of the ASME/ANSI Code B31.3. A minimum sample of 10% of all welds shall be non-destructively examined as per requirements of ASME/ANSI B31.3 Category D Normal Fluid Service as per Specification 44 01 29. Non-destructive testing shall be paid for by the contractor.

.1 Should any weld fail the visual examination, the Contractor will be responsible to perform additional non-destructive radiographic testing up to an additional 10% of the piping system as selected by the Contract Administrator.

.2 Should any weld fail the radiographic testing, all welds made by the responsible welder will be tested at the expense of the contractor.

.2 The Contractor Administrator may, at their expense, test any weld completed on the project in addition to the welds tested as part of the contract requirements identified in this section. The contactor will be responsible to repair any failed weld and piping replacement depending on the extent and ability to make a satisfactory repair as determined by the Contract Administrator.

.3 Testing (to be completed in accordance with this section Part 3 - Execution):

.1 Give 24 hours written notice of date of tests.

.2 Insulate and/or conceal work only after testing is satisfactorily completed and witnessed.

.3 Conduct all tests in the presence of the Contract Administrator.

.4 Bear all costs of testing including retesting and correcting any deficiencies.

.5 Maintain test pressures for at least 4 hours unless otherwise specified.

.6 Leakage from pipes will be zero. No loss of pressure will be accepted.

.7 If leaks are detected in the pipe or any of the appurtenances connected thereto, make any necessary repairs and retest.

.8 Provide test equipment as required to complete testing per ANSI/ASTM B31.1 and B31.3.

.9 Prior to tests, isolate all equipment or other parts, which are not designed to withstand test pressures.

.10 Contractor shall document each individual test, including: test pressure, temperature, duration, date and time of day, test fluid, and signatures of Contract Administrator and Contractor's representatives who witnessed the test, identification of piping

system tested. Contractor shall provide a test plan and schedule to Engineer at start of work. The format of these records shall be approved by the Contract Administrator prior to the commencement of any field pressure testing.

1.8 PRODUCT DELIVERY, STORAGE AND HANDLING

.1 All materials and products shall be managed in accordance with the Process General Requirements (Section 44 00 10).

PART 2 PRODUCTS

2.1 GENERAL

.1 Refer to Drawings for piping systems specified in this Section.

.2 Pipe sizes shown are nominal sizes in mm. Actual pipe dimensions are in accordance with commercially available products, unless otherwise specified.

.3 Provide new pipe materials free from defects conforming to specified reference standard.

.4 Comply with new reference standard superseding specified standard.

.5 Supply the equipment complete in all respects including all other accessories and auxiliaries necessary to provide for a satisfactory installation.

.6 Where equipment is supplied with larger or smaller power requirements than that shown coordinate with the electrical requirements of Division 25 - 28 to ensure compatibility with electrical and control components so that a complete working system is in place without extra cost to the Contract.

.7 It is the Contractor’s responsibility to confirm the Electrical Rating and Area Classification required for all equipment installed within Division 44. The electrical rating shall be as per NFPA 820.

.8 All external piping and electrical connections to this equipment, and all concrete and foundation bases (excluding grouting and shimming) will be done under the respective Sections for such work.

.9 Install drains on bottom of horizontal pipe at low points in the piping system, drawings may not indicate all required drain points.

.10 Check dimensions associated with existing structures, equipment and piping in the field before fabrication and installation are started.

.11 Contractor shall coordinate with the operating authority for any tie-ins, shut-downs or other existing process interruptions required to carry out work.

.12 All piping materials, valves and appurtenances located within 2.0 meters of the top water level of all process tanks, vessels or reactors shall be fabricated in stainless steel.

.13 All piping materials and appurtenances including couplings (flanges, mechanical grooved end couplings, bolting, nuts, etc.) supports, valves and valve actuators submerged in liquids shall be stainless steel.

.14 The process drawings may not present all required couplings and expansion joints. The Contractor or coupling Supplier shall review the entire pipeline and configurations with pipe supports and submit their review for the Engineer's approval. As per the pipe stress analysis or coupling Supplier's recommendations, the pipe support locations and coupling/expansion joint type may be changed, but no extra cost to the Owner shall be permitted. unless additional couplings, expansion joints and supports are required ten (10) percent more than them shown on the process drawings. The process drawings, unless otherwise specified, do not present any required rigid coupling, but flexible couplings only.

.15 The Contractor shall provide the detailed piping layouts, sections and calculation sheets as the shop drawings stamped by professional engineer who shall coordinate the coupling installation with the coupling manufacturer. Present the fixed and sliding support locations with couplings on the layout for the Engineer's review.

.16 Provide one (1) flexible coupling at every 90-degree bends to allow for deflection.

.17 Provide flexible couplings where deflection would occur and one (1) rigid coupling within 1.0m from each valve and flanged instrument for maintenance.

.18 Maximum temperature variation of process and channel mixing air pipe from blower/compressor shall be 140°C (-30°C to 110°C) to calculate the maximum expansion/contraction in the pipeline considering 107°C± of blower discharge temperature. Assume that the temperature during the pipeline installation would be 0°C.

.19 One (1) pipe expansion joint shall be installed above structural expansion joint. Assume that there would be one (1) structural expansion joint every 20 m if the structural expansion joints are not shown on the process drawings with existing structures.

.20 Provide two (2) supports at both sides of a thermal expansion /contraction joint with 1.0 m spacing from the joint.

.21 Maximum temperature variation of water and sludge piping shall be in the range of 0°C to 10°C to calculate the maximum expansion/contraction in the pipeline.

2.2 TYPE 304 L STAINLESS STEEL (SS1 AND SS3)

.1 General

.1 ANSI/ASTM Rating: Class 150 FF

.2 Service Limits:

.1 1050 kPa at a temperature range of -40°C to 40°C.

.2 750 kPa at a temperature of 50°C

.2 Pipe

.1 Tubing: 6 to 12mm, Seamless stainless steel tube to A269 Grade TP 304.

.2 Size: 12 to 50 mm, TP 304L Schedule 40s with PE, fully annealed hydraulic tubing, electric fusion welded stainless steel, A312 TP 304L, Joint Eff. 0.80. Dimensions conforming to ANSI B36.19.

.3 SS1 Size: 65 to 600 mm, TP 304L Schedule 10s with BE, Electric fusion welded stainless steel, A312 TP 304L, Joint Eff. 0.80, with dimensions conforming to ANSI B36.19.

.4 SS3 Size: 65 to 800 mm, TP 304L Schedule 40s with BE, Electric fusion welded stainless steel, A312 TP 304L, Joint Eff. 0.80, with dimensions conforming to ANSI B36.19.

.5 All pipe shall be pickled and passivated as per ASTM 380.

.3 Nipple

.1 Size: 12 to 50 mm, TP304L Seamless stainless steel to A312 in 50, 80 and 100 mm lengths with ends as required. Use Schedule 80s for all threaded nipples, wall schedule to match pipe schedule for all plain and beveled end nipples.

.4 Swages

.1 Size: 19 to 150 mm, TP304L Seamless stainless steel to A3012. Use Schedule 80s for all threaded swages. Wall schedule to match pipe schedule for all plain and beveled end swages.

.5 Flanges (Welded)

.1 Size: 12 to 19 mm, TP 304L 150# Raised Faced socket welded stainless steel flanges to A182 Grade F304L.

.2 Size: 25 to 600 mm, TP 304L 150# Flat Faced stainless steel Lap joints, galvanized carbon steel A105 (unless located in a submerged or within 2m of the TWL location in which case the use of SS304L Lap joint is required), for use with stub ends.

.3 Stub Ends: 25 to 600 mm, Schedule 10s with beveled end, Lap-stubs, MSS Type A Short, A403 Gr. WP 304L.

.6 Flanges (Grooved)

.1 Size: 12 to 600 mm, TP 304L 150# Raised Faced stainless steel blind flanges to A182 Grade F304L.

.2 Size: 65 to 600 mm, Grooved-end to Flange adapter to accommodate proposed bolt hole pattern (ANSI B16.1 Cl. 125) to be Ductile Iron, or

Stainless steel if installed in submerged condition or within 2.0m of water level.

.7 Couplings

.1 Stainless Steel: Sizes 65 to 600 mm, grooved end cast type 304 stainless steel housing with EPDM gasket (Water) or Fluoroelastomer (Air). To be used where piping is submerged or within 2m of the TWL.

.2 Carbon Steel (C/S): Sizes 65 to 600 mm, grooved end cast type carbon steel housing with EPDM gasket (Water) or Fluoroelastomer (Air). Not to be used in submerged applications. Standard of Acceptance: Victaulic hot-dipped galvanized Style 07.

.8 Piping/Fitting Below Ground

.1 All underground stainless steel piping shall be wrapped with a petroleum based anti-corrosion tape.

.1 Anti-corrosion materials consisting of Denso Paste Primer or Priming Solution for cold temperature application, Denso Profiling Mastic or Mastic Blankets for profiling of irregular contours and Denso LT or Densyl tape, or approved alternative that complies with CSA Z-245-30, meets ISO 9001 and ISO 14001 and is CFIA Approved.

.9 Fittings

.1 Sizes: 6 to 25 mm (O.D.), Type 316 stainless steel compression type fitting, Standard of Acceptance: Swagelok or approved equal.

.2 Sizes: 12 to 50 mm, Stainless steel socket weld 3000# stainless steel, A182, Grade F304L.

.3 Sizes: 65 to 600 mm, Schedule 10s stainless steel butt weld to A403 Grade WP 304L, ASME/ANSI B16.9.

.4 Sizes: 65 to 250 mm, Schedule 10s grooved end stainless steel to A403 Grade WP 304L. Standard of Acceptance: Victaulic hot-dipped galvanized Style 07.

.10 Unions

.1 Sizes: 12 to 50 mm, 150 # threaded 304 stainless steel unions, with dimensions to ANSI B16.3 for M.I. screwed fittings.

.11 Nuts and Bolts

.1 ASTM A-307 Grade B zinc chromate plated carbon steel heavy hexagonal head bolts. Type 316 stainless steel ASTM A-193 Grade B8 M (buried service, submerged service, outdoor service, or when installed within 2.0m of water level) with heavy hex nuts A194 Gr. 8.

.12 Gaskets

.1 3mm thick, full faced premium grade EPDM with punched holes to match class of flanges and fittings as required. Standard of Acceptance: Garlock 8314.

.13 Instrument Connections

.1

Connection	Pressure	Flow
Piping Connection	NPS 19 mm SW	NPS 12 mm FNPT
Instrument Connection	19 mm FNPT	NPS 12 mm FNPT
Block Valve	19 mm THD Ball Valve	12 mm THD Ball Valve
Temperature Instrument Connection: NPS 25 mm FNPT		

.2 Ball Valves: Threaded, Class 150 Ball Valve, bronze body, chrome plated stainless steel ball, PTFE Teflon adjustable packing, brass gland and PTFE Teflon Buna N seat with screwed ends and steel lever handle. Standard of Acceptance: Milwaukee BA-100, Valpres 171N.

2.3 TYPE 316 L STAINLESS STEEL (SS2 & SS4)

.1 General

.1 ANSI/ASTM Rating: Class 150 FF

.2 ANSI B36.19

.3 Service Limits:

.1 1050 kPa at a temperature range of -40°C to 40°C.

.2 750 kPa at a temperature of 50°C

.2 Pipe (Above ground)

.1 Tubing: 6 to 12mm O.D., Seamless stainless steel tube to A269 Grade TP 316 with a minimum USS #16 gauge. Fittings shall be of the mechanical compression type.

.2 Tubing: 12 to 25 mm O.D., Seamless stainless steel tube to A269 Grade TP 316 with a minimum USS #14 gauge. Fittings shall be of the mechanical compression type.

.3 Size: 12 to 50 mm, TP 316L Schedule 40s with plain ends, fully annealed hydraulic tubing, electric fusion welded stainless steel, A312 TP 316L, Joint Eff. 0.80. Dimensions conforming to ANSI B36.19. All threaded fittings shall be Class 3000 threaded end type and comply with ANSI B16.11.

.4 Size: 65 to 600 mm, TP 316L Schedule 10s with bevelled ends, Electric fusion welded stainless steel, A312 TP 316L, Joint Eff. 0.80, with dimensions conforming to ANSI B36.19.

.5 All pipe shall be pickled and passivated as per ASTM 380.

.3 Pipe (Buried/Below Ground **SS4)**

.1 Size: 19 to 325 mm, TP 316L Schedule 40s with beveled ends. Electric fusion welded stainless steel, A312 TP 316L, Joint Eff. 0.80, with dimensions conforming to ANSI B36.19.

.2 Biogas Application

.1 For Biogas applications there shall be no buried fittings (threaded or flanged) permitted.

.2 All pipe to be continuously sloped to condensate drains and shall be installed having a minimum 2% slope.

.3 Pipe to be identified and colour coded in accordance with CSA B149.6 Section 8.7.

.4 Exterior piping stall be insulated as per Specification 44 05 40.

.5 No flexible connections, flanged couplings or otherwise shall be used in the below grade piping.

.6 Transition couplings shall be provided 1m from the building/foundation wall, connecting the interior piping and the exterior piping. The transition coupling shall be:

.7 Standard of Acceptance: Straub Grip L (SS 316 L) restrained coupling with SS 316 insert, **Arpol FIX Pro restrained Coupling complete with SS 316 insert as necessary**

.8

.3 All underground stainless steel piping shall be wrapped with a petroleum based anti-corrosion tape.

.1 Anti-corrosion materials consisting of Denso Paste Primer or Priming Solution for cold temperature application, Denso Profiling Mastic or Mastic Blankets for profiling of irregular contours and Denso LT or Densyl tape, or approved alternative that complies with CSA Z-245-30, meets ISO 9001 and ISO 14001 and is CFIA Approved.

.2 Installation shall conform to manufacturers execution procedure.

.4 Nipple

.1 Size: 12 to 50 mm, TP316L Seamless stainless steel to A312 in 50, 80 and 100 mm lengths with ends as required. Use Schedule 80s for all threaded nipples, wall schedule to match pipe schedule for all plain and beveled end nipples.

.5 Swages

.1 Size: 19 to 150 mm, TP316L Seamless stainless steel to A3012. Use Schedule 80s for all threaded swages. Wall schedule to match pipe schedule for all plain and beveled end swages.

.6 Flanges (Welded)

.1 Size: 12 to 19 mm, TP 316L 150# Raised Faced socket welded stainless steel flanges to A182 Grade F316L.

.2 Size: 25 to 600 mm, TP 316L 150# Flat Faced stainless steel Lap joints for use with stub ends. Weld neck flanges are also acceptable.

.3 Stub Ends: 25 to 600 mm, Schedule 10s with beveled end, Lap-stubs, MSS Type A Short, A403 Gr. WP 316L.

.7 Flanges (Grooved)

.1 Size: 12 to 600 mm, TP 316L 150# Raised Faced stainless steel blind flanges to A182 Grade F316L.

.2 Size: 65 to 600 mm, Grooved-end to Flange adapter to accommodate proposed bolt hole pattern (ANSI B16.1 Cl. 125) to be Stainless steel.

.8 Couplings

.1 Stainless Steel: Sizes 65 to 600 mm, grooved end cast type 316 stainless steel housing with EPDM gasket (Water) or Fluoroelastomer (Air).

.9 Fittings

.1 Sizes: 6 to 25 mm (O.D.), Type 316 stainless steel compression type fitting, Standard of Acceptance: Swagelok or approved equal.

.2 Sizes: 12 to 50 mm, Stainless steel socket weld 3000# stainless steel, A182, Grade F316L.

.3 Sizes: 65 to 600 mm, Schedule 10s stainless steel butt weld to A403 Grade WP 316L, ASME/ANSI B16.9.

.4 Sizes: 65 to 250 mm, Schedule 10s grooved end stainless steel to A403 Grade WP 316L. Standard of Acceptance: Victaulic hot-dipped galvanized Style 07.

.10 Unions

.1 Sizes: 12 to 50 mm, 150 # threaded 316 stainless steel unions, with dimensions to ANSI B16.3 for M.I. screwed fittings.

.11 Nuts and Bolts

.1 ASTM A-307 Grade B zinc chromate plated carbon steel heavy hexagonal head bolts. Type 316 stainless steel ASTM A-193 Grade B8 M (buried service, submerged service, outdoor service, biogas service or when installed within 2.0m of water level) with heavy hex nuts A194 Gr. 8 to ANSI B18.2.1.

.12 Gaskets

.1 3.17 mm thick, full faced premium grade EPDM or Neoprene with punched holes to match class of flanges and fittings as required. Standard of Acceptance: Garlock 8314.

.13 Instrument Connections

.1

Connection	Pressure	Flow

Piping Connection	NPS 19 mm SW	NPS 12 mm FNPT
Instrument Connection	19 mm FNPT	NPS 12 mm FNPT
Block Valve	19 mm THD Ball Valve	12 mm THD Ball Valve
Temperature Instrument Connection: NPS 25 mm FNPT		

2.4 PVC PIPING (PVC-1)

.1 General

.1 This specification includes the PVC piping for process chemicals and other process related functions, refer to Division 33 for PVC in buried applications. Refer to ANSI B16.5 for service ratings and fitting dimensions.

.2 All PVC piping for water service shall be CSA-900 certified.

.3 Cutting and installation shall be in accordance with the manufacturers' recommendations.

.4 Solvent weld all piping contained within the PVC-1specification.

.2 Pipe

.1 Size: 12 to 200 mm, PVC Type 1, Grade 1 Schedule 80s Class 12454-B conforming to ASTM D1785 and CSA B137.3.

.3 Flanges

.1 Size: 12 to 200 mm, Socket welded PVC Schedule 80, ANSI/ASTM D2467, Class 12454-B with ratings and dimensions as per ANSI B16.5 Class 150 flange.

.4 Fittings

.1 Socket welded PVC Schedule 80, ANSI/ASTM D2467 Class 12454-B to ANSI B16.5.

.5 Unions

.1 Sizes: 12 to 65 mm, Socket welded PVC Schedule 80, ANSI/ASTM D2467 Class 12454-B, PVC Type 1 with Buna-N/Vitron/EPDM O-ring seal depending on service application.

.6 Nuts and Bolts

.1 Bolts: ASTM A-307 Grade B zinc chromate plated carbon steel heavy hexagonal head bolts, galvanized.

.2 Nuts: ASTM A-563 Grade A zinc chromate plated carbon steel heavy hexagonal head bolts, galvanized.

.7 Gaskets

.1 3mm thick, full faced premium grade EPDM with punched holes to match class of flanges and fittings as required. Standard of Acceptance: Garlock 8314.

.8 Instrument Connections

.1

Connection	Pressure	Flow
Piping Connection	NPS 19 mm SW	NPS 12 mm SW
Instrument Connection	NPS 19 mm FNPT	NPS 12 mm FNPT
Bleed Valve	NPS 19 mm Ball Valve SW x THD	
Block Valve	19 mm THD Ball Valve SW	12 mm Ball Valve SW x THD
Temperature Instrument Connection: NPS 25 mm FNPT		

.9 Ball Valves: SW, Class 150 Ball Valve, PVC true union ball valves c/w PTFE seats, Vitron seals, for sizes 25mm and smaller provide round handle operator, for sizes up to 150 mm provide lever operator. To be used for drain and venting applications. Standard of Acceptance: Nibco/Chemtrol U45TB-V, or Spears equivalent.

.10 Check Valves: PVC True union ball type check valve c/w PTFE seats, Vitron seals for Class 150 service. For sizes 25mm and smaller provide round handle operator, for sizes up to 150 mm provide lever operator. End connections as specified. Standard of Acceptance: Nibco/Chemtrol S/U 45BC-V, or Sprears equivalent.

2.5 TEFLON TUBING (PP1)

.1 Pipe: Sizes : 6 to 25 mm, Pure Teflon PFA tubing with a minimum wall thickness of 1.0mm, per ASTM D 6867-03. Service pressure: 1050 kPa; Service temperature: -40 °C to 40 °C. For Aluminum Sulfate, Sodium Hypochlorite and Sodium Bisulfate service.

.2 Fittings: Pure Teflon PFA fittings suitable for service pressure. Standard of Acceptance: ChemFlare.

2.6 POLYETHYLENE TUBING (PP2)

.1 Pipe: LDPE Tubing with a minimum wall thickness of 0.063mm.

.2 Fittings: Pure Teflon fittings suitable for service. Standard of Acceptance: Swagelok.

2.7 VALVES (SS1, SS2, SS3, SS4)

.1 Needle Valves: 316 Stainless steel body with threaded ends, stem and bonnet, PTFE packing suitable for 6000# service. Standard of Acceptance: CFF/Needle Valve.

.2 Globe Valves: Cast iron construction, with flanged ends ANSI Class 125/150 to ASTM A126, Class B body, bronze trim and bronze disc. Standard of Acceptance: Crane Fig No. 351.

.3 Ball Valves: Cast 316 Stainless steel body, ASTM A351 Gr. CF8M, 316SS ball and stem, blow-out proof stem, reinforced PTFE seats, PTFE seals, 80 mm and smaller shall be lever operated 100 mm and larger shall be gear operated. Provide electric actuator where indicated. Standard of Acceptance: Neles-Jamesbury/7150-31-3600MTT-1 CFF 13

.4 Check Valves:

.1 Size: 12 – 50 mm, Check valve with bronze body to ASTM B62 with threaded bonnet, integral seat, renewable disc, swing type with bronze trim. Threaded or socket weld ends for Class 150 service. Standard of Acceptance: Crane/137, Nibco/T-433-B.

.2 Size: 65 – 200 mm, Dual plate wafer style check valve, Cast 316 SS body and disc to ASTM A351 Gr. CT8M, 316 SS trim, metal to metal seat, Inconel X spring. Standard of Acceptance: AMRI/2A66MR, Mueller/72-HHH-H-X, PMP 2025.

.3 Size: 65 – 200 mm, Ball style check valve with full faced flanged ends, nodular cast iron body c/w floating or sinking ball to match service. Metal core ball with nitrile rubber vulcanized coating. Bolted valve cover, 3mm (T) red rubber gasket, valves to be epoxy coated with 316SS Cover bolts, rated to Class 125 service. Standard of Acceptance: GA Industries Figure 240-D, Xylem Flygt/HDL CV Type 5087.

.4 Size: 65 – 200 mm, Swing Check style check valve for low lift applications with full faced flanged ends, cast iron body bolted valve cover, weight and lever type with stainless steel shafts and double O-ring packings with grease fittings. Valves to be epoxy coated with 316SS Cover bolts, rated to Class 125 service. These valves shall be used for all sludge pipe services. Standard of Acceptance: Jenkins/477LJ, Pratt/Milliken Millcentric 801BBW, Apco 250.

.5 Butterfly Valves:

.1 Size: 65 to 510 mm, Resilient seated butterfly valve with offset disc and lug style body. Cast iron to ASTM A126 Class B body, 316 SS ASTM A743, Gr. CF-8M Disc, 316 SS ASTM A276 Shaft with EPDM seat. PTFE stainless steel coated bearing, EPDM shaft seal, 316 SS Trim, ANSI Class 125 lugged end connections. For sizes up to 65 mm supply with 10 position lever actuator, for sizes 80 mm and larger supply with manual gear actuator. Standard of Acceptance: Dezurick/BRS, *, I1, CI, EPDM, EPDM,S2,S2; BRAY 31-169; Val-Matic.

.6 Plug Valves:

.1 Sizes: 12 to 50 mm, Eccentric plug valve with cast iron body, resilient faced plug. Threaded ends to ANSI Class 150. Cast iron, ASTM A126 Class B body. 316L SS bearing, packing to be Buna-N filed TFE U-ring seal c/w

neoprene plug facing. Lever actuator with SS bolting with grease fitting in body and externally adjustable packing. Standard of Acceptance: Val-Matic, Dezurik/PEC,*,T1,CI,NBR,CR,LV,SB,BXX005; Pratt/Milliken Millcentric 603E1, GA.

.2 Sizes: 65 to 450 mm, Eccentric, full-port plug valve with cast iron body, resilient faced plug. Flanged ends to ANSI Class 125/150. Cast iron, ASTM A126 Class B body. 316L SS bearing and plug, packing to be Buna-N filed TFE U-ring seal c/w neoprene plug facing. Fusion bonded epoxy coating. Lever actuator with SS bolting with grease fitting in body and externally adjustable packing. Standard of Acceptance: Val-Matic, Dezurik/PEC,*,F1,CI,NBR, CR, GS-6-HD*,BXX003; Pratt/Milliken Millcentric 601N1AG, GA.

.3 Sizes: 65 to 300 mm, Eccentric plug valve with cast iron body, resilient faced plug. Ends to be flexible grooved ends (Style 31). Cast iron, ASTM A126 Class B body. 316 SS plug, 316L SS bearing, packing to be Buna-N filed TFE U-ring seal c/w neoprene plug facing. Lever actuator with SS bolting with grease fitting in body and externally adjustable packing. Standard of Acceptance: Val-Matic, Dezurik/PEC, *,VF, CI, NBR, CR, LV, SB, BXX005; Pratt/Milliken Millcentric 606SSN1, GA.

.7 Knife Gate Valve: 304 SS Valve body and gate c/w EPDM resilient seals and lugged body to ANSI B16.5 Class 150. For valves 200 mm and smaller provide handwheel actuator. For valves 250 mm and larger provide a fully enclosed grease packed bevel gear actuator complete with 90 degree mitre with 50mm nut and crank. Maximum operating pull on the manual operator at 350 kPa pressure differential shall be 180 N. Actuator: 50-200 mm provide handwheel, 250mm and larger prove 90 deg. Mitre actuator. Standard of Acceptance: Trueline, Dezurik/KCB, Orbinox, *,F1 (Lug Style), S1, TBP, S1, EPDM;

.8 Duckbill Check Valves

.1 All rubber construction (Neoprene, Buna-N, EPDM or Viton).

.2 Flat-bottom, eccentric design with slip-on end and 304SS (or 316SS) clamping ring.

.3 Valve to have flat-bottom.

.4 Manufacturer shall have a minimum of 10 years experience in the design and manufacture of a flat-bottom, duckbill check valve.

.5 Acceptable Manufacturer: Tideflex, EVR,

.9 Vent and Drain Valves: Bronze body, chrome plated stainless steel ball valve with PTFE teflon adjustable packing, brass gland and PTFE teflon Buna-N seat. Screwed or threaded ends to ANSI Class 150 c/w steel lever handle. Standard of Acceptance: Neles-Jamesbury/7150-31-3600MTT-CFF 13.

.10 Air Release Valves: Wastewater Combination Air Valves shall be single body, double orifice automatic float operated valves to AWWA C512, designed to exhaust large quantities of air during the filling of a piping system and close upon liquid entry. The valve shall open during draining or if a negative pressure occurs.

The valve shall also release accumulated air from a piping system while the system is in operation and under pressure. The valve shall perform the functions of both Air Release and Air/Vacuum Valves and furnished as a single body or dual body type as indicated on the plans. The valve should be suitable for operation in wastewater applications. Body and cover material made of Ductile Iron ASTM A-536 grade 65-45-12 ductile iron. Valve body to have holiday free interior and exterior, holiday free, Fusion Bonded Epoxy Coating, applied at the manufacturer's facility in accordance with AWWA C550. Stainless steel or polycarbonate float. Working pressure range shall be minimum 75 kPa to 1,035 kPa (11psi to 150 psi). Threaded (NPT) intake and discharge ends. Size in accordance with drawings. Valve shall come complete with backwash accessories, which shall consist of an inlet shut-off valve, a blow-off valve, a clean water inlet valve, rubber supply hose and quick disconnect coupling. Standard of acceptance: DeZurik/APCO or Val-Matic, Pratt, GA

2.8 PUDDLE FLANGES AND PIPE SLEEVES

.1 Puddle flanges and sleeves shall be provided at locations where pipes pass through concrete, masonry or other structure shall be stainless steel type 304L Schedule 40s with an annular fin welded continuously at midpoint of pipe penetrations. The fin shall be constructed of 6.35mm steel plate (min.) and shall have diameters as follows:

.1 Pipe diameter: 75 to 300 mm; Puddle flange dia.: Pipe dia. plus 50 mm.

.2 Pipe diameter: 350 to 550 mm; Puddle flange dia.: Pipe dia. plus 100 mm.

.3 Pipe diameter: 600 and larger mm; Puddle flange dia.: Pipe dia. plus 150mm.

.2 Puddle flanges shall be provided with adequate clearances to suite the process arrangement and provide sufficient space for installation of the required connection. Flanges shall be the same specification as the piping.

.3 Sleeves shall be completed flush with the interior and exterior of the wall and extend 100 mm above the finished floor elevation. Sleeve sizing shall provide a minimum of 6 mm of annular space between the penetrating pipe and the sleeve. Where sleeve penetrate walls into process vessels, these are to be provided with modular mechanical seal.

.1 Modular Mechanical Seals: EPDM rubber seals c/w 316 SS hardware and reinforced nylon polymer pressure plates. Standard of Acceptance: LS-316 Link -Seal Modular Seal.

2.9 HEAT TRACING

.1 All electrical heat-tracing applications shall be designed to maintain the process temperatures of 10°C with an exposure temperature of -40°C) using self-regulating cables. As a minimum, the heat-tracing shall provide 80 mm pipe and smaller with 25 mm thick insulation, 4 watts/0.3 m, and 100 mm pipe and larger with 50 mm thick insulation, 8 watts/0.3 m.

.1 Self-regulating heating cable shall vary its power output relative to the temperature of the surface of the pipe or the vessel. The cable shall be designed such that it can be crossed over itself and cut to length in the field.

.2 Self-regulating heating cable shall be designed for a useful life of 20 years or more with “power on” continuously, based on the following useful life criteria:

.1 Retention of at least 75 percent of nominal rated power after 20 years of operation at the maximum published continuous exposure (maintain) temperature.

.2 Retention of at least 90 percent of nominal rated power after 1000 hours of operation at the maximum published intermittent exposure temperature. The testing shall conform to UL 746B, IEC 60216-1.

.3 A warranty against manufacturing defects for a period of 10 years shall be available.

.4 All cables shall be capable of passing a 2.2 kV dielectric test for one minute after undergoing a 1.0 kg-0.7 m impact (IEC/IEEE 60079-30-1:2015, clause 5.1.5.1).

.2 Process Temperature Maintenance

.1 The heating cable shall consist of two 16 AWG or larger nickel-plated copper bus wires, embedded in a self-regulating polymeric core that controls power output so that the cable has a temperature identification number (T-rating) of T4 (275°F or 135°C) without use of thermostats.

.2 A ground-fault protection device set at 30 mA, with a nominal 100-ms response time, shall be used to protect each circuit.

.3 The heating cable shall have a tinned copper braid wire with a cross-sectional area being equal to or greater than conductor cross-sectional area. The braid shall be protected from chemical attack and mechanical abuse by a fluoropolymer outer jacket.

.4 Standard of Acceptance: Raychem QTVR-CT self-regulating heater or approved equivalent.

.3 Terminations for Nonhazardous and Hazardous Class I, Div 2 Locations

.1 All connection kits used to terminate heating cables—including power connectors, splices, tees, and connectors—shall be approved for the respective area classification and approved as a system with the particular type of heating cable in use. Under no circumstances shall terminations be used which are manufactured by a vendor other than the cable manufacturer.

.2 In order to keep connections dry and corrosion resistant, connection kits shall be constructed of nonmetallic, electrostatic, charge-resistant, glass-filled, engineered polymer enclosure rated TYPE 4X. The connection kit stand shall allow for up to four inches (100 mm) of thermal insulation.

.3 Terminals shall be the spring clamp wire connection type to provide reliable connection, maintenance-free operation, and ease of reentry.

.4 Heating cable terminations shall use cold-applied materials and shall not require the use of a heat gun, torch, or hot work permit for installation.

.5 Components shall be rated to a minimum installation temperature of –40°C, minimum usage temperature of –60°C, and maximum pipe temperature of 60°C.

.6 Standard of Acceptance: The connection kit system shall be Raychem JBM-100-L-A connection kit complete with integral LED power indicating light to serve as complete power, splice, or tee connection for up to three industrial parallel heating cables or approved equivalent.

2.10 FLEXIBLE ADAPTER COUPLINGS FOR UNDERGROUND APPLICATION

.1 Flexible couplings are to be fusion bonded epoxy coated carbon steel couples with ANSI 304 hardware. Gaskets for be compatible with contacting materials. To be sized to allow coupling of different OD piping in transition between pipe types. Standard of Acceptance: Robar 1506 or approved equivalent.

.2 Flanged to Plain End flexible sleeve type couplings:

.1 Type: Flanged cylindrical centre ring, companion flange, one follower ring, resilient gasket, and connecting bolts.

.1 Acceptable manufacturers:

.1 Robar 7808.

.2 Romac 501 & 400

.3 Blair Smith 400 Series

.4 GE Multi-Joint 3000 Plus to be used at Headworks to IPS Raw Sewage piping connection to splitter box.

.3 Provide necessary amount and appropriate size of restraining rods and gussets as recommended by manufacturer.

.4 Mechanical Joint Restraint Glands:

.1 Use flexible sleeve-type coupling with restraining rods (3 x 16mm dia. Minimum), and gussets welded to pipe. Provide sufficient restraint to resist pressure equal to twice system test pressure. Restraint Glands to be cast ductile iron Grade 70-50-5, compliant with AWWA/ANSI C110/A21.10/11. 16 mm set screws with knurled cup-point, 4140 steel, Rockwell ‘C’ scale 45-47.

.5 Do not use Type I flexible couplings in pipe systems which undergo thermal expansion and contraction; do not use these couplings at structural joints.

.6 Thrust Restraint:

.1 Provide hardened steel wedges that bear against and engage outer pipe surface, and allow articulation of pipe joint after assembly while wedges remain in their original setting position on pipe surface.

.2 Products employing set screws that bear directly on pipe will not be acceptable.

.3 Manufacturer and Product: EBAA Iron Sales Co.; Mega-Flange.

2.11 RIGID AND FLEXIBLE COUPLINGS FOR AIR, WATER AND SLUDGE PIPES

.1 Rigid couplings shall be required for maintenance of valves and flanged instruments; one (1) rigid coupling within 1.0m from each valve and flanged instrument for maintenance. Rigid couplings shall be also applied to the pipeline wherever the clearance for welding or flange connections is not sufficient.

.2 Flexible couplings shall be provided for the air, water and sludge pipes located inside the buildings to allow for deflection and minor axial movement.

.3 As the Contract Drawings may not present all flange or coupling connections, the Contractor shall determine the location of flange or coupling connections. Submit the shop drawing to present the connection type and locations.

Item	Size Range (mm)	Application	Description
Flexible Couplings	All sizes	Potable and non-potable lines	Victaulic Style 232S, 316L.
	All sizes	Process air AND sludge	Victaulic Style 77 and W77 c/w fusion bonded epoxy. W77 with AGS roll groove.
Rigid Couplings	40 mm to 500 mm	Potable and non-potable lines	Victaulic Style 489 and W489, 316L. W489 with AGS roll groove.
	600 mm & larger		Victaulic Style W89 c/w NSF approved coating. AGS roll groove.
	50 mm to 600 mm	Process air and sludge	Victaulic Style 89 and W89 c/w fusion bonded epoxy. W89 with AGS roll groove.
	750 mm and larger		Victaulic Style W07 c/w fusion bonded epoxy. AGS roll groove.
Coating on Couplings	All sizes	The colour of Fusion bonded epoxy to be similar to pipe colour.	

.4 Other acceptable products for couplings in addition those listed in the table above:

.1 Straub couplings may be acceptable for the process air, odorous air lines, water and sludge lines, but not for underground application.

.2 Refer to 44 01 27 Field Pressure Testing of Process Piping to comply with the pressure requirements. 1.2 of safety factor shall be applied to test pressure.

.3 Straub axial restraint pipe couplings;

.1 No deflection nor axial movement.

.2 All component material shall be of stainless steel 316L.

.4 Straub (Straub-Flex) non-axial restraint pipe couplings;

.1 More Straub couplings and supports may be required to provide the required thermal axial movement. The Contract Drawings are developed based on Victaulic expansion joints.

.2 Those shall be furnished with a strip insert to allow for the required expansion. It is a distance between pipe ends, but required axial

movement. Refer to Clause 2.1.7.4 herein for expansion calculation.

.3 Allow for deflection and some axial movement.

.4 All component material shall be of stainless steel 316L.

.5 The Contractor and coupling Supplier shall confirm the gasket seal requirements for couplings; liquid and temperature.

.1 Potable and non-potable water lines:

.1 Grade “E” EPDM: UL Classified in accordance with NSF/ANSI/CAN 61 for cold and hot water service and NSF/ANSI/CAN 372 with temperature range of –34°C to +110°C

.2 Sludge lines

.1 Grade “E” EPDM: UL Classified in accordance with NSF/ANSI/CAN 61 for cold and hot water service and NSF/ANSI/CAN 372 with temperature range of –34°C to +110°C

.3 Sewer and raw wastewater lines

.1 Grade “T” Nitrile, flush seal type with temperature range of –29°C to +82°C

.4 Process lines

.1 Grade “L” Silicone: Dry heat, air without hydrocarbons and certain chemical services with temperature range of –34°C to +177°C

2.12 PIPE HANGERS, SUPPORTS, AND GUIDES

.1 Pipe connections to equipment shall be supported, anchored, and guided to minimize stresses and loads on equipment flanges and equipment. Supports and hangers shall comply with the requirements of Division 22 and/or as shown in the drawings. Hangers, supports, and guides shall be designed and installed in compliance with ANSI/ASME B31.3 and with MSS-SP-58, MSS-SP-69 and as shown in the drawings.

2.13 FLEXIBLE CONNECTORS AND DUAL PIPE COUPLINGS

.1 Flexible connectors shall be installed in piping connections to engines, blowers, compressors, and other vibrating equipment in accordance with the requirements of the ANSI B31.1. Flexible connectors shall be provided in all piping connections to engines, blowers, compressors, vibrating equipment, and where indicated. Flexible connectors for service temperatures up to 90 °C shall be flanged reinforced neoprene or butyl rubber spools, rated for working pressures of 275 to 1050 kPa or reinforced flanged rubberized duck, as best suited for the application. For temperatures above 90 °C, flexible connectors shall be flanged braided Type316 stainless steel spools with inner corrugated stainless steel hose rated for minimum 1050 kPa working pressure unless indicated otherwise. Connectors shall be minimum of 200 mm face to face between flanges. Material selection shall be proposed by the manufacturer based on the application.

.2 Dual pipe couplings, separated by an 18-inch pipe spool unless otherwise indicated, shall be installed on the suction and discharge of all pumps - inboard of the isolation valves. Dual pipe couplings, separated by not less than two pipe diameters nor more than 1.5m, shall be installed on all piping where it exits a structure. Couplings shall be restrained where required. Dual flexible pipe joints may be used where indicated in buried pipe applications in lieu of dual pipe couplings. Flexible connectors are not permitted where dual pipe couplings are specified.

.3 For Flexible Connection of standard lengths:

.1 Type 316L s/s braided, corrugated metal hose complete with Class 150 raised face stainless steel flanges.

.2 Maximum working pressure to be 1064KPa @ 177°C.

.3 Length: 300mm flange to flange, minimum live length of 216mm.

.4 Standard of Acceptance: Senior Flexonics model UFBX-1-16.

.4 For Flexible Connections requiring short lengths:

.1 Multi-ply stainless steel bellows complete with Class 150 SS316 flat faced flanges.

.2 Maximum working pressure to be 1446KPa @ 121°C.

.3 Overall face to face length to be 150mm for nominal pipe sizes of 50mm thru 200mm inclusive, and 200mm face to face for nominal pipe sizes of 250mm thru 350mm inclusive.

.4 Standard of Acceptance:Senior Flexonics model TCS-R.

.5 Expansion Joints

.1 Elastomer Bellows:

.1 Type: Reinforced molded wide arch.

.2 End Connections: Flanged, drilled Class 125 ASME B16.1 standard, with split galvanized steel retaining rings.

.3 Washers: Over retaining rings to help provide a leak-proof joint under test pressure.

.4 Thrust Protection: Control rods to protect the bellows from overextension.

.5 Bellows Arch Lining: Buna N, nitrile, or butyl.

.6 Rated Temperature: Suitable for intended service.

.7 Rated Deflection and Pressure:

.1 Lateral Deflection: 19 mm, minimum.

.2 Burst Pressure: Four times the working pressure.

.3 Maximum compression deflection and minimum working pressure as follows:

Size (mm)	Deflection (mm)	Pressure (kPa(g))
65 to 300	27	1035

350	42	896
400 to 500	42	759

.8 Manufacturers and Products:

.1 General Rubber Corp.; Style 1015 Maxijoint.

.2 Mercer Rubber Co; Flexmore Style 450.

.3 Goodall Rubber Company of Canada; Specification E 711.

.4 Unisource Manufacturing, Inc.; Series 1500.

.5 Proco Products, Inc.; Series 251.

.6 Teflon Bellows:

.1 Type: Three convolutions, with metal reinforcing bands.

.2 Flanges: Ductile iron, drilled Class 150 ASME B16.5 standard.

.3 Working Pressure Rating: Suitable for the intended service..

.4 Thrust Restraint: Limit bolts to restrain force developed by the specified test pressure.

.5 Manufacturers and Products:

.1 Garlock Inc. Sealing Technologies; Style 215.

.2 Crane Co. Resistoflex; No. R6905.

.3 Unisource Manufacturing, Inc.; Style 113,

.4 Proco Products, Inc.; Series 443.

.7 Metal Bellows:

.1 Type: Single-ply, annular corrugated metal bellows with limit rods. Circumferential convolution welds not permitted.

.2 Material: Type 316 stainless steel.

.3 End Connections: ASME Class 150 carbon steel flanges.

.4 Minimum Design Working Pressure: Suitable for the intended service

.5 Length: Minimum of four convolutions and the minimum recommended by the manufacturer for vibration isolation.

.6 Manufacturers and Products:

.1 Hyspan Precision Products, Inc.; Series 1500.

.2 Senior Flexonics Inc.

2.14 EXPANSION JOINTS FOR AIR, WATER AND SLUDGE PIPES

.1 Linear Expansion Only:

.1 Thermal Expansion/Contraction Joints: Victaulic Style 231S Non-Restrained flexible expansion coupling. Stainless steel 304 or 316L same as pipe material. Shoulders and two (2) restraint rings for 400 mm and larger size couplings.

.2 Refer to Clause 2.10 for gaskets and alternatives.

.2 Linear, Angular, and Lateral Movement:

.1 Straub (Straub-Flex) non-axial restraint pipe couplings with strip inserts.

.2 Straub-Flex 1 & 2 couplings shall be installed on the air and sludge pipes between AGS tanks and operation building to allow for both axial movement and deflection. No alternative.

.3 Refer to Clause 2.10 for gaskets.

2.15 QUICK CONNECT

.1 Quick connectors shall be Kamlock type quick connectors, constructed of 316L stainless steel, seals to be compatible with piping service. Flanged ends for pipe connections DN 65 and larger, threaded ends for connections DN 50 and smaller.

.2 Provide female cap with chain for male end; male dust plug for each female end.

.3 Sizes: Line size as per drawings

.4 Pressure Rating: Suitable for the intended service

.5 Manufacturers and Products:

.1 OPW Engineered Systems Inc.; Kamlok.

.2 Ryan Herco Products Corp; 1300 Series.

2.16 FLEXIBLE HOSE

.1 Rubber steel reinforced hose.

.2 Ends to have female Kamlock quick connect ends constructed of 316L stainless steel.

.3 Diameter: 50 to 250 mm.

.4 Pressure rating of the hose is have a Maximum pressure: 689 KPa (100 psi) and mush be adequate for suction applications.

.5 Length: As required to suit site conditions with adequate additional length to provide easy manipulation and handling of hose.

2.17 PRESSURE RELIEF VALVE

.1 Pressure relief valve for potable and non-potable water supply to equipment.

.2 Brass body construction, hardened 416 stainless steel piston, 50mm diameter (or size as indicated) NPT pipe connections, viton O-ring cap seal, and spring selected to achieve 30 psi overpressure at 100 GPM full bypass. Maximum flow to be 150 GPM.

.3 Standard of Acceptance: VSS Fulflo Pressure Relief Valve or Approved Equivalent.

2.18 ELECTRIC SOLENOID VALVES

.1 Gland Sealed Electric Solenoid Valves

.1 Electric solenoid valve for the provision of water to all pump gland seals and other locations as indicated..

.2 The solenoid valve shall be pilot operated diaphragm type solenoid valve having a brass body and resilient seat and operate with minimum operating pressure differential no greater than 70 kPa and maximum operating pressure differential no less than 680 MPa. Internal parts shall be corrosion-resistant. The solenoid valve shall have Class F molded coils for operation on 120 volts, 60-Hz, ac, unless otherwise indicated. The solenoid enclosure shall conform to NEMA 4X enclosure (non hazardous area) or NEMA 7 enclosure (hazardous area). Solenoids on double acting cylinders for open-close and throttling valves shall be four-way with dual coils.

.3 The solenoid valve shall be a 2 way normally open valve (open when de-energized).

.4 Standard of Acceptance: ASCO General service valve or Approved Equivalent.

2.19 PRESSURE REDUCING REGULATOR

.1 Pressure Reducing Regulator shall be spring operated, with epoxy coated carbon steel body and spring chamber, flow to open with internal pressure balancing piston-cylinder that provides high flow capacity and high pressure drop capacity.

.2 Standard of Acceptance: Kaye MacDonald (Cashco) Model DA1 Do-All Series 1 or Approved Equivalent.

2.20 LOW PRESSURE CONTROL VALVE

.1 Low Pressure Control Valve shall be a segment valve with 316SS flanged body, ANSI class 150, AISI 329 hard chrome plated segment, shafts, pins and bearing AISI 329SST & PTFE on 316SS net, PTFE V-Ring packing, stainless steel metal seat with CoCr hard facing. Valve shall be supplied complete with spring diaphragm rotary actuator and intelligent valve controller.

.2 Standard of Acceptance: Segment Valve: Neles Model# RECA06CJJST, Spring Diaphragm Rotary Actuator: Jamesbury Quadra-PowrX Model #QPX4C/K40, Intelligent Valve Controller: Neles ND9000 Model # ND9106HU2Y w/ 2-line display visible through main cover and local interface for configuration and calibration.

2.21 SINGLE BRAIDED STANDARD PRESSURE HOSE

.1 Single braded standard pressure hose.

.2 Material to be SS321 Stainless Steel complete with FNPT connections.

.3 Size: 6 to 50 mm

.4 Length: As required to suite site conditions with adequate additional length to provide easy manipulation and handling of hose.

.5 Minimum hose working pressure: 2600 kPa.

.6 Standard of Acceptance: Senior Flexonics Series 101 hose braided stainless 321 hose or equivalent.

2.22 PIPE SLEEVES

.1 Steel Pipe Sleeve:

.1 Minimum Thickness: 4.7 mm.

.2 Seep Ring:

.1 Center steel flange for water stoppage on sleeves in exterior or water-bearing walls, 4.7 mm minimum thickness.

.2 Outside Diameter: Unless otherwise shown on the Contract Drawings, 80 mm greater than pipe sleeve outside diameter.

.3 Continuously fillet weld on each side all around.

.3 Factory Finish:

.1 Galvanizing:

.1 Hot-dip applied, meeting requirements of STM A153/A153M.

.2 Electroplated zinc or cadmium plating is unacceptable.

.2 Shop Lining and Coating: Factory prepare, prime, and finish coat in accordance with the specification requirements.

.2 Molded Polyethylene Pipe Sleeve:

.1 Molded HDPE with integral water stop ring not less than 80 mm larger than sleeve.

.2 Provided with end caps for support during concrete placement.

.3 Manufacturer and Product: Century-Line, Model CS sleeves as manufactured by PSI-Thunderline/Link-Seal Inc.

.3 Insulated and Encased Pipe Sleeve:

.1 Manufacturer and Product: Pipe Shields, Inc.; Models WFB, WFB-CS and -CW Series, as applicable.

.4 Modular Mechanical Seal:

.1 Type: Interconnected synthetic rubber links shaped and sized to continuously fill annular space between pipe and wall sleeve opening.

.2 Fabrication:

.1 Assemble interconnected rubber links with ASTM A276, Type 316 stainless steel bolts and nuts.

.3 Pressure plates shall be reinforced nylon polymer.

.4 Size: According to the manufacturer's instructions for size of pipes shown to provide a watertight seal between pipe and wall sleeve opening, and to withstand a hydrostatic head of 12 metres of water.

.5 Manufacturer: Thunderline Corp., Link-Seal Division.

2.23 SLAB, FLOOR, WALL AND ROOF PENETRATIONS

.1 General: Base design on use of stainless steel wall pipe with thrust collar, unless otherwise specified or shown on the Contract Drawings and Standard Details therein.

.2 Ductile Iron Pipe:

.1 For penetrations through water-retaining concrete walls, floors, slabs, or roofs that are to be watertight.

.2 Diameter and Ends: Same as connecting ductile iron pipe.

.3 Thickness: Equal to or greater than remainder of pipe in line.

.4 Fittings: In accordance with the applicable Piping Specification.

.5 Provide taps for stud bolts in flanges set flush with wall face.

.6 Thrust Collars:

.1 Base design on use for all wall pipes.

.2 Rated for thrust load developed.

.3 Safety Factor: Minimum of two.

.4 Material and Construction:

.1 Ductile iron or cast iron, cast integral with wall pipe wherever possible.

.5 Fabricate by welded attachment of ductile iron thrust collar to pipe where casting impossible.

.1 Perform in the pipe manufacturer's shop by qualified welders as specified herein.

.2 Welds: Electric arc welds of ductile iron with NI 55 or FC 55, nickel-iron-carbon weld rod.

.3 Continuously weld on each side all around.

.3 Stainless Steel Pipe: Base design on use of same material and thickness as connecting pipe; however, minimum thickness of 6mm (¼ inch) is required.

.1 Lining: Same as connecting pipe.

.2 Thrust Collar:

.1 Outside diameter 75 mm greater than outside diameter of wall pipe.

.2 Continuously fillet welded on each side all around.

.4 Pipe Sleeves: Base design on use of 5 mm minimum thickness steel pipe.

.1 Above grade in Nonsubmerged Areas: Hot-dip galvanized after fabrication.

.2 Below grade or in Submerged or Damp Environments: Lined and coated after fabrication with Stainless Steel.

.3 Seep Ring:

.1 5 mm minimum thickness center flange for water stoppage on sleeves in exterior or water-bearing walls.

.2 Outside Diameter: 75 mm greater than wall pipe outside diameter.

.3 Continuously fillet weld on each side all around.

.4 Existing Concrete Walls: Holes drilled with a core drill may be used in lieu of sleeves. In existing masonry walls, use a sleeve and grout around sleeve. Specify fill openings as required to maintain room classifications.

2.24 MISCELLANEOUS SPECIALTIES

.1 Strainers, Water Service, 50 mm and Smaller:

.1 Type: Bronze body, Y-pattern, 1380 kPa nonshock rated, with screwed gasketed bronze cap.

.2 Screen: Heavy-gauge Type 304 stainless steel or Monel, 20-mesh.

.3 Manufacturers and Products:

.1 Armstrong International Inc.; Model F.

.2 Corix Water Products Inc. Model 351M.

.2 Strainers, Water Service, 65 mm and Larger:

.1 Type: Cast iron or ductile iron body, Y-pattern, 1200 kPa nonshock rated, with flanged gasketed iron cap.

.2 Screen: Heavy-gauge Type 316 stainless steel, 1.1 mm perforations.

.3 Manufacturers and Products:

.1 Armstrong International, Inc.; Model A1FL 125.

.2 Corix Water Products Inc. Model 751/752.

.3 Strainers, Plastic Piping Systems, 100 mm and Smaller:

.1 Type: Y-pattern PVC body, 1035 kPa non-shock rated, with screwed PVC cap and Viton seals

.2 End Connections: Screwed or solvent weld, 50 mm and smaller. Class 150 ANSI flanged, 65 mm and larger.

.3 Screen: Heavy-gauge PVC, 0.8 mm mesh, minimum 2 to 1 screen area to pipe size ratio.

.4 Manufacturer: Hayward Industries Inc.

.4 Pump Seal Water Sight Flow Indicator: 10 mm horizontal, ball action with tempered glass.

.1 Rated 860 kPa with NPT screwed ends.

.2 Operate with a minimum flow of 0.94 Litres/min.

.3 Manufacturers and Products:

.1 Eugene Ernst Products Co.; Series E-57-4.

.2 Jacoby Tarbox Co.

.5 Rotameters for seal water connection:

.1 Type: glass tube variable area rotameter.

.2 Tube: Borosilicate glass.

.3 Housing: Cast aluminum alloy with epoxy paint.

.4 Float: 316 stainless steel.

.5 Capacity: 8 litres per minute.

.6 Scale: 200 mm, detachable aluminum plate.

.7 Accuracy: ±2 per cent of full scale from 10 per cent to 100 per cent of scale reading

.8 Pressure rating: 2068 kPa

.9 Connections: Flanged ANSI Class 150.

.10 Manufacturers and Products:

.1 Brooks Instrument LLC; Model 1024

.2 or an approved equal

2.25 RESTRAINED JOINTS AND VALVES

.1 Where not expressly indicated on the Contract Drawings, thrust blocks shall be used for thrust restraint as per the latest revision of OPSD 1103.010, 1103.020.

.2 Valves shall also be restrained using the strap method of thrust restraint as per the latest revision of OPSD 1103.020.

.3 Pipe restraint, where indicated on the Contract Drawings, shall be provided by a system using wedges or gripping teeth. The system shall be specifically recommended by the restraint manufacturer for use on PVC, HDPE, and/or Stainless Steel pipe. Systems with set screws shall not be used.

.4 Minimum Pressure Rating: 1034 kPa(g).

2.26 VALVE BOXES

.1 Valve boxes to be 150 mm screw type.

.2 Valve boxes are to be grey iron, have a tensile strength of not less than 138 Mpa, and shall conform to CSA 61.

.3 The length of the valve box from the top of the connecting pipe to the ground shall be suitable to match the finish grading shown on the Drawings.

.4 Valve boxes are to be supplied with a guide plate to centre the bottom of the box on the valve.

.5 Supply with adjustable valve box and lid.

.6 Acceptable manufacturers:

.1 Bibby-Ste-Croix div. of Canada Pipe Co. Ltd.

.2 Sigma Valves Inc.

.3 Mueller Flow Control Inc.

2.27 YARD HYDRANTS

.1 Hydrants to be Zurn Z-1483, 40 mm diameter, non-freeze type post hydrant, with goldenized decorative aluminium shield and removable keys.

.2 Depth of burial from top of hydrant lead pipe to finished grade – 1800 mm.

PART 3 EXECUTION

3.1 INSTALLATION

.1 All piping systems and process appurtenances shall be fabricated, installed, inspected and tested according to the following:

.1 For all liquids: the Fabrication, Assembly and Erection shall be as per ASME B31.3 for Normal Fluid Service.

.2 For all air piping: Fabrication, Assembly and Erection shall be as per ASME B31.1 for Power Piping.

.3 For all biogas piping: Fabrication, Assembly and Erection shall be consistent with the requirements of CSA-B149.6-2022 as amended.

.4 All water distribution piping shall be installed as per Part 7 of the Ontario Building Code.

.5 All application specific installations shall meet the requirements of the applicable governing authority including the Technical Standards and Safety Authority (TSSA) and the specific regulations under TSSA (i.e. Boilers and Pressure Vessels Act, Digester, Landfill & Biogas Approval Code etc.).

.2 Installation General:

.1 Piping shall be cleaned of all foreign materials. If the piping is suspected of containing materials other than those required for testing, commissioning and operation, the Contractor will be responsible to drain and CCTV the pipe to confirm the internal condition.

.2 No backing rings will be allowable.

.3 Branch connections and reinforcing pads shall be as per section Chapter V of B31.3.

.4 Pipes, fittings, and appurtenances shall be installed in accordance with the manufacturer's installation instructions.

.5 Protect installed work from dust, contamination and damage from other construction activities prior to substantial completion. Cover open ended pipes following erection and until connections and terminations are complete. Provide appropriate care to new and existing piping, equipment, instrumentation and appurtenances to maintain their respective protective coatings, painting, and pickled/passivated surfaces from contamination during construction. Contactor shall be responsible to repair or replace damaged process piping and equipment as determined by the Contract Administrator.

.3 Connecting Dissimilar Piping System

.1 Provide dielectric fittings and/or adapting flanges and couplings to connect dissimilar metals such as steel and stainless steel.

.4 Drains

.1 Services: All.

.2 Horizontal pipes: 25 mm drains point with Schedule 40S Type 304L stainless steel NPS pipe, manual ball valve, nipple and a plug. Valves are supplied under this section. For piping smaller than 25 mm, provide drain and vents that are line size.

.3 Nipples shall extend 80mm beyond pipe insulation.

.4 Locations:

.1 Install drain point on bottom of horizontal pipe at low points in process piping system in order to drain the lines or equipment.

.2 Where indicated on Drawings. Drawings may not indicate all required drain point locations.

.5 Vents shall be provided at high points in the piping system to bleed off/purge air. Vents shall be constructed in the same manner as drains.

.6 Vents, Drains and Instrument connections shall be constructed using ‘Olets (Weldolets, Coupolet, Nipolet, Thredolet, etc.).

.7 Existing Pipe, Channel and Vessel Cleaning

.1 Flush existing pipe, channel and Vessels, scheduled to be reused where connected to new piping, free of waste material. Clean existing pipe with high-pressure pipeline washing equipment.

.2 Provide required fittings, temporary pipe connections and other similar items for high pressure wash cleaning.

.3 Complete all cleaning to the Contractors requirements, as per their Health and Safety Plan, in order to complete work.

.4 Submit cleaning procedures to Engineer for review well in advance of work.

.8 Cleaning

.1 Pipe cleaning: In accordance with Section 44 05 00 and Division 01.

.2 Replace equipment damaged during initial operating period due to foreign material not removed from piping systems.

.3 Clean piping systems of slag and foreign material by blowing with clean compressed air before connecting piping to valves, meters, instruments, and equipment.

.4 Additional cleaning requirements for all air piping systems:

.1 Clean piping system free of dust, dirt and debris after successful pressure testing of piping system.

.2 Clean pipe in sections so that air velocity in each pipe section being cleaned is minimum 8 m/sec.

.9 Pipe Sleeves and Wall/Floor Penetrations

.1 All sleeves, holes and pipe chases, penetrations in general through walls and floors shall be large enough to accommodate the thickness of insulation specified.

.2 Penetrations through fire separations shall be provided with adequate annular space for fire stopping. The integrity of the fire rating shall be maintained.

.3 The annular space between the pipe and sleeve shall be adequately sized to be sealed with Rockwool insulation and caulked with waterproof fire resistant non-hardening mastic.

.10 Field Testing

.1 All process pipe testing shall be completed in accordance with ANSI/ASTM B31.3 -Chapter VI, as applicable and ANSI/ASTM B31.1 for compressed air systems. Non-metallic piping shall be tested in accordance with B31.3 in adherence with the manufacturer's rated capacities.

.2 The process piping system shall be completed by preparing the piping for testing in accordance with B31.3 Section 345.5.

.3 Biogas piping shall be tested in accordance with CSA B149.6-20.

.4 All instrumentation shall be removed prior to testing.

.5 All piping system valves and appurtenances not rated for the test pressure shall be removed or isolated prior to the test.

.6 The test shall be applied incrementally, air shall be purged during filling and the initial pressurization, equipment vents shall be opened to avoid pressure buildup beyond the testing segment.

.7 Following testing all piping systems shall be drained, all temporary blanks and temporary shall be removed. Disconnect all testing equipment.

.8 Repair all deficiencies as required and re-test.

.9 Reconnect all appurtenances and instruments that removed for testing.

.10 Replace all gaskets that where in-place for temporary blanks, blinds, etc.

.11 Return all valving to the normal operating condition.

.12 Clean all temporary strainers and other consumable items and install permanent items.

END OF SECTION

VARIOUS PROCESS PUMPS

PART 1 GENERAL

1.1 SUMMARY

.1 This section includes design, supply, fabrication, installation, testing and placing into operation submersible sewage pumps and associated appurtenances.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittals

.2 Division 26 – Electrical

.3 Section 26 29 20 – Variable Frequency Drives

.4 Section 44 00 10 – Process General Requirements

.5 Section 44 05 50 – Process Piping

.6 Section 25 05 01 – Control Panels

1.3 SUBMITTALS

.1 Submit shop drawings and product data in accordance with Section 01 33 00 – Submittals.

.2 Indicate:

.1 Manufacturer's data, including materials of construction, equipment weight, connections, fittings, control assemblies and ancillaries. Identify whether factory or field assembled.

.2 Wiring and schematic diagrams.

.3 Dimensions and recommended installation.

.4 Data regarding pump and motor characteristics and performance inclusive of guaranteed performance curves showing that the equipment meets the specified requirements of head, capacity and horsepower for the specific application.

.5 Motor data.

.6 Provide characteristic curves for variable speed pumps for both actual maximum pump speed and for speed required to obtain minimum pump flow specified.

.7 Use Tag numbers for all equipment as indicated and specified.

.8 A copy of this specification with addenda updates, and all referenced sections with addenda updates, with each paragraph check marked to show specification compliance or marked to show deviations.

.3 The pump supplier shall review the contract drawings and specifications to ensure the pump application and sizing is acceptable and notify the Contract Administrator immediately regarding any concerns.

1.4 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into manual specified in Section 01 33 00 – Submittals.

.2 Data to include:

.1 Manufacturers name, type, model, capacity, head, serial number and performance curves.

.2 Mill certifications confirming hardness of rotor.

.3 Applicable operation and maintenance information as specified in section 01 33 00.

.4 Installation certification form.

.5 Training Certification form.

PART 2 PRODUCTS

2.1 GENERAL

.1 All pumping equipment furnished under this Section shall be of a design and manufacture that has been used in similar applications, and it shall be demonstrated to the satisfaction of the Owner that the quality is equal to equipment made by that manufacturer specifically named herein.

.2 Pumps, complete with motor, V-belt or couplings, necessary guards and all other specified accessories and appurtenances shall be furnished by the pump manufacturer to ensure compatibility and integrity of the individual components and provide the specified warranty for all components.

.3 The process piping arrangements have been designed using the pumps listed as “approved manufacturer”. Pumps listed as “alternates” may require modifications to the piping arrangements, connections or concrete bases currently shown on the contract drawings. The contractor assumes all responsibility for said adjustments or extension of the work necessary for the accommodation of the alternate suppliers named.

.4 All submersible pumps shall be supplied with a thermal overload and leak detection relay (110V). Relay is to be provided loose to the contractor for installation as detailed on the contract drawings.

.5 Pump supplier to provide all accessories for pump installation including upper guide bar holders (316SS), cable hook (304SS), horizontal regulator hanger (304SS), holder clamp for lifting cable (316SS) and lifting cable assembly. For the

onsite pumping station the supplier shall also include the side mount lifting davit base and lifting davit.

2.2 PUMP LIFTING SYSTEM

.1 All pumps to be complete with sliding guide and brackets, stainless steel cable and quick leak-proof disconnect to discharge piping, allowing for withdrawal of pumps.

.2 Provide stainless steel cable or galvanized chain for each pump accessible from roof access hatches along with associated chain/cable hook.

.3 Provide 50mm (RPS/SP) and 80mm (IPS) diameter schedule 40 stainless steel pipes to act as guide rails for pumps.

2.3 RAW SEWAGE SUBMERSIBLE PUMPS RSP-RSP-1151 AND RSP-RSP-1251 (ON-SITE PUMPING STATION)

.1 Pumps:

.1 Number of pumps: three (3).

.2 Function: to pump sewage variable rate, to the influent pre-screening channel.

.3 Pump shall be vertical, single stage, bottom suction, non-clog, heavy duty, dry pit, centrifugal pumps, direct connected to motor by solid stainless steel shaft and fitted with thrust bearings.

.4 Pumps shall be submersible non-clog wastewater pumps designed to handle raw, unscreened sanitary sewage.

.5 Each pump shall be equipped with a submersible electric motor, Nema-B design induction type with squirrel cage rotor, shell type design and be housed in an air filled, watertight chamber. The motor shall be capable to withstand at least 15 evenly spaced starts per hour and also be designed for continuous duty while handling pump media up to 40°C. Three thermal switches shall be embedded in the stator end coils, one per phase winding, to monitor the stator temperature. The motor shall be:

.1 Maximum speed = 1175 RPM

.2 Maximum horse power = 33.5 kW (45hp)

.3 Power: 600 V/60 HZ/3 Phase

.4 Suitable for VFD use.

.6 Major pump components shall be grey cast iron. ASTM A-48, Class 35B, with smooth surfaces devoid of blow holes or other irregularities. All exposed nuts shall be of ANSI Type 316 stainless steel. An approved sewage resistant coating shall protect all metal surfaces coming into contact with the pumpage other than stainless steel or brass.

.7 Impeller shall be of hard iron, ASTM A-48 Class 35B, dynamically balanced, semi-open, multi-vane, back swept, screw-shaped, non-clog design. The screw shaped leading edges of the impeller shall be hardened to RC 45 and shall be capable of handling solids, fibrous materials, heavy

sludge and other matter normally found in wastewater. The impeller shall be capable of momentarily moving axially upwards a distance of 15mm to allow larger debris to pass through and immediately return to normal operating position.

.8 The pump/motor assembly shall have CSA approval as one unit, per CSA Standard C22.2-108. The pump/motor unit must also be approved by CSA for service in Class 1, Division I, groups A, B, C or D hazardous locations.

.9 The pumps shall meet the following characteristics:

.1 Discharge connection: 200 mm.

.2 Design duty point: 100 L/s at 18.5 m TDH.

.3 Minimum shut-off head: 29.8 m.

.4 Minimum overall efficiency at duty point: 68.9%

.5 One of the two pumps specified shall be supplied with a mix flush valve.

.10 The pump system shall be Flygt model NP-3202.095 MT Impeller code 641 354 mm Adaptive c/w 2 mini CAS II relays to be delivered to Division 25/26.

2.4 [ITEM P1] BIOSOLIDS MIXER PUMPS (BI-DSP-7120 AND BI-DSP-7220)

.1 Pumps:

.1 Number of pumps: Two

.2 Function: to mix the biosolids storage tanks.

.3 The pumps shall be dry well horizontal chopper pump specifically designed to pump and agitate waste solids at heavy consistencies. Materials shall be macerated and conditioned by the pump as an integral part of the pumping action. The pump must have demonstrated the ability to chop through, mix and pump high concentrations of solids such as plastics, heavy rags, grease and hair balls, wood, paper products and stringy materials without plugging, both in tests and field applications.

.4 Motors shall be in accordance with NEMA MG 1 and shall be of explosion-proof design for operation near digester gas. Motor shall be sized for and shall not overload under the intended conditions. The motor shall be:

.1 Maximum speed = 1200 RPM

.2 Maximum horsepower = 44.7 kW (60 hp)

.3 Power: 575 V/60 HZ/3 Phase

.4 Suitable for VFD use.

.5 The pump casing shall be of semi-concentric design, with the first half of the circumference being cylindrical beginning after the pump outlet, and the remaining circumference spiraling outward to the 150 lb. flanged centerline discharge. Back pull-out adapter plate shall allow removal of pump components from above the casing and allow external adjustment of impeller-to-cutter bar clearance. Wear plate shall be integral to the back pull-out plate and shall include an internal cutter for stringy materials caught between the wear plate and the pump-out vanes on the back of the impeller. Casing and adapter plate shall be ductile cast iron with all water

passages to be smooth, and free of blowholes and imperfections for good flow characteristics. Wear plate shall be heat treated steel plate.

.6 The impeller shall be semi-open type with pump out vanes to reduce seal area pressure. Chopping/maceration of materials shall be accomplished by the action of the cupped and sharpened leading edges of the impeller blades moving across the cutter bar at the intake openings, with a maximum set clearance between the impeller and cutter bar of .020"-.030" cold. Impeller shall be cast steel, heat treated to minimum Rockwell C 60 and dynamically balanced. The impeller shall be threaded to the shaft and shall have no axial adjustments and no set screws.

.7 The pump/motor assembly shall have CSA approval as one unit, per CSA Standard C22.2-108. The pump/motor unit must also be approved by CSA for service in Class 1, Division I, groups A, B, C or D hazardous locations.

.8 The pumps shall meet the following characteristics:

.1 Discharge connection: 250 mm.

.2 Design duty point: 230 L/s at 12.5 m TDH.

.2 The pump system shall be Vaughan Model HE10R12CS-130 Horizontal Chopper Pump, Hayward Gordon CHOPX10B Chopper Pump, or approved equivalent

2.5 [ITEM P3] BIOSOLIDS TRANSFER PUMPS (BI-PMP-2142 AND BI-PMP-2242)

.1 Pumps:

.1 Number of pumps: Two

.2 Function: to pump biosolids from digesters to biosolids storage tanks.

.3 The pumps shall be dry well horizontal chopper pump specifically designed to pump and agitate waste solids at heavy consistencies. Materials shall be macerated and conditioned by the pump as an integral part of the pumping action. The pump must have demonstrated the ability to chop through, mix and pump high concentrations of solids such as plastics, heavy rags, grease and hair balls, wood, paper products and stringy materials without plugging, both in tests and field applications.

.4 Motors shall be in accordance with NEMA MG 1 and shall be of explosion-proof design for operation near digester gas. Motor shall be sized for and shall not overload under the intended conditions. The motor shall be:

.1 Maximum speed = 1200 RPM

.2 Maximum horsepower = 22.3 kW (30 hp)

.3 Power: 575 V/60 HZ/3 Phase

.4 Suitable for VFD use.

.5 The pump casing shall be of semi-concentric design, with the first half of the circumference being cylindrical beginning after the pump outlet, and the remaining circumference spiraling outward to the 150 lb. flanged centerline discharge. Back pull-out adapter plate shall allow removal of pump components from above the casing and allow external adjustment of impeller-to-cutter bar clearance. Wear plate shall be integral to the back

pull-out plate and shall include an internal cutter for stringy materials caught between the wear plate and the pump-out vanes on the back of the impeller. Casing and adapter plate shall be ductile cast iron with all water passages to be smooth, and free of blowholes and imperfections for good flow characteristics. Wear plate shall be heat treated steel plate.

.6 The impeller shall be semi-open type with pump out vanes to reduce seal area pressure. Chopping/maceration of materials shall be accomplished by the action of the cupped and sharpened leading edges of the impeller blades moving across the cutter bar at the intake openings, with a maximum set clearance between the impeller and cutter bar of .020"-.030" cold. Impeller shall be cast steel, heat treated to minimum Rockwell C 60 and dynamically balanced. The impeller shall be threaded to the shaft and shall have no axial adjustments and no set screws.

.7 The pump/motor assembly shall have CSA approval as one unit, per CSA Standard C22.2-108. The pump/motor unit must also be approved by CSA for service in Class 1, Division I, groups A, B, C or D hazardous locations.

.8 The pumps shall meet the following characteristics:

.1 Discharge connection: 200 mm.

.2 Design duty point:

.1 Transfer: 16.5 L/s at 7.05 m TDH.

.2 Transfer: 70 L/s at 12.5 m TDH.

.2 The pump system shall be Vaughan Model HE8K10CSEC2-120 Horizontal Chopper Pump.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Follow the manufacturer's recommended installation details and procedures supplemented by details on the drawings.

.2 Install in a neat, workmanlike manner so that connections and disconnections can be easily made with parts accessible for inspections, maintenance and repairs.

.3 Install at correct elevations, true, square, plumb and level and provide all shims required.

.4 Apply protection so that anchor bolts, shims and miscellaneous metals are fully corrosion protected.

.5 Contractor shall prove the pump's discharge port connection to process lines are made in a free supported state without need to apply vertical or horizontal pressure to align piping with pump nozzle.

.6 The installation and initial operation of all components shall be certified in accordance with 01 91 23 Equipment Installation and Start Up and shall be subject to the complete commissioning process.

3.2 TESTING

.1 After completion of installation, the pumps shall be completely tested to demonstrate compliance with operating requirements as specified. Testing and final acceptance shall be completed by pump manufacturer.

3.3 FIELD QUALITY CONTROL

.1 After completion of installation, representative of pump manufacturer shall complete inspection and supervise startup of the equipment and provide to contract administrator a written startup and commissioning report confirming that the equipment is installed and operating in accordance with manufacturers standards, and that the warranty is in effect until one year following the date of substantial completion.

.2 Provide materials, labour, liquid and ancillary equipment necessary to fulfil tests.

.3 Test to demonstrate that:

.1 Pumps and equipment run free from heating, or vibration.

.2 Operation meets requirements of these specifications.

.3 Pumps and pumping are free and clear of debris and obstructions.

.4 Replace equipment found defective.

.1 Repeat test until equipment is accepted by contract administrator.

END OF SECTION

PROCESS WATER PUMPING SYSTEM

PART 1 GENERAL

1.1 SUMMARY

.1 The Contractor shall supply and install a triplex pumping system, complete with three (3) variable speed, 24-hour continuous duty, centrifugal effluent water pumps complete with all ancillary equipment as specified hereinafter.

.2 The effluent water system is to be installed in a basement in the UV disinfection building as noted on the Contract Drawings.

.3 This section specifies the supply, installation, testing and commissioning of the effluent water pumping system using treated secondary effluent at a water source.

.4 Provide process water pumping system complete with pumps, electric motors, pressure tanks, control panel, and all specified appurtenances.

1.2 RELATED SECTIONS

.1 Section 01 33 00 – Submittals

.2 Division 26 – Electrical

.3 Section 26 29 20 – Variable Frequency Drives

.4 Section 44 00 10 – Process General Requirements

.5 Section 44 05 50 – Process Piping

.6 Section 25 05 01 – Control Panels

1.3 REFERENCE STANDARDS

.1 Conform to the following reference standards in accordance with:

.1 Ontario Building Code (OBC).

.2 Canadian Standards Association (CSA).

.3 American National Standard Institute (ANSI): B-16.5 - Pipe Flanges and Flanged Fittings.

.4 American Society of Mechanical Engineers (ASME): Section VIII, Division 1-: Pressure Vessels Design and Fabrication.

.5 American Wastewater Association (AWWA): C504 - Rubber Sealed Valves.

.6 American Society for Testing Materials (ASTM): A536 - Standard Specification for Ductile Iron Casting, Grade 65-45-12.

.7 Canadian Standards Association, CSA C22.1, Canadian Electrical Code (CEC), Safety Standard for Electrical Safety Installations

1.4 SUBMITTALS

.1 Provide the following information in one complete submittal in accordance with Section 01 33 00.

.1 Manufacturer's data including equipment weight.

.2 Performance curves developed for specified operating conditions indicating relationship between speed, capacity, head, horsepower, and efficiency; indicate the rated operating points on the curve.

.3 Shop drawings, including dimensions and sectional view of equipment and sump arrangement for pipe and access opening showing details of construction, arrangement and installation.

.4 Parts list complete with a list of recommended spare parts.

1.5 SERVICE CONDITIONS

.1 Select and design pumps specifically for continuous and intermittent duty pumping of treated secondary effluent.

.2 The fluid temperature is expected to range from 0°C to 25°C.

.3 Total suspended solids is expected to range from 15 mg/L (average) to 30 mg/L (maximum).

.4 Pumps shall be designed for quiet operation. The desirable maximum sound power level (PWL) shall not exceed 100 dB. The maximum sound pressure level (SPL) of any point one meter from pump shall not exceed 80 kB.

1.6 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into manual specified in Section 01 33 00 – Submittals.

.2 Data to include:

.1 Manufacturers name, type, model, capacity, head, serial number and performance curves.

.2 Mill certifications confirming hardness of rotor.

.3 Applicable operation and maintenance information as specified in Section 01 33 00.

.4 Installation certification form.

.5 Training Certification form.

PART 2 PRODUCTS

2.1 PRODUCTS

.1 Provide products, modified as necessary, to meet the specified features and operating conditions.

.2 Design Standard: The system has been designed around the named supplier. Any alternates to be considered shall fit into the available space. Any design changes to accommodate the alternate equipment shall be the responsibility of the General Contractor.

.3 Acceptable Manufacturers are:

.1 Grundfos

2.2 PUMPS (PWA-PMP-6105, PWA-PMP-6205 AND PWA-PMP-6305)

.1 All pumps shall be ANSI/NSF 61 approved for drinking water.

.2 The pumps shall be of the submersible, vertically mounted, multi-stage design.

.3 The head-capacity curve shall have a steady rise in head form maximum to minimum flow within the preferred operating region. The shut-off head shall be a minimum of 20% higher than the head at the best efficiency point.

.4 Submersible Pumps:

.1 General

.1 The Submersible pump and motor shall be designed for continuous submerged operation.

.2 The pump shall be driven by a motor attached above the pump section.

.3 The pump system shall be Grundfos model 150S75-4 pumps or approved equivalent.

.2 Pump Capacity and Electrical Requirements

.1 Each pump shall have the following characteristics:

.1 Discharge Connection: 75mm

.2 Design duty point: 8 L/s at 42 m TDH.

.3 Minimum Shutoff head: 57m TDH

.4 Minimum overall efficiency at duty point: 58%

.2 The motor shall be:

.1 Maximum Speed: 3450 RPM

.2 Maximum Horsepower: 5.5 kW (7.5 hp)

.3 Power: 575 V/3 ph / 60 Hz.

.4 Suitable for VFD use.

.3 The cable between the motor and service entry shall be at least 10 meter, 600-volt insulation.

.3 Pump Design

.1 Pumps shall be mounted in a vertical flow sleeve designed specifically for the pump by the pump manufacturer. The flow sleeve is intended to induce cooling flow over the pump motor.

.2 There shall be a check valve integrally designed into the pump discharge housing.

.3 The pump shall have integrated protection against upthrust.

.4 The pumping downthrust shall be absorbed by the motor thrust bearing.

.5 Each impeller shall be fitted with a seal ring around its eye or skirt to prevent hydraulic losses.

.6 A filter screen shall be included as part of the suction inlet assembly.

.4 Pump Materials of Construction

.1 The pump bowls, impellers, guide vanes, strainer, and check valve shall be 300 Series stainless steel. The shaft and coupling shall be 300 or 400 Series stainless steel. No moving parts shall be constructed from plastic or other brittle materials.

.2 The intermediate and top bearings shall be Nitrile Rubber (NBR).

.5 Motor Design

.1 The motor shall be a Squirrel-Cage induction motor designed for continuous underwater operation in conformance to NEMA standards.

.2 The motor shall have a Kingsbury-type or Michell thrust bearing capable of carrying the maximum pump thrust loads.

.3 The motor shall be water filled for cooling and lubrication. No oils or grease lubrication shall be used.

.4 A flexible diaphragm shall be provided to permit expansion and contraction of the internal motor fluid when the motor heats and cools during operation.

.5 A shaft seal shall be provided to ensure the internal motor fluid is not mixed with the pumped fluid.

.6 Motor Materials of Construction

.1 The motor diaphragm shall be Nitrile Rubber or Type 100 Hydrin.

.2 The shaft seal shall be a Nitrile Rubber or Type 100 Hydrin.

.3 The motor shall be of 200 or 300 Series stainless steel.

2.3 VARIABLE FREQUENCY DRIVE

.1 VFDs shall be as specified in Section 26 29 20 - Variable Frequency Drives.

.2 VFDs to control each effluent water pumps shall be supplied as part of this section's package.

2.4 PUMP SYSTEM CONTROLLER

.1 The pump system controller shall be a product developed and supported by the pump supplier.

.2 The controller shall be microprocessor based capable of having software changes and updates via personal computer (notebook). The controller user interface shall have a VGA display with a minimum screen size of 3½" x 4-5/8" for easy viewing of system status parameters and for field programming. The display shall have a back light with contract adjustment. Password protection of system settings shall be standard.

.3 The controller shall display the following as status readings from a single display on the controller.

- .1 Current value of the control parameter (Discharge pressure).
- .2 Most recent existing alarm (if any).
- .3 System status with current operating mode.
- .4 Status of each pump with current operating mode and rotational speed as a percentage (%).

.4 The controller shall have as a minimum the following inputs and outputs for connection to the plant SCADA:

- .1 Effluent wet well water level (4-20mA signal).
- .2 Each pump's running status (dry contact).
- .3 Each pump's running speed (4-20 mA signal).
- .4 Each pump's fault status (dry contact).
- .5 System pressure on the discharge manifold (4-20 mA signal).
- .6 System discharge flow (4-20 mA signal).

.5 Pump system programming (field adjustable) shall include as a minimum the following:

- .1 Transducer Settings (Discharge Analog supply/range).
- .2 High system pressure indication and shut-down.
- .3 Low system pressure indication and shut-down.
- .4 Low suction pressure (via digital contact).
- .5 Low suction pressure (via analog signal).
- .6 Discharge flow meter settings (analog 4-20 mA signal).
- .7 Wet well low level pump stop.

.6 The system pressure set-point shall be capable of being automatically adjusted by using an external set-point influence. The set-point influence function enables the user to adjust the control parameter (typically pressure) by measuring an additional

parameter. (Example: Lower the system pressure set-point based on a flow measurement to compensate for lower friction losses at lower flow rates).

.7 The controller shall be capable of receiving a remote analog set-point (4-20mA) as well as a remote system on/off (digital) signal.

.8 The pump system controller shall store up to 24 warning and alarms in memory. The time, date and duration of each alarm shall be recorded. A potential-free relay shall be provided for alarm notification to the plant SCADA. The controller shall display the following alarm conditions:

High System Pressure	Low System Pressure
Low Suction Pressure (warning and/or alarm	Individual Pump Failure
VFD Trip/Failure	Loss of Sensor Signal (4-20mA)
Loss of Remote Set-Point Signal (4-20mA)	System Power Loss

.9 The pump system controller shall be mounted in a NEMA 4 enclosure (NEMA 3R if cooling fan is required). The entire control panel shall be CSA approved. The control panel shall include a main disconnect, circuit breakers for each pump and the control circuit and control relays for alarm functions.

Control panel options shall include, but not be limited to:

Pump Run Lights	Pump Alarm Lights
System Fault Light	Audible Alarm (80 dB [A])
Surge Arrestor	Control Panel Internal Illumination
Emergency/Normal Operation Switches	Service Disconnect Switches

2.5 SEQUENCE OF OPERATION

.1 The system controller shall operate from three equal capacity pumps and three Variable Frequency Drive (VFD) to maintain a constant discharge pressure (system set-point). The system controller shall receive an analog signal [4-20mA] from the discharge installed pressure transducer on the discharge manifold, indicating the actual system pressure. When a flow demand is detected (drop in system pressure) the VFD duty-controlled pump shall start first. As flow demand increases, the speed of the VFD controlled pump shall be increased to maintain the system set-point pressure. When the VFD controlled pump cannot maintain the system set-point as flow increases (pressure starts to drop below system set-point), an additional pump will be started. Then both pumps shall immediately

adjust speed to maintain the system set-point. Additional pumps shall be started as flow demand increases. As flow demand decreases, the pump speed shall be reduced while system set-point pressure is maintained. The system controller shall switch off pumps as required with decreasing flow. The system controller shall be capable of switching pumps on and off to satisfy system demand without the use of flow switches, motor current monitors or temperature measuring devices.

2.6 SYSTEM CONSTRUCTION

.1 A properly sized, bladder expansion tank, be provided under this section for field installation on the discharge manifold.

.2 A pressure transducer shall be supplied under this section for field installed on the discharge manifold. Pressure transducers shall be made of 316 stainless steel. Transducer accuracy shall be ±1.0% full scale with hysteresis and repeatability of no greater than 0.1% full scale. The output signal shall be 4-20 mA with a supply voltage range of 9-32 VDC.

.3 A bourdon tube pressure gauge, 64mm diameter, shall be placed on the suction and discharge manifolds. The gauge shall be liquid filled and have copper alloy internal parts in a stainless-steel case. Gauge accuracy shall be 2.5%. The gauge shall be capable of a pressure of 30% above its maximum span without requiring recalibration.

.4 Effluent Water Pumping System shall be supplied complete with a 304SS guide rail system for the individual pump removal and insertion without dewatering the wet well.

2.7 WARRANTY

.1 The warranty period shall be a non-prorated period of 12 months from date of installation, not to exceed 30 months form date of manufacture on which the Contract is Substantially Performed. [Addendum 01].

2.8 VIBRATION

.1 The pump assembly shall be properly balanced and mounted so that the vibration do not exceed 0.13mm per meter distance above the mounting flange, in the operating speed range.

2.9 TESTING

.1 The standard non-witnessed performance test of the pump units shall be performed at the factory by taking readings at a minimum of five capacity points, including one point at the design capacity specified above (Duty Point) in accordance with the American National Standard for Vertical Turbine Pumps ANSI/AWWA E101, Section A6 - Factor inspection and Tests.

.2 At the conclusion of the test, two certified copies of the test data sheet and the anticipated field performance curve shall be supplied to the Contract Administrator before the equipment is delivered to the site. The acceptance of the pump unit will be based on the achievement of test results satisfactory to the Contract Administrator. If the efficiencies of the pump or drive are more than 3% below that guaranteed, the Owner reserves the right to reject the equipment.

2.10 SPARE PARTS

.1 Provide the following spare parts: 2 sets of all gaskets.

.2 Tag and store spare parts.

PART 3 EXECUTION

3.1 INSTALLATION

.1 General:

.1 Install pumps in accordance with manufacturer's instructions and shop drawings and Hydraulic Institute Standards.

.2 Support pump foundation plates on concrete pads as shown on Drawings.

.3 Set anchor bolts according to specifications prior to placing pump foundation plates. Accurately level plates, bedded in non-shrink grout prior to placing pump base.

.4 Pumps to operate smoothly and quietly and within vibration limits set by Hydraulics Institute.

.2 Lubrication, Grease, Oil and Fuel

.1 Perform the complete initial lubrication of all equipment in accordance with the manufacturer's instructions. Provide all grease, oil, lubricants, etc., as required for the initial operation of the equipment.

.3 Certify proper installation and operation of all components.

3.2 COMMISSIONING

.1 Commission pumping unit in accordance with Section 01 91 13 – Commissioning Requirements.

END OF SECTION

CHEMICAL METERING SYSTEM

PART 1 GENERAL

1.1 DESCRIPTION

.1 This section covers the requirements for the supply, installation and testing for the following equipment, including all associated appurtenances:

.1 Two complete pre-packaged, self-contained, and fully assembled and tested feed equipment skid package for aluminum sulfate solution.

.2 Chemical piping and valves, including secondary containment.

.2 The equipment provided under this section shall be fabricated, assembled, erected, and placed in proper operating condition in full conformity with drawings, specifications, engineering data, instructions, and recommendations of the equipment manufacturer, unless exceptions as otherwise noted by the Engineer.

.3 All material and equipment shall be new, of the best quality and as specified and shown on the drawings. The Contactor shall be responsible for, and shall replace at its own expense, any work and material improperly fabricated or constructed to the satisfaction of the Engineer.

.4 All appurtenances, fittings, and accessories necessary for the proper functioning of all the equipment or reasonably inferable from the drawings shall be supplied and installed with the equipment, whether indicated on the drawings or specified herein, or not.

1.2 RELATED SECTIONS

.1 Section 44 00 10 - General Requirements

.2 Section 44 05 50 - Process Piping

.3 Division 25 – Instrumentation

.4 Division 26 - Electrical

1.3 REFERENCES, CODES AND STANDARDS

.1 American Society of Testing Materials (ASTM).

.1	D638	Tensile Properties of Plastics
.2	D883	Standard Definitions of Terms Relating to Plastics
.3	D1505	Density of Plastics by the Density-Gradient Technique
.4	D1525	Test Method for Vicat Softening Temperature of Plastics
.5	D1693	ESCR Specification Thickness 0.125" F50-10% Igepal
.6	D1998	Standard Specification for Polyethylene Upright Storage Tanks

.7 F412 Standard Terminology Relating to Plastic Piping Systems

.2 ANSI Standards: B-16.5, Pipe Flanges and Flanged Fittings

.3 ARM: Low Temperature Impact Resistance (Falling Dart Test Procedure).

1.4 SITE CONDITIONS

.1 The following site operating conditions shall be assumed for all design calculations:

.1 40°C maximum/+5°C minimum ambient air temperature
.2 30°C maximum/0°C minimum chemical temperature
.3 95% maximum relative humidity (non-condensing)

.2 Chemical tanks and pump skid to be installed indoors in a concrete secondary containment area located in the Operations Building lower level.

.3 Alum dosing location shall be to the following locations:

.1 Alum Metering Fedd Pump Panel ALU-FD-2180
.1 Parshall Flume located in the new Headworks
.2 Primary Clarifiers Splitter Box (not used)
.2 Alum Metering Fedd Pump Panel ALU-FD-2280
.1 Aeration Tank #1 outlet channel (tie-in to existing tubing)
.2 Aeration Tank #2 outlet channel (tie-in to existing tubing)
.3 Secondary Clarifier Splitter Box (tie-in to existing tubing)

.4 Refer to the Contract Drawings for further details.

1.5 CONDITIONS OF SERVICE

.1 Provide equipment and appurtenances suitable for handling 30-60% Aluminum Sulfate Solution with specific gravity 1.3 – 1.35 at 20°C in solution with pH<3.

1.6 SUBMITTALS

.1 In accordance with Section 01 33 00 – Submittals.

.2 The shop drawing submission shall include, but not be limited to, the following:

.1 Dimensional chemical system panel layout.
.2 Pump output curves for each pump.
.3 Basic design details for each piece of equipment, including sizing calculations, control panel layout, control schematics and wiring diagram(s).
.4 Detailed engineering drawings of each tank with port sizes, connections and locations, fittings, accessories, restraints and supports.
.5 Tank and Fitting Material

.1 Resin Manufacturer Data Sheet
.2 Fitting Material
.3 Gasket style and material
.4 Bolt material

.6 Data confirming that the material of equipment is resistant to the chemicals used.

.7 For each major component include the name of Manufacturer, type and model of equipment and net weight.

.8 Descriptions of the materials of construction of the major components. Provide sufficient detail to show the general construction pertinent to the proper review of the equipment.

.9 A precise list of all electrical requirements for the equipment including all controls, monitoring equipment and instruments shall be given including all power characteristics and materials of construction.

.10 The Supplier shall indicate a list of spare parts, which they would recommend be purchased and individual prices for each item.

.11 All ancillary equipment to be provided by the Supplier shall be listed.

.12 Special accessories or tools for the adjustment or removal of parts required for any piece of equipment shall be listed and furnished as part of the supply.

.13 Manufacturer's warranty.

.3 Provide unloading procedure, installation, operations and maintenance data for incorporation into operation manual specified in Section 01 33 00 - Submittals.

PART 2 PRODUCTS

2.1 GENERAL

.1 Provide and install alum chemical metering system as indicated on the Drawings.

.2 Provide two (2) chemical feed system (c/w two pumps each panel) for aluminum sulfate that is capable of operating 24 hours per day 365 days per year.

.3 One (1) high density polyethylene piping panels with fiberglass supports, pre-mounted, pre-piped, pre-wired and 24-hours pressure tested with local and remote control.

.4 Chemical piping and chemical carrier piping for the dosing of aluminum sulfate in the locations identified in this specification and as shown on the Contract Drawings.

2.2 ALUM METERING PUMPS

.1 Alum metering pump requirements:

Feed Pump Panel Tag No.	Pump Qty.	Capacity (L/h) per pump	Discharge Head (m)	Location of Panels	Control Feature
ALU-FD-2180 ALU-FD-2280	2 PER PANEL (4 Pumps Total) (1duty, 1 standby per panel)	Min – 0.075 Max – 75	Max - 100	A2000 Basement	4-20mA control from SCADA, 4-20mA feedback to SCADA

.2 The diaphragm metering pumps will include, but not limited to the following:

.1 Chemical metering pumps shall be Mechanically Actuated Diaphragm, positive displacement, motor driven, metering pump.

.2 Chemical metering pump shall be driven by a microprocessor controlled stepper motor providing a minimum of 1000:1 turndown ratio. The stepper motor is to be coupled to a flat, PTFE diaphragm via a gear assembly. The drive assembly shall be a maintenance free design.

.3 The pump shall operate at 100% stroke length throughout the pumps entire capacity range.

.4 Solenoid-driven pumps, hydraulically actuated diaphragm pumps and those with a lost motion spring return will not be accepted.

.5 The liquid end & valve design shall provide for ease of maintenance. Ball checks shall be cartridge type design.

.6 The pump shall be able to measure actual flow through the head to monitor the dosing process without need for additional measuring equipment.

.3 The enclosure will include, but not limited to the following:

.1 Drive mechanism and microprocessor shall be housed in a corrosion resistant, plastic UV stabilized enclosure.

.2 The pump design shall include provisions for optional positioning of the control interface/display, for right/left side and front mounting.

.3 Pump enclosure rating shall be to IP65 and NEMA 4X standards.

.4 The pump design shall include an integral removable click stop mounting plate, to allow for flat base or wall mounting.

.4 The pump drive will include, but not limited to the following:

.1 The pump's stroke length will always be 100%. No adjustment to the stroke length, to regulate flow, or for other reasons, is acceptable.

.2 An integral variable speed stepper motor shall be used to ensure the pump discharge phase extends throughout the full period between suction intervals.

.3 Variable frequency drives shall not be accepted.

.4 The motor shall be integral, supplied with power cord and plug.

.5 The drive mechanism shall not require regular field service or external lubrication.

.5 The interface will include, but not limited to the following:

.1 User interface/display shall be backlit LCD with selectable on-site positioning for either side or front mounting.

.2 The interface shall provide a selection of metered output to be displayed in liters per hour (l/h) or gallons per hour (gph). Pumps displaying percent (%) of output only will not be accepted.

.3 The interface should include a turn and push knob (click wheel) for easy navigation.

.4 The interface menu shall include 25 language selections and provide easy navigation of all configuration and operational functions.

.5 The interface shall include a lock function to protect against unauthorized changes.

.6 A built in counter shall be included to provide a running total of, accumulated strokes, cumulative hours of operation and dosing flow.

.7 A priming button shall be provided on the interface. The priming button shall initiate a time selectable prime cycle operating at full capacity without need of attenuating the pumps output setpoint.

.8 A system of white, red, yellow and green LCD shall indicate pump status and alarm conditions.

.6 The liquid end will include, but not limited to the following:

.1 The process diaphragm shall be PTFE, PTFE coated diaphragms are not acceptable.

.2 Head and valves body material shall be (PVDF) with (Ceramic) ball material.

.3 Wetted gasket material shall be EPDM.

.4 Suction and discharge valve design shall incorporate double ball arrangement. Spring-loaded valves shall be available as an option. Direction of flow shall be clearly marked on each check valve to ensure correct installation.

.5 Head design shall incorporate integral priming valve.

.6 A back-plate with separation chamber shall have a safety lip seal and drain hole.

.7 Metering Pump Control

.1 Analog: Pump shall include direct interface provisions for analog control. Both direct and reverse acting 0/4-20mA input configurations are to be acceptable inputs. The menu configuration shall permit pump maximum output multipoint scaling. The pump shall include a local alarm for loss of input signal.

.2 Pulse: The pump shall include direct interface provisions for pulse output devices. In pulse control mode, the pump shall be configured to deliver a volume of product per incoming pulse. The pump speed shall attenuate the delivery rate based on the frequency of pulses generated by the external device.

.3 Batch: In batch mode the pump shall respond to deliver a menu configurable quantity of liquid after receiving a remotely provided contact input.

.4 Cycle timer: The configuration menu of the cycle timer shall permit the user to prescribe batch volume, timed sequence start point and the time between each successive timed delivery cycle.

.5 Week timer: The pump shall be equipped with a real-time clock and a seven-day internal week timer. The configuration menu shall permit the user to prescribe up to 16 procedures with batch volume, dosing time, start time and weekdays.

.8 Acceptable suppliers are as follows: Grundfos by SPD Sales, Prominent by SCG Process, or approved equivalent.

2.3 ALUM FEED SYSTEM

.1 The alum feed system shall be provided as a complete system by a supplier with at least five (5) years experience in Municipal chemical dosing systems.

.2 Contractor shall provide all chemical piping, fitting, and valves between chemical system and the identified dosage locations as indicated on the Contract Drawings.

.3 The Contract Process Drawings may not present all chemical piping.

.4 Where the chemical pipe is located outside the concrete containments, it shall be installed with dual containment using clear HDPE piping as second containment.

.5 Provide two (2) aluminum sulfate feed systems, including two (2) metering pumps and accessories pre-mounted on the HDPE chemical panel with fiberglass supports with pump skid and instruments per panel. If bolts are used, stainless steel SS316 must be used. The Contractor shall provide the supports and anchorage in the shop drawing.

.6 Pump accessories pre-mounted on each panel shall include, but not be limited to the following:

.1 One (1) back pressure valve

.2 One (1) pressure relief valve (multifunctional valve from Grundfos)

.3 Isolation ball valves for the pump panel, quantity as per drawings.

.4 One (1) lot of PVC isolation ball valves, tubing and fittings

.7 Accessories supplied loose shall include:

.1 The Manufacturer shall coordinate with the Contractor, the required length for input & output signal cables which shall be supplied by the Manufacturer.

PART 3 EXECUTION

3.1 INSTALLATION AND INSPECTION

.1 The chemical dosing pumps, storage tanks and other chemical system shall be installed as indicated on the Contract Drawings, in accordance with the Manufacturer's recommendations and as approved by the Engineer.

.2 The Contractor shall provide a dual containment clear HDPE pipe where the pipe runs outside the containment in the building.

.3 Prior to start-up, a factory trained service representative employed directly by the Manufacturer shall inspect, operate, test, adjust and troubleshoot the installation. This work will ensure that the equipment has been installed properly, lubricated adequately, checked for soundness and ready to be started.

.4 The factory trained representative, mentioned above, will certify that the equipment is ready for operation before use.

.5 In addition, the factory trained representative shall instruct the owner's operation personnel in the proper operation and maintenance of the equipment supplied.

.6 Provide for additional supervision of installation by equipment Supplier as required.

.7 Arrange with the Contract Administrator a mutually agreeable date when the representative should be on site.

.8 Submit a report, signed by the Manufacturer's representative, describing in detail the inspection, tests, and adjustments made, quantitative results and suggestions for precautions to be taken to ensure proper maintenance. The report must verify that the equipment conforms to all specifications.

.9 Inspection to include checking for:

.1 Cracks and other damaged or defective parts.

.2 Completeness of installation as specified and as recommended by the Manufacturer.

.3 Correctness of setting, alignment and relative arrangement of various parts of the system.

3.2 MECHANICAL TESTING AND CERTIFICATION

.1 After start-up and prior to final acceptance, the Contractor shall conduct Engineer-witnessed performance tests on the equipment.

.1 Prepare calibration curves for each of the pumps at 8 mA through 20 mA flow signals using a minimum of 16 different data points.

.2 Prepare tables to record the test results for each calibration curve. Have table reviewed by the Engineer prior to testing. Submit the results to the Engineer for review.

.3 Conduct the calibration curve testing using the intended design flow rates.

.2 A field service representative will start the chemical dosing pumps to perform all mechanical functions that the pumps are designed to perform. Tests will be scheduled with the Contract Administrator at least two (2) weeks prior to the planned test date.

.3 The factory trained representative shall submit to the Engineer a written report stating that the equipment has been checked and is suitable for operation.

.4 Hydrostatic test: Following installation of storage tanks, including inlet and outlet fittings, shall be hydraulically tested with water by filling to the top sidewall for a minimum of 24 hour and inspected for leaks.

3.3 SUPERVISION OF INSTALLATION AND COMMISSIONING

.1 Test and commission the equipment in accordance with Section 01 91 13 Commissiong Requirements and Section 01 91 23 Equipment Installation and Start Up.

.2 At the completion of satisfactory installation, each unit shall be started by the General Contractor under the supervision of the Supplier and in cooperation with the plant operations staff. All controls and alarms shall be checked and tested to ensure proper control and equipment protection.

.3 Equipment will only be accepted after receipt of a satisfactory report submitted by the Manufacturer's representative(s).

.4 When the installation and operation is satisfactory, the Supplier shall certify in writing to the General Contractor that the unit is available for operation.

.5 Modify or replace equipment or materials failing required tests.

.6 Perform additional testing required due to changes of materials, and/or failure of materials or construction to meet specifications at no extra cost to the Owner.

.7 As a minimum, allow the following:

.1	Installation Inspection	1 trip, 1 day
.2	Startup/Commissioning	1 trip, 2 days

3.4 DELIVERY AND STORAGE

.1 Contractor is to coordinate equipment delivery to construction site with Manufacturer. Unloading and storage prior to installation at site is the responsibility

of the Contractor. Prior to the installation, the chemical dosing pumps and systems and accessories should be protected and stored indoors in a dry area, in accordance with the Manufacturers recommendations.

3.5 MAINTENANCE

.1 Provide maintenance on Supplier's equipment as required by the Supplier from the date of delivery to the initial start-up.

3.6 TRAINING

.1 The manufacturer of the chemical systems shall furnish the services of a competent and experienced operator of the equipment, who is directly employed by the manufacturer, to instruct the Owner's operating personnel in the proper operation and maintenance of the equipment. In accordance with Section 01 91 41 - Commissioning Training.

3.7 WARRANTY

.1 Each unit shall be new and shall carry the full Manufacturer's warranty on parts, service, and performance. The warranty shall include replacement of all defective equipment and shall extend two (2) years beyond date of completion.

.2 Corrective Work. Any location where corrosion is evident shall be considered a failure of the material or the protection system. Before starting corrective work, the Manufacturer shall submit to the Engineer for review an analysis of the cause of the failure and details of the proposed corrective work. The Manufacturer shall make repairs acceptable to the Engineer at all points where failures are observed within the Warranty Period.

.3 Inspection. Each unit shall be inspected at the end of the warranty period by representatives of the Owner, the Engineer, and the Manufacturer to identify any failures that may have occurred. The Manufacturer shall establish the date of each inspection and shall notify the Owner at least 30 days in advance. The scheduled inspection shall not relieve the Manufacturer from the obligation to perform corrective work whenever needed.

.4 The Manufacturer shall prepare and deliver to the Owner an inspection report covering each inspection, indicating the number and type of failures observed, material and part where materials have failed, the percentage of the surface area where corrosion protection system failure has occurred, and the names of the persons making the inspection. Colour photographs illustrating each type of failure shall be included in the report.

END OF SECTION

AUTOMATIC REFRIGERATED SAMPLER

PART 1 GENERAL

1.1 WORK OF THIS SECTION

.1 The work of this section includes providing an automatic refrigerated wastewater samplers and all necessary piping, pumps, connections, controls, mounts, valves, motors, and appurtenances, complete and operable.

1.2 RELATED SECTIONS

.1 Section 01 33 00 – Submittals

.2 Section 01 91 13 – Commissioning Requirements

.3 Section 01 91 33 – Commissioning Forms

.4 Section 01 91 41 – Commissioning Training

1.3 SUBMITTALS

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

1.4 COMMISSIONING AND TRAINING

.1 Commissioning, Training and closeout documents are to be carried out in accordance with Sections 01 91 13, 01 91 33, and 01 91 41.

1.5 SYSTEM DESCRIPTION

.1 Performance Requirements

.1 Sample cooling: maintain sample liquid at 4°C (39°F) in ambient temperature to 50°C (122°F) maximum; accurate to ±0.8°C (±1.5°F).

.2 Sample volume: programmable in 10 mL increments from 10 to 10,000 mL. Sample volume repeatability ±5% of 200 mL sample volume with: 4.6 m (15 ft.) vertical lift, 4.9 m (16 ft.) of 3/8- in vinyl intake tube, single bottle, full bottle shut-off at room temperature and 1524 m (5000 ft.) elevation.

.3 Pacing intervals: selectable in single increments from 1 to 9,999 flow pulses or 1 to 999 hours in 1 minute increments. Accepts 4-20mA input from an external device to pace the sampler.

.4 Vertical lift: 8.5 m (28 ft.) using 8.8m (29 ft.) maximum of 3/8-in. vinyl intake tube at sea level at 20 to 25°C (68 to 77°F).

.5 Sample volume accuracy: ±5% of 200 mL sample volume with: 4.6 m (15 ft.) vertical lift, 4.9 m (16 ft.) of 3/8- in. vinyl intake tube, single bottle, full bottle shut-off at room temperature and 1524 m (5000 ft.) elevation.

.6 Sample transport velocity: 0.9 m/s (2.9 ft./s) at 4.6 m (15 ft.) vertical lift (16 ft. of 3/8-in. vinyl intake tubing at 70°F at 5000 ft. elevation).

.7 Pump flow rate: 4.8 L/min (1.25 gpm) at 1 m (3 ft.) vertical lift with 3/8-in intake tube typical.

1.6 CERTIFICATIONS

.1 Controller: CE/CSE

.2 Cabinet: UL/CSA/CE

1.7 ENVIRONMENTAL REQUIREMENTS

.1 Operational Criteria

.1 Ambient operating temperature with controller compartment heater: 5 to 50 °C.

.2 Headworks Influent Sampler: Class 1 Division 1 Group D.

.3 UV Effluent Sampler: Unclassified.

PART 2 PRODUCTS

2.1 AUTOMATIC SAMPLER

.1 The automatic sampler shall consist of a controller and all weather refrigerator.

.2 Tubing:

.1 Pump tube: 0.95 ID x 0.16 OD cm (3/8 ID x 5/8 in. OD)

.2 Intake tube: 9.5 mm (3/8 in.) ID vinyl or Teflon® lined polyethylene 25 ft. lengths

.3 Weighted strainer constructed of 316 stainless steel and Teflon

.3 The controller housing of the automatic sampler shall be submersible, watertight, dust-tight, corrosion- and ice-resistant to NEMA 4X, 6, IP68 standards.

.4 The Graphics Display shall be 1/4 VGA, Color; self-prompting/ menu-driven program.

.5 The desiccant cartridge, which prevents moisture from accumulating inside the controller electronics area, shall be visual and accessible externally from the side of the controller; the replacement of the desiccant shall not require tools or disassembly of controller from base.

.6 The pump shall use spring loaded rollers and be accessible by a clear hinged cover with single thumbscrew.

.7 The Refrigerated cabinet shall be insulated with 3-inch rigid foam insulation on the walls, 6 inches on the bottom and 5 inches on top. The cover for the controller compartment shall also be insulated.

.8 The cabinet shall have a heavy-duty compressible gasket on controller compartment lid, compressor compartment lid and refrigeration compartment door.

.9 The refrigeration components and copper plumbing shall be corrosion protected with conformal coating.

.10 The thermal control system shall be digital microprocessor-based and responds to a system of temperature sensors that continually monitor the evaporator plate, controller compartment air temperature, and refrigerated compartment air temperature.

.11 An air sensing thermostat shall be capable of maintaining sample liquid within specified limits.

.12 The power requirement is 115 Vac, 60 Hz.

.13 The sampler shall be equipped with the following communication protocol:

.1 USB and RS485 (Modbus)

.14 The membrane switch keypad user interface shall be self-prompting/menu driven program with 2 multiple function soft keys.

.15 Sampling pacing modes shall include Time Weighted, Flow Weighted, Time Table, Flow Table, and Event.

.16 Internal software shall be protected by a 7 amp fuse.

.17 Diagnostics: View event and alarm logs.

.18 A program lock shall be provided for access code protection to prevent tampering of program and system settings.

.19 The sampler shall be configured for composite sampling, and shall be equipped with a 5.5 gallon sample bottle and full bottle shut-off control.

.20 Sampling features are to include:

.1 Dual programming: Up to 2 sample programs can be run sequentially, in parallel, or according to day of week scheduling; enabling a single sampler to function like multiple samplers

.2 Cascade sampling: for two samplers in combination—the first sampler, at the completion of the program, initiates the second.

.3 Status Screen: Communicates what program is running, if there are any missed samples, when the next sample will be taken, how many samples remain, number of logged channels, time of last measurement, memory available, number of active channels, if alarms were triggered, when alarms were triggered, active sensors and cabinet temperature

.21 Datalogging

.1 Sample History: Stores up to 4000 entries for sample time stamp, bottle number and sample status (success, bottle full, rinse error, user abort, distributor error, pump fault, purge fail, sample timeout, power fail and low main battery)

.2 Measurements: Stores up to 325,000 entries for selected measurement channels in accordance with the selected logging interval

.3 Event Log: Stores up to 2000 entries. Records Power On, Power Fail, Firmware Updated, Pump Fault, Distributor Arm Error, Low Memory Battery, Low Main Battery, User On, User Off, Program Started, Program Resumed, Program Halted, Program Completed, Grab Sample, Tube Change Required, sensor communication errors, cooling failed, heating failed, thermal error corrected

.22 Automatic shutdown modes:

.1 Multiple bottle mode: after complete revolution of distributor arm (unless continuous mode is selected).

.2 Composite mode: after preset number of samples have been delivered to composite container, from one to 999 samples, or upon full container.

.23 Sample distribution modes include single bottle composite, multi-bottle composite, multi-bottle discrete, bottles per sample, samples per bottle or a combination of bottles per sample and samples per bottle

.24 The sample collection cycle is optionally repeated from one to three times if a sample is not obtained on the initial attempt.

.25 Controller to be able to receive 0/4 – 20 mA signal from external instruments and be equipment with four low voltage, contact closures and four relay controlled by alarms

.26 Standard equipment shall include:

.1 Controller: high impact injection-molded ABS/PC plastic

.2 All weather cabinet: linear low density polyethylene with UV-inhibitors

.3 Pump enclosure: corrosion-resistant polycarbonate door, high impact-resistant plastic, polyphenylene sulfide track complete with heating elements to prevent the sample bottles and tubing from freezing, capable of maintaining a 5°C internal temperature with a minimum external temperature identified above.

.4 Intake strainers in standard size, high velocity, or low profile for shallow depth applications. All 316 stainless steel.

.5 Exterior dimensions shall not exceed 51” H x 30” W x 32” D.

.6 Controller compartment heater

.7 Bottle kits

.8 20m of 3/8” ID, 5/8” OD medical grade silicone suction line with stainless steel strainer and quick release stainless steel coupling.

.9 AC battery back up

.10 Cables and interfaces (as required for programming and/or data acquisition

.11 Anchor brackets

2.2 MODE OF OPERATION

.1 The sampler is to be set up as a composite sampler and programmed to take one 24-hour sample every week using an integrated signal with the SBR discharge sequencing programmer.

.2 Timing of sample is to be programmable on date and time of day.

2.3 STANDARD OF ACCEPTANCE

.1 Hach Model AS950, All-Weather Refrigerated Sampler including refrigerated sampler complete with sampler controller, transition assembly, refrigerated assembly, bottle tray, composite bottle, intake tubing and strainer.

PART 3 EXECUTION

3.1 INSTALLATION AND COMMISSIONING

.1 Install sampler and accessories in accordance with Section 44 05 00 and this specification.

.2 Install sampler and accessories in accordance with manufacturer's recommendations

.3 Provide training and commissioning in accordance with Division 1.

END OF SECTION

PARSHALL FLUME

PART 1 GENERAL

1.1 SUMMARY

.1 This section includes the provision and installation of Parshall Flumes.

1.2 RELATED SECTIONS

.1 The work of the following sections applies to this Section, those referenced below and others required for proper performance of this work.

.1 Division 25 and 26

1.3 REFERENCES

.1 ASTM D 638 – Standard Test Method for Tensile Properties of Plastics.

.2 ASTM D 790 – Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

.3 ASTM D 1941-91(2001) – Standard Test Method for Open Channel Flow Measurement of Water with the Parshall Flume

.4 ASTM D 2583 – Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor.

.5 ISO 9826-92 – Measurement of Liquid Flow in Open Channel – Parshall and SANIIRI Flumes.

.6 United States Department of the Interior, Bureau of Reclamation, Water Measurement Manual.

1.4 SUBMITTALS

.1 Shop Drawings:

.1 The following shall be submitted in compliance with Section 01 33 00:

.2 Product Data: Test results of representative fiberglass reinforced plastic laminate.

.3 Shop Drawings:

.1 Critical dimensions, jointing and connections, fasteners and anchors.

.2 Materials of construction.

.3 Sizes, spacing, and location of structural members, connections, attachments, openings, and fasteners.

.4 Samples: 8-inch square sample of representative fiberglass reinforced plastic laminate.

.5 Manufacturer’s installation instructions.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Store products indoors or in weather protected area until installation. Protect from construction traffic and damage.

PRODUCTS

1.6 MANUFACTURER

.1 The product shall be manufactured by TRACOM, Virtual Polymer Compounds (VPC), or Open Channel Flow (OCF).

.2 Warranty: Flumes shall be warranted to be free of defects in workmanship and materials for a period of two years from substantial performance.

1.7 PARSHALL FLUMES

.1 Flume Type: Provide flumes of the following types:

.2 Size: 457.2mm (18 inch).

.3 Construction:

.1 One-piece construction. Plus the additional wingwalls.

.4 Materials:

.1 Fiberglass reinforced plastic.
.2 Gloss inside surfaces, free of irregularities.
.3 Minimum 3/16 inch wall thickness.
.4 Minimum 30% glass by weight.
.5 Isophthalic polyester resin.
.6 .Removable pultruded fiberglass bracing at top of flume with T-304 stainless steel hardware.
.7 2 inch (minimum) top and end stiffening flanges.
.8 Molded-in stiffening ribs, maximum 12 inch center to center spacing.
.9 15 mil Isophthalic U.V. resistant gel coat on all surfaces, white interior, grey exterior.
.10 Anchor clips, pre-drilled with a 3/4 inch hole, pultruded fiberglass construction.
.11 Tensile strength (ASTM D 638): 14,000 PSI.
.12 Flexural strength (ASTM D 790): 27,000 PSI.
.13 Flexural modulus (ASTM D 790): 1,000,000 PSI.
.14 Barcol hardness (ASTM D 2583): 50.

.5 Laminated, high visibility staff gauge:

.1 Graduated in 2mm increments.

.6 Ultrasonic mounting bracket:

.1 Horizontally and vertically adjustable stainless steel.

.2 2 inch NPT coupling for ultrasonic mounting bracket (bracket by others).

.7 End Connections:

.1 Inlet and outlet wingwalls (45 degree angle type or as recommended by the manufacturer for the channel).

EXECUTION

1.8 EXAMINATION

.1 Verify that the flume dimensions are correct and project conditions are suitable for installation. Do not proceed with installation until condition deficiencies have been corrected.

1.9 INSTALLATION

.1 Install products in accordance with engineer's instructions, plans, blueprints, etc.

.2 Ensure that the product is installed plumb and that the upstream floor is level.

.3 Set the flume at the elevation indicated on the design drawings.

.4 Embed the flume in concrete; pour concrete in maximum 6 inch lifts; internally line and brace the flume as necessary to ensure bowing or distortion does not occur.

.5 For additional installation instructions refer to the Flume supplier.

1.10 ADJUST AND CLEAN

.1 Clean surfaces in accordance with the manufacturer's instructions.

.2 Remove trash and debris, and leave the site in a clean condition.

END OF SECTION

PRESELECTED EQUIPMENT

PART 1 GENERAL

1.1 DEFINITIONS

.1 Preselected Equipment Supplier: The party under separate contract with the Contract Administrator to furnish the Products or special services specified herein.

.2 Preselected Equipment Suppliers:

.1 Headworks Screening and Vortex Grit Removal: Claro Environmental Technologies

.2 UV Disinfection Equipment: Trojan Technologies

.3 [P1] Biosolids Storage Tanks: Greatario

.3 Tender Documents, Drawings/Contract Drawings means all documents, specifications, plans, profiles, drawings, sketches or copies thereof, used or prepared for, or in connection with, the Work and are included in the Contract Documents as Appendices clearly labeled and identified.

.4 Preselected Equipment Contracts: Purchase Agreements with Preselected Equipment Suppliers that include the services specified herein and Novated by the Contractor.

.5 Preselected Equipment and Systems: Equipment, structural platform systems, electrical and instrumentation systems supplied by the Preselected equipment Supplier and installed by the Contractor

.6 Preselected Engineering Services: Design of piping systems and electrical and instrumentation systems by the Preselected equipment Supplier that are to be supplied and installed by the Contractor.

.7 Preselected Equipment Supplier Drawings: Shop drawings and design drawings provided by the Preselected Equipment Supplier, these are also included in the Contract Documents as an Appendix.

1.2 REFERENCES

.1 All sections of this contract Divisions 01 through 44.

.2 Section 44 50 10 – Screening and Vortex Equipment

.3 Section 44 50 50 – UV Disinfection

.4 Section 44 50 60 – Biosolids Storage Tank

1.3 INTENT

.1 This Section covers the review of Preselected Equipment Supplier drawings; receipt of equipment direct delivery from the Preselected Equipment Suppliers storage; installation; commissioning of all Preselected equipment; and, provision and installation of various process piping, electrical and instrumentation systems designed by the Preselected Equipment Suppliers.

.2 In general, the Preselected Equipment Supplier will provide the following work:

.1 Prepare and deliver Preselected Equipment Supplier Drawings.

.2 Design and fabricate the specified Preselected equipment as per consultant pre-selection specifications.

.3 Design of various process piping, electrical and instrumentation systems

.4 Arrange and pay for delivery of Preselected equipment and material to the Site and/or the Contract Administrator's storage facilities, as instructed by the Contract Administrator/Consultant.

.5 Maintain equipment in accordance with its own instructions and recommendations prior to delivery to the Site and/or the Contract Administrator's storage facilities.

.6 Provide written instructions and recommendations for unloading/handling, long term storage, and maintenance of equipment.

.7 Deliver bill of materials to the Contract Administrator.

.8 Inspect deliveries jointly with the Contract Administrator, the Consultant and the Contractor.

.9 Supervision of unloading of Preselected equipment.

.10 Complete shop tests and Certified Factory Acceptance Testing and arrange for the Contract Administrator/Consultant to witness tests.

.11 Complete the PLC software programming required to achieve full operation of automatic equipment, where specified.

.12 Calibrate instruments and submit calibration certificates of instruments supplied as part of the Preselected package.

.13 Provide written instructions and recommendations for assembly and installation.

.14 Supervise and certify the installation of Preselected equipment, various process piping, field devices and instruments.

.15 Assist with startup and commissioning of Preselected packages.

.16 Provide operator training prior to equipment operation and services during the warranty period.

.17 Correct Preselected equipment deficiencies where applicable and with direction of original equipment manufacturer, as identified by the Contract Administrator.

.18 Prepare and submit equipment operation and maintenance manuals.

.19 Prepare and submit electronic copies of the PLC application programs with documentation.

.20 Supply tools and spare parts.

.3 In general, the Contractor shall provide the following Work:

.1 Review all Preselected Equipment Supplier Drawings provided by each Preselected Equipment Supplier and compare. It should be noted that the Supplier' shop drawings have been pre-purchased.

.2 Plan and coordinate equipment delivery from the Contract Administrator's storage or from the Preselected Equipment Supplier, where the delivery date is scheduled during construction.

.3 Plan and coordinate receipt of Preselected equipment at Site.

.4 Inspect deliveries jointly with the Contract Administrator, the Consultant and the various Preselected Equipment Suppliers.

.5 Review Preselected Equipment Suppliers' bills of materials and notify the Contract Administrator of any discrepancies with the reviewed shop drawings or problems anticipated in the installation of the equipment.

.6 Handle Preselected equipment and material including receiving, unloading, uncrating and on-Site storage before installation in accordance with the Preselected Equipment Supplier's instructions and directions.

.7 Maintain Preselected equipment in accordance with the Preselected Equipment Supplier's instructions and directions until installation and commissioning.

.8 Install Preselected equipment, piping, instruments, field devices and control panels, including components shipped loose, in accordance with the Preselected Equipment Supplier's reviewed shop drawings and installation instructions.

.9 Supply and install field wiring to ensure a complete and fully functional system.

.10 Supply and install power to Preselected equipment and field devices to ensure a complete and fully functional system.

.11 Plan and coordinate supervision of installation, inspection, testing, commissioning, training and other services provided by the Preselected Equipment Suppliers.

.12 Assist with testing, startup and commissioning of Preselected equipment.

.13 Correct any installation deficiencies identified by the Contract Administrator/Consultant and/or the Preselected Equipment Suppliers.

.14 Provide warranty services for the installation of Preselected equipment.

1.4 PRESELECTED EQUIPMENT

.1 The Contractor shall review the Preselection contract documents and drawing submittals, to determine the exact extent of the Work required to install the Preselected Equipment. Refer to the Appendices to the Specifications for the Preselected Contracts and drawing submittals.

.2 The Contractor shall take directions from the Preselected Equipment Suppliers regarding the intricacies of installations, the extent of Work required, and coordination requirements.

.3 The costs for the preselected equipment have been secured and letters of intent have been attached in the Appendices. The Contractor shall carry the costs of the preselected equipment in the Tender price.

.4 The Contractor shall plan and coordinate the following:

.1 Equipment delivery from the Preselected Equipment Suppliers and on-Site storage of equipment upon its delivery.

.2 Inspection of equipment deliveries, testing, commissioning, training and other field services provided by Preselected Equipment Suppliers.

1.5 SUBMITTALS

.1 The Supplier shop drawings have been pre-purchased. The Contractor shall be responsible to review and re-submit the shop drawings included in Appendices of this contract to ensure that the design and shop drawings match.

.2 Show the layout, location, and identification of materials and equipment provided by the Contractor for installation of Preselected Products.

PART 2 PRODUCTS

2.1 EQUIPMENT

.1 All materials and equipment as per System #1 & System #2 – Quotation as modified by addendums are to be supplied F.O.B. construction site.

.2 The contractor shall refer the equipment preselection specification for the equipment manufacturer’s product responsibilities.

PART 3 EXECUTION

3.1 INSTALLATION - GENERAL

.1 The Contractor shall install Products in conformance with the Preselected Equipment Supplier‘s Product shop drawings, design drawings, installation instructions and on-Site supervisors’ directions.

.2 The Contractor shall obtain verification that all Preselected equipment has been installed in accordance with the Manufacturer’s instructions and documentation from the Supplier. Refer to the Manufacturer’s Certificate of Proper Installation.

.3 The Contractor shall provide all interconnecting structures, equipment, piping complete with fittings, manual valves and electrical power and wiring, conduits,

instrumentation, finish painting and accessories required for the components of the Preselected Equipment Supplier's equipment to be installed with the equipment provided under the contract. The Contractor shall verify with each Preselected Equipment Supplier what is being supplied by the Supplier and what is to be provided by the Contractor for a complete and functional system. The Contractor shall refer to the Preselected Equipment Suppliers' shop drawings and design drawings found in the Appendices to the Contract Documents.

.4 The Contractor shall provide foundation pads for the Preselected Equipment as shown on the Contract Drawings including the Preselected Equipment Supplier Drawings. Verify the exact dimensions and configuration of all pads, including penetrations, with the Preselected Equipment Suppliers' Product drawings.

.5 Anchor Bolts:

.1 Where not provided by the Preselected Equipment Supplier, the Contractor shall provide anchor bolts, fasteners, washers, and templates needed for the complete installation of the Preselected Equipment.

.2 The Contractor shall size and locate anchor bolts in accordance with the Preselected Equipment Supplier's Product drawings and installation instructions.

.3 The Contractor shall supply the anchor bolt pattern templates and install the anchor bolts both in existing and new concrete slabs.

.6 The Contractor shall properly align, plumb and level, with no stresses on connecting piping or conduit, the Owner's Preselected equipment.

.7 The Contractor shall verify the correct installation of all Preselected electrical installation prior to starting up any electrical equipment including but not limited to direction of motor rotation before starting equipment drives.

.8 The Contractor shall verify the operability and safety of the electrical system needed to operate Preselected Equipment. Check the electrical system for continuity, phasing, grounding, and proper functions.

.9 Unloading, equipment, installation, start-up and commissioning of equipment to be as per manufacturer's specifications, instructions, and as per approved shop drawings.

.10 Provide all connections, fittings, piping, valves, power and control wiring, electrical and instrumentation equipment, etc. to render the systems complete and operational.

3.2 CONTORLS AND INSTRUMENTATION

.1 Collect and file all test reports that are provided with each instrument and submit to Consultant as on arrival of each instrument. The Contractor shall advise the Consultant of any missing instrument test report.

.2 In the event of damage to instrument and/or control panels during shipment report the details of such damage to Consultant and the Preselected Equipment Suppliers.

.3 Install instruments and control panels as shown in installation detail drawings supplied by the Supplier and the Contract Drawings

.4 Provide or Site fabricate instrument pipe stands/brackets for all standalone type installation.

.5 Provide concrete plinth for floor mounted panels and make arrangements for cable entry in coordination with panel shop drawing.

.6 Install instruments and provide impulse tubing, Instrument isolation valves and associated fittings in accordance with instrument installation details. Provide signal and power supply cables as required.

.7 Provide cable tags and wire numbers as specified in the Contract Drawings and Documents.

.8 Provide local electrical power ON/OFF switch for field instruments requiring 120 V AC power supplies.

.9 Configure/setup all transmitters/indicators.

.10 Conduct loop test for all loops (Analog and Digital). Submit loop test report using sample loop test report provided.

.11 Analog loops shall be tested using 4-20 mA signal generator with values recorded at 0, 25, 50, 75, and 100 percent of span, rising and falling. The loop shall include field transmitter/indicator, cable, PLC and HMI.

.12 Where instruments are found defective or out of calibration the Contractor shall inform the Preselected Equipment Supplier and the Consultant. Upon receipt of authorization from the Preselected Equipment Supplier remove the instrument by disconnecting associated cables/impulse tube and return the instruments to the Preselected Equipment Supplier. Once the repaired instrument has been reinstalled by the Contractor, the Contractor shall carry out necessary steps to make the instrument ready for loop check.

.13 The Contractor shall coordinate the installation, the placing and location of system components, their connections to the process equipment panels, cabinets and devices, under the direction of the Preselected Equipment Supplier. Contractor shall be responsible to insure that all field wiring for power and signal circuits are correctly done and provide for all necessary system grounding to insure a satisfactory functioning installation. The Contractor shall schedule and coordinate work under this Section with that of the electrical work specified under applicable Sections of Division 16 – Electrical.

.14 Submit reports as listed below and as per the Electrical Common Work Requirements Specification 26 05 00.

.1 System Problem Report
.2 Sample I/O Test Report
.3 Loop Status Report
.4 Instrument Calibration Report
.5 I & C Valve Adjustment Sheet
.6 Performance Test Sheet
.7 Reliability Test – Repair Report

3.3 FIELD FINISHING

.1 Products will be delivered with prime and finish coat(s) applied.

.1 The Contractor shall touch up or repair damage to coatings resulting from handling, storage, installation, testing, and startup.
.2 If finish coats are damaged extensively after transfer, the Contractor shall completely repaint.
.3 The Contractor shall touch up, repair, or complete the repainting to match the colour of the original paint, and the paint used shall be fully compatible with applied primers and finish.

3.4 PRODUCT PROTECTION

.1 Immediately after installation, until substantial performance of the Work, the Contractor shall lubricate components in accordance with the Preselected Equipment Suppliers' instructions.

.2 The Contractor shall follow the Preselected Equipment Suppliers' instructions for protection and maintenance during storage, and after installation until the date of Substantial Performance.

.3 The Contractor shall furnish incidental supplies including lubricants, cleaning fluids, and similar products as needed for protecting and maintaining the Preselected Equipment Suppliers' Products.

3.5 TEST AND INSPECTION

.1 The Contractor shall assist the Preselected Equipment Suppliers in performing tests and inspections of installed Products in accordance with the requirements shown herein, Section 01 91 13 – Commissioning Requirements, and the Preselected Equipment Suppliers' instructions.

END OF SECTION

PART 1 GENERAL

1.1 REFERENCE

.1 Appendix H – Ingleside WWTP Upgrades Phase 1, quotation Documents for supplying, delivering and commissioning pre-selected equipment systems – System #1 & 2 – Screening and Vortex Grit Removal Equipment.

.2 The contractor shall novate the purchase agreement between the Owner (Township of South Stormont) and the equipment supplier (Claro Environmental Technologies). Via the Novation agreement the contractor will become responsible for the equipment purchase agreement, installation and commissioning of the equipment.

1.2 PRE-SELECTED EQUIPMENT

.1 Claro Environmental Technologies & Equipment has been pre-selected to supply, deliver and commission the Fine Screening Equipment and the Vortex Grit Removal Equipment as per the preselection specification documentation included Appendix H. Contractor shall contact Pro Aqua Inc. (Scott Lenhardt, scott@proaquasales.com, 905-330-9244) the representative of the equipment manufacturer Claro Headworks equipment (Peter Lipert Jr., pjr@claroglobal.ca, 1-514- 562-4575) to obtain a final quotation price and delivery period, and to verify and confirm the materials, equipment and commissioning services that will be supplied as per their preselected equipment obligations. The quotation and delivery period for the above-mentioned equipment is to be entered in the Form of Tender of the General Contract in the "Schedule of Pre-Selected Equipment".

1.3 APPROVALS

.1 Equipment and materials to be CSA certified. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from Electrical Inspection Department prior to installation of equipment.

.2 Factory assemble control panels and component assemblies.

1.4 SUBMITTALS

.1 Provide Shop Drawings stamped by a Professional Engineer licensed to practice in the Province of Ontario.

.2 Shop Drawings shall be provided in digital platforms that can be imported into Revit or Solidworks for use during the detailed design.

.3 Complete assembly and installation drawings, together with wiring diagrams, detailed specifications, and data covering materials used, parts, devices, and other accessories forming a part of the equipment furnished, shall be submitted in accordance with Division 01 Specifications.

.4 Electrical connection diagrams and schematics identifying all items requiring electrical control or power for operation of the equipment shall be submitted for review. Submittals shall verify each applicable feature in this specification.

.5 The data and specifications for each unit shall include, but shall not be limited to, the following:

.1 Catalogue cuts or equipment data sheets showing Equipment Supplier's complete descriptive information and product literature, Equipment make and model, materials of construction.

.2 Dimensioned drawings for each process unit and accessories (General Arrangement Drawings), showing plans, elevation and appropriate cross sections of the complete process unit, including recommended location of local control panels, any lifting locations and type, materials of construction, overall weights, weights of largest components requiring removal for maintenance, clearance required around unit for maintenance access.

.3 Installation Instructions specific to the project.

.4 Drawings indicating all structural connections, clearances to structures and indicate loads transferred through connections.

.5 Process Control Narrative for the proposed control system, which shall detail operation mode, control strategy, default parameter setting and alarms. Operating description for the local control panel covering all logic and sequences of operation.

.6 Electrical requirements and all electrical and mechanical components, including catalogue data on ancillary electrical components including limit switches.

.7 Data indicating range and required setting of indicators, instruments, timers and other related devices.

.8 Submit Equipment Testing and Commissioning Plan, and Operating and Maintenance Manual, specific to the project, including the recommended procedures for off-loading, handling and storage of equipment until installed, lubrication, trouble-shooting guide, and safety issues.

.6 Distribution of supplied information:

.1 Upon notification of the award, the successful proponent shall prepare and submit, within the time period identified in the submittal forms, the above listed documents to the owner's representative for review and integration in the detailed design. The successful supplier shall provide a single technical contact person who will be available to provided detailed design recommendations.

1.5 STANDARDS

.1 All equipment and materials in accordance with the latest issue of all appropriate Standards and Codes, including, but not limited to the following:

.1 AFBMA - Load Ratings and Fatigue Life for Ball Bearings

.2 AGMA – American Gear Manufacturer's Association

.3 ANSI – American National Standards Institute
.4 ASME – American Society of Mechanical Engineers
.5 ASTM – American Society for Testing and Materials
.6 CEC – Canadian Electrical Code
.7 CEMA – Canadian Electrical Manufacturers Association
.8 CSA – Canadian Standards Association
.9 CWB – Canadian Welding Bureau
.10 IEC – International Electrotechnical Commission
.11 NEC - National Electrical Code
.12 NEMA – National Electrical Manufacturer's Association
.13 NFPA – National Fire Protection Association
.14 NFPA – National Fluid Power Association
.15 OSHA – Occupational Safety and Health Administration
.16 SSPC – Steel Structures Painting Council
.17 UL (cUL) – Underwriter's Laboratories Inc.

PART 2 PRODUCTS

2.1 EQUIPMENT

.1 All materials and equipment as per System #1 & System #2 – Quotation as modified by addendums are to be supplied F.O.B. construction site.

.2 The contractor shall refer the equipment preselection specification for the equipment manufacturer's product responsibilities.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Unloading, equipment, installation, start-up and commissioning of equipment to be as per manufacturer's specifications, instructions, and as per approved shop drawings.

.2 Provide all connections, fittings, piping, valves, power and control wiring, electrical and instrumentation equipment, etc. to render the systems complete and operational.

3.2 START-UP AND COMMISSIONING

.1 Complete the start-up and commissioning as per the requirements of Division 01 of this contract.

END OF SECTION

ULTRA-VIOLET DISINFECTION SYSTEM

PART 1 GENERAL

1.1 REFERENCE

.1 Appendix H – Ingleside WWTP Upgrades Phase 1, quotation Documents for supplying, delivering and commissioning pre-selected equipment systems – System #5 – Ultra-Violet Disinfection System.

.2 The contractor shall novate the purchase agreement between the Owner (Township of South Stormont) and the equipment supplier (Trojan Technologies). Via the Novation agreement the contractor will become responsible for the equipment purchase agreement, installation and commissioning of the equipment.

1.2 PRE-SELECTED EQUIPMENT

.1 Trojan Technologies has been pre-selected to supply, deliver and commission the Ultra-Violet Disinfection System as per the quotation document in Section 10 including all addendums listed hereafter. Contractor shall contact H2Flo (Yianni Siamandouros, yianni@h2flow.com, 1-416-835-8851) the representative of the equipment manufacturer Trojan Technologies (Rob Jansen, rjansen@trojanuv.com, 519-457-3400) to obtain a final quotation price and delivery period, and to verify and confirm the materials, equipment and commissioning services that will be supplied as per this quotation. The quotation and delivery period for the above-mentioned equipment is to be entered in the Form of Tender of the General Contract in the "Schedule of Pre-Selected Equipment".

1.3 APPROVALS

.1 Equipment and materials to be CSA certified. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from Electrical Inspection Department prior to installation of equipment.

.2 Factory assemble control panels and component assemblies.

1.4 SUBMITTALS

.1 Provide Shop Drawings stamped by a Professional Engineer licensed to practice in the Province of Ontario.

.2 Shop Drawings shall be provided in digital platforms that can be imported into Revit or Solidworks for use during the detailed design.

.3 Complete assembly and installation drawings, together with wiring diagrams, detailed specifications, and data covering materials used, parts, devices, and other accessories forming a part of the equipment furnished, shall be submitted in accordance with Division 01 Specifications.

.4 Electrical connection diagrams and schematics identifying all items requiring electrical control or power for operation of the equipment shall be submitted for review. Submittals shall verify each applicable feature in this specification.

.5 The data and specifications for each unit shall include, but shall not be limited to, the following:

.1 Catalogue cuts or equipment data sheets showing Equipment Supplier's complete descriptive information and product literature, Equipment make and model, materials of construction.

.2 Dimensioned drawings for each process unit and accessories (General Arrangement Drawings), showing plans, elevation and appropriate cross sections of the complete process unit, including recommended location of local control panels, any lifting locations and type, materials of construction, overall weights, weights of largest components requiring removal for maintenance, clearance required around unit for maintenance access.

.3 Installation Instructions specific to the project.

.4 Drawings indicating all structural connections, clearances to structures and indicate loads transferred through connections.

.5 Process Control Narrative for the proposed control system, which shall detail operation mode, control strategy, default parameter setting and alarms. Operating description for the local control panel covering all logic and sequences of operation.

.6 .Electrical requirements and all electrical and mechanical components, including catalogue data on ancillary electrical components including limit switches.

.7 Data indicating range and required setting of indicators, instruments, timers and other related devices.

.8 Submit Equipment Testing and Commissioning Plan, and Operating and Maintenance Manual, specific to the project, including the recommended procedures for off-loading, handling and storage of equipment until installed, lubrication, trouble-shooting guide, and safety issues.

.6 Distribution of supplied information:

.1 Upon notification of the award, the successful proponent shall prepare and submit, within the time period identified in the submittal forms, the above listed documents to the owner's representative for review and integration in the detailed design. The successful supplier shall provide a single technical contact person who will be available to provided detailed design recommendations.

1.5 STANDARDS

.1 All equipment and materials in accordance with the latest issue of all appropriate Standards and Codes, including, but not limited to the following:

.1 AFBMA - Load Ratings and Fatigue Life for Ball Bearings

.2 AGMA – American Gear Manufacturer's Association

.3 ANSI – American National Standards Institute
.4 ASME – American Society of Mechanical Engineers
.5 ASTM – American Society for Testing and Materials
.6 CEC – Canadian Electrical Code
.7 CEMA – Canadian Electrical Manufacturers Association
.8 CSA – Canadian Standards Association
.9 CWB – Canadian Welding Bureau
.10 IEC – International Electrotechnical Commission
.11 NEC - National Electrical Code
.12 NEMA – National Electrical Manufacturer's Association
.13 NFPA – National Fire Protection Association
.14 NFPA – National Fluid Power Association
.15 OSHA – Occupational Safety and Health Administration
.16 SSPC – Steel Structures Painting Council
.17 UL (cUL) – Underwriter's Laboratories Inc.

PART 2 PRODUCTS

2.1 EQUIPMENT

.1 All materials and equipment as per System #5 – Quotation as modified by addendums are to be supplied F.O.B. construction site.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Unloading, equipment, installation, start-up and commissioning of equipment to be as per manufacturer's specifications, instructions, and as per approved shop drawings.

.2 Provide all connections, fittings, piping, valves, power and control wiring, electrical and instrumentation equipment, etc. to render the systems complete and operational.

3.2 START-UP AND COMMISSIONING

.1 Complete the start-up and commissioning as per the requirements of Division 01 of this contract.

END OF SECTION

BIOSOLIDS STORAGE TANK

PART 1 GENERAL

1.1 REFERENCE:

.1 This section is to be included in the scope of work for Provisional Item P1 listed in the contract documents.

1.2 WORK INCLUDED:

.1 The two (2) above-grade storage reservoirs, one (1) built on a new concrete foundation and one (1) utilizing a specialty inverted concrete foundation reusing the existing concrete sludge storage tank and shall be supplied by the proposed tank supplier named herein, referred to in this Section as the “Tank Supplier” or “Supplier”.

.2 The supply of bolted tanks utilizing an inverted foundation includes specialty engineered design, safety planning, and construction methods which require specific experience measured in 1.05 Qualifications of Tank Supplier which must strictly be adhered to during bid submission.

.3 The General Contractor shall review the quotation to establish the Supplier’s limit of equipment supply and installation and the General Contractor’s responsibilities.

.4 The General Contractor shall review the sample novation agreement to establish the terms set out by the Client in accordance with the contract documents.

1.3 RELATED WORK:

.1 Section 01 11 00 – Summary of the Work

.2 Section 01 33 00 – Submittals

.3 Section 01 71 00 – Examination and Preparation

.4 Section 01 91 13 – Commissioning Requirements

.5 Section 03 20 00 – Concrete Reinforcing

.6 Section 03 30 00 – Cast-in-Place Concrete

.7 Section 05 50 00 – Metal Fabrications

.8 Section 05 51 00 – Metal

.9 Section 09 91 00 – Paint

.10 Section 25 05 01 – Control Panels

.11 Section 26 27 26 – Wiring Devices

.12 Section 44 00 10 – Process General Requirements

.13 Section 44 05 50 – Process Piping

1.4 CODES AND STANDARDS:

.1 The work of this Section shall conform to the following:

.1 Relevant Sections of the latest edition of the Ontario Building Code and associated regulations.

.2 The latest edition of the NBCC.

.3 AWWA D103-19 - Factory-Coated Bolted Carbon Steel Tanks for Water Storage.

.4 AWWA D108-19 - Aluminum Dome Roofs for Water Storage Facilities

.5 ISO 28765-16 Class Level B - Standards for Vitreous and porcelain enamels

.6 Ontario Ministry of Labour, Relevant Sections of the latest edition of the Occupational Health and Safety Act and all applicable regulations and codes.

.7 Details and Fabrication – to NAMM – Metal Stair Manual, fourth edition, 1982.

.8 AISI - American Iron and Steel Institute.

.9 AISC - American Institute Steel Constructions.

1.5 QUALIFICATIONS OF TANK SUPPLIER

.1 The factory-applied glass-fused-to-steel bolt-together tank construction for this project has been predicated upon the design criteria, construction methods specified, and optimum coating for resistance to internal and external tank surface corrosion.

.2 Provide a new tank structure as supplied by a manufacturer specializing in the design, fabrication, and erection of factory-applied glass-fused-to-steel, bolt-together tank systems.

.3 The tank manufacturer's quality system shall be ISO9001, ISO14001, and ISO18001 certified. Up-to-date health & safety and environmental certifications are required.

.4 The Tank Supplier shall hold a valid safety program with current Certificate of Recognition (COR) from the Infrastructure Health & Safety Association (IHSA).

.5 Tank supplier is to be in good standing with WSIB.

.6 Tank supplier shall have dedicated service crews regularly engaged in the inspection, maintenance, and repair of municipal potable water tanks available to

provide servicing for warranty or on an as-needed basis when requested by the Owner.

.7 Acceptable supplier of tank materials and construction:

.1 Balmoral Tanks GFS Premium supplied by Greatario Engineered Storage Systems.

.2 Permastore HV “Tri- Fusion” or better supplied by H2Flow Tanks & Systems Inc.

.8 Alternate glass-fused-to-steel tank suppliers wishing to pre-qualify shall submit the following to the Consultant for consideration during the question period in advance of bid closing:

.1 Typical structure and foundation drawing(s) in CAD.

.2 List of tank materials, appurtenances, tank coating specifications, and other documentation indicating compliance with all portions of this section

.3 Provide a detailed reference list, outlined below, confirming five (5) tanks designed, built, and constructed in Ontario, Canada by the Tank Supplier named, which utilized a specialty inverted concrete foundation (new concrete or existing tank) that was designed and supplied by the Tank Supplier. Tank manufacturers will not be accepted.

.9 Proof of 100% labour, material, and performance bonding ability for the total project value with an Agreement To Bond document issued to the named company submitting the bid and performing the work.

.10 Proof of umbrella insurance coverage not less than $10,000,000.

.11 COR Certificate of good standing.

.12 WSIB confirmation of good standing.

1.6 SUBMITTALS:

.1 Structural calculations and design drawings for tank shell structure, foundation interface, roofing system and any accessories of the shell and roof, signed and sealed by a Professional Engineer registered in the Province of Ontario.

.2 Foundation requirements including, without limitation to, cast-in items, dimensions, clearances, and tolerances.

.3 Assembly, installation, connection and equipment termination details. Show required ancillary services that are to be provided by others.

.4 List of materials of construction detailing component parts and reference specifications.

.5 Drawings and detailed specifications, capacities, and data for mixers, pumps and other related equipment, accessories and components.

.6 Process flow diagram for the tank mixing system.

.7 List of pre-assembled process components that will be shipped to site including the dimensions and mass of each component. Include storage and off-loading requirements and details. Provide a materials list for other components, parts and materials shipped to site.

.8 List of spare parts and special tools supplied with equipment.

.9 Provide performance testing protocol.

.10 Warranty letter.

1.7 ENVIRONMENTAL CONDITIONS:

.1 Tanks will be located outside in an unheated space open to the atmosphere.

.2 Tanks will be used to store biosolids during winter months. A mixing system of nozzles and chopper pumps will be used on occasion, or once per year according to the preference of the owner, to mix up the biosolids.

1.8 HANDLING AND STORAGE

.1 The Supplier shall provide all necessary equipment, materials and labour to off-load equipment at the site and provide for any additional transportation necessary for storage or installation on-site. The methods employed for off-loading and handling must be to the satisfaction of the Supplier or Contract Administrator.

.2 Off-load equipment promptly and pay any charges due to delays.

.3 Before taking delivery examine the equipment for any damage. Rectify damage to equipment. Ensure that any repairs are first approved by the Supplier such that guarantees are not invalidated.

.4 If not required for immediate use, adequately store and protect all equipment against weather, damage and theft. Take particular care with corrodible and electrical equipment. Store mechanical equipment in an area heated to a minimum of 10°C.

1.9 APPURTENANCE, FITTINGS, CONNECTING PIPE AND ACCESSORIES

.1 Supply and install with the equipment and materials all appurtenances, fittings, connecting piping and accessories necessary for the proper installation and functioning of the equipment and materials, and that are reasonably inferable from the Contract Documents, whether or not specifically indicated on the Drawings or in the Specifications.

1.10 QUALITY ASSURANCE:

.1 Equipment manufacturer to have an effective Quality Management System (QMS) in place registered to ISO 9001:2000.

.2 Equipment manufacturer to have been regularly engaged in the design and manufacture of the specified equipment for a minimum of 5 years.

PART 2 PRODUCT

2.1 SUPPLIER'S RESPONSIBILITY

.1 Unless noted otherwise, the complete above grade reservoir including concrete base, piping and piping supports within a 2.0 m radius of the tank shall be supplied by the tank supplier. Electrical instrumentation equipment and wiring shall be supplied and installed under Division 16.

.2 The General Contractor shall coordinate with supplier all connection points outside of the 2.0 m radius described above.

2.2 EQUIPMENT

.1 Equipment to be supplied as per the attached specifications, the Contract Drawings and all other necessary piping, instrumentation, concrete, etc. to provide a complete system in accordance with the Suppliers scope of supply.

.2 The General Contractor is to note that the supplier is to complete and submit final design for approval during the shop drawing stage.

2.3 GENERAL:

.1 Supply glass-fused-to-steel bolted tanks and accessories in accordance with the requirements in this section and as shown on the Drawings.

2.4 TANK PERFORMANCE AND DESIGN REQUIREMENTS:

.1 One (1) Extended GFS tank embedded in the existing concrete tank utilizing a specialty inverted foundation

.1	Tank Diameter:	24.176 m
.2	Tank Height:	3.875 m sidewall (above concrete foundation wall)
.3	Expandable tank height (future):	8.00 m (GFS portion only)
.4	Foundation type:	Existing concrete sludge tank wall and embedded starter strip.
.5	Freeboard:	406mm
.6	Capacity:	1,592 m^3 (useable new GFS tank capacity)
.7	Seismic Design:	NBCC Latest

	.8	Wind Design:	NBCC Latest

.2 One (1) New GFS bolted tank utilizing slab on grade

.1	Tank Diameter:	23.396 m
.2	Tank Height:	8.675 m sidewall (above concrete foundation)
.3	Expandable tank height (future):	17.00 m (GFS portion only)
.4	Foundation type:	Embedded starter on new concrete slab on grade foundation.
.5	Freeboard:	406mm
.6	Capacity:	3,554 m^3 (total useable capacity)
.7	Seismic Design:	NBCC Latest
.8	Wind Design:	NBCC Latest

.3 Sludge Characteristics:

.1	External Temperature:	-40 to 40 degree C
.2	Solids Consistency:	4.2% TS
.3	pH	6.5 – 8.5
.4	Specific Gravity	1.05

.4 Flow and Loading Conditions:

.1	Sludge Feed	57.6 m^3/d
.2	Total Solids	2,500 kg/d

2.5 MATERIALS:

.1 Conform to AWWA D103-19, latest revision and to the Ontario Building Code, 2020 including any amendments or updates affecting specifications and standards referenced by AWWA D103-19 or the Ontario Building Code 2020.

.2 Use either “web-truss” design with extended tail, or rolled steel angle design for wind stiffeners. Hot-dip galvanize wind stiffeners, and fasteners. Tank manufacturer responsible for selection and design of appropriate type of wind stiffeners, and for performance and structural adequacy of same within the environmental conditions set out in subsection 1.06, Environmental Conditions.

.3 EPDM or Neoprene gaskets may be used for access doors, and for sealing dome roof structure to tank shell structure only.

.4 Acceptable lap joint sealants Sikaflex TS Plus.

.5 Bolts shall be geomet coated structural grade. Encapsulate bolt heads with high impact, UV stabilized polypropylene co-polymer.

2.6 EQUIPMENT AND ACCESSORIES:

.1 Include the following in the scope of supply:

.1 Design, fabricate, supply, deliver and erect glass-fused-to-steel tank and clear-span aluminum geodesic dome roofing system per tank.

.2 Design tank foundations, complete with Ontario P.Eng. stamp.

.3 Supply and install starter section to be embedded in foundation along with any similar or related components required for the tank system. Tank to be constructed by method of jacking from the foundation and the starter strip.

.4 Provide one (1) 800mm access manway on north side of each tank.

.5 Design, supply and install sacrificial cathodic protection system.

.6 Provide single-sided walkway for each dome roof to gravity vent and dome apex.

.7 Provide top platform with guardrails for each dome roof at access hatch.

.8 Provide access hatch on each dome roof, complete with guardrails.

.9 Provide stainless steel safety cable.

.10 Provide neoprene dome gasket.

.11 Design, fabricate, supply and install aluminum vent system for each dome.

2.7 DESIGN LOADS

.1 Seismic, dead and live loads per *Ontario Building Code*, latest revision and ANSI/AWWA D103-19.

.2 Supplier to confirm all design loads meet Ontario Building Code latest revision, Post Disaster Construction Requirements, and verify with the local municipal Building Department.

.3 Seismic, dead and live loads tank is to be designed to are as follows:

.1	Wind Velocity:	0.41 kPa
.2	Wind Importance Factor: Post-Disaster	1.25
.3	Snow Importance Factor: Post-Disaster	1.25
.4	Seismic Importance Factor: Post-Disaster	1.50
.5	Ss:	2.3 kPa
.6	Sr:	0.40 kPa
.7	Seismic site class:	C
.8	Seismic use group:	IV
.9	Sa (0.2):	0.819
.10	Sa (0.5):	0.474
.11	Sa (1.0):	0.246
.12	Sa (2.0):	0.11

.13 PGA: 0.448

2.8 ROOF VENT

.1 To be designed by the tank supplier to prevent freezing and ingress by birds, insects or other animals.

.2 The vent shall be a minimum of 600mm in diameter c/w insect screen.

.3 The vent shall be constructed of aluminum.

.4 The overflow is not to be considered a vent.

2.9 TANK APPURTENANCES

.1 Pipe Connections

.1 Where pipe connections are shown to pass through tank panels, they shall be precut by the tank manufacturer prior to glass application, when necessary, field located saw cut, (Acetylene torch cutting or welding is not permitted) and utilize an interior and exterior flange assembly and the tank shell reinforcing shall comply with AWWA D103 latest edition. Sikaflex TS Plus or approved equivalent, shall be applied on any cut panel edges or bolt connections.

.2 Inlet/Outlet

.1 Inlet/outlet stainless steel piping shall be installed by the Supplier as shown on contract drawings. Piping shall extend through the tank floor and exit the foundation below the applicable frost level as specified by the tank manufacturer.

.3 Tank Sidewall Access Manway

.1 One (1) tank sidewall access manway per each tank shall be provided as shown on the Contract Drawings in accordance with AWWA D103-19.

.2 Manways shall be 800 mm in diameter and shall include a properly designed reinforcing frame and cover plate complete with hinge connected to the reinforcing frame.

.4 Outside Tank Ladder

An outside tank ladder and top observation platform shall be furnished and installed as shown on the contract drawings. Ladders shall be fabricated of aluminum and utilize grooved, skid-resistant rungs. Safety cage and step-off platforms shall be fabricated of galvanized steel. Ladders shall be equipped with a hinged lockable entry device.

.5 Tank Roof Access Hatch

.1 One (1) tank roof access hatch 750mm x 750mm with safety grating as per the contract drawings, complete with fall protection rated tie off points,

supplied and installed with adequate anchor points for travel restraint system on the roof surface, platform in accordance with O.REG 213/91, Section 26.7.

.6 Identification Plate

.1 A manufacturer's nameplate shall list the tank serial number, tank diameter and height, and maximum design capacity. The nameplate shall be affixed to the tank exterior sidewall at a location approximately 1,500 mm from grade elevation in a position of unobstructed view.

.7 Cathodic Protection

.1 The tank will include a sacrificial anode cathodic protection system as designed and supplied by the tank manufacturer. The anodes shall be designed for ten (10) year life.

.8 Cable Tray

.1 The tank will include an aluminum cable tray (minimum 450 mm wide) on the exterior sidewall of the tank extending the full sidewall height for power, monitoring and instrumentation wiring.

.2 Supplier to confirm cable tray width required with General Contractor.

.3 The cable tray shall be fastened to the tank via a bolted connection inherent with the bolted steel tank design.

2.10 DOME ROOF

.1 Tank shall be constructed with a dome roof structure in accordance with AWWA D108 – Aluminum Dome Roofs for Water Storage Facilities."

.2 The dome roofs shall be provided with a step-off access platform adjacent to the tank ladder, measuring 1.5m wide x 1.5m deep.

.1 The dome step-off platforms shall be connected with sidewall access manway ladder. Railings, handrails, and toe plates shall be supplied as per OHSA standard.

.2 The dome step-off platforms shall incorporate a davit base only for supply of davit crane. Consideration for the davit crane swing radius accessing the dome access hatch is a requirement of the final design submission.

.3 Provide one (1) 300mm access port complete with blind flange to accommodate both level/temperature sensors and float (provided by others) to be accessible from platform.

.4 All accessible locations on the dome roof shall be provided with a non-skid coating.

2.11 FABRICATION AND ERECTION – GENERAL

.1 Plates and Sheets

.1 Plates and sheets used in the construction of the tank shell, tank floor (when supplied) and tank roof, shall comply with the minimum standards of AWWA D103, latest edition.

.2 Design requirements for mild strength steel shall be ASTM A1011 Grade 30 with a maximum allowable tensile stress of 100 MPa (14,566 psi).

.3 Design requirements for high strength steel shall be ASTM A1011 Grade 50 with a maximum allowable tensile stress of 179 MPa (26,000 psi).

.4 The annealing effect created from the glass coated firing process shall be considered in determining ultimate steel strength. In no event shall yield strength greater than 345 MPa (50,000 psi) be utilized for calculations detailed in AWWA D103, Sections 3.4 and 3.5.

.5 Multiple vertical bolt line sheets and plates of ASTM A607 Grade 50 only shall be manufactured such that holes are staggered in the vertical bolt lines and that no two adjacent holes are in-line horizontally, except at the center of the sheet or plate.

.6 The tank design shall incorporate standard design plate thickness as per AWWA D-103. Laminating sheets to meet required tank wall thickness will not be acceptable.

.2 Galvanized Steel

.1 All outer steel surfaces (platforms, safety railing, etc.) shall be protected by hot dipped galvanizing according to CSA G-164M providing a minimum zinc mass of 610 g/m^2.

.3 Rolled Structural Shapes

.1 Material shall conform to minimum standards of ASTM A36 or AISI 1010.

.4 Horizontal Wind Stiffeners

.1 Design requirements for intermediate horizontal wind stiffeners shall be of the “web truss” design.

.2 Web truss stiffeners shall be of steel with hot dipped galvanized coating.

.3 Rolled steel angle stiffeners are permitted for intermediate stiffeners.

.5 Bolt Fasteners

.1 Bolts used in tank lap joints shall be ½” – 13 UNC-2A rolled thread.

.2 Bolt Material.

.1 SAE Grade 2

.2 Tensile Strength – 510 MPa (74,000 psi) Min.

.3 Proof Load – 380 MPa (55,000 psi) Min.

.4 Allowable shear stress – 125 MPa (18,164 psi) (AWWA D103).

.5 SAE Grade 8/ASTM A325 heat treated to:

.6 Tensile Strength – 1,035 MPa (150,000 psi) Min.

.7 Proof Load – 825 MPa (120,000 psi) Min.

.8 Allowable shear stress – 255 MPa (36,818 psi) (AWWA D103).

.9 Bolt Finish - Zinc Plate

.10 0.0003” Min – under bolt head.

.11 0.0003” Min – on shank.

.12 0.0005” to 0.0007â – on last five threads.

.13 Iridite #3 bronze color coat.

.14 Bolt Head Encapsulation

.15 High impact polypropylene encapsulation of entire bolt head up to the splines on the shank.

.16 Resin shall be stabilized with an ultraviolet light resistant material such that the color shall be black.

.17 Bolt heads shall be individually coloured for each length for ease of identification of bolts on site during construction and maintenance.

.3 All bolts shall be installed such that the head portion is located inside the tank, and the washer and nut are on the exterior.

.4 All lap joint bolts shall be properly selected such that threaded portions will not be exposed in the “shear plane” between tank sheets. Also, bolt lengths shall be sized as to achieve a neat and uniform appearance. Excessive threads extending beyond the nut after torquing will not be permitted.

.5 All lap joint bolts shall include a minimum of four (4) splines on the underside of the bolt head at the shank in order to resist rotation during torquing.

.6 Geomet is the only acceptable bolt coating.

.7 Hot dipped galvanized bolts shall not be permitted**.**

.6 Sealants

.1 The lap joint sealant shall be a one component, moisture cured, polyurethane compound.

.2 The sealant shall be used to seal lap joints, bolt connections and sheet edges. The sealant shall cure to a rubber-like consistency, have excellent adhesion to the glass coating, have low shrinkage, and be suitable for interior and exterior exposure.

.3 Sealant curing rate at 22.8˚C and 50% RH.

.1 Tack-free time: 6 to 8 hours.

.2 Final cure time: 10 to 12 days.

.3 The sealant shall be ESPC sealer No. 98 or approved equivalent.

.4 Neoprene gaskets and tape type sealer shall not be used.

.7 Structural aluminum – to Aluminum Company of Canada designations:

.1 Extruded structural shapes 6061-T6.

.2 Smooth plates 5052-H323.

.3 Grating and bearing plates 6351-T6.

.4 Handrail and posts 6063-T6.

.5 Pipe 6351-T6.

.8 Nuts and bolts (tank accessories) – stainless steel, conforming to ASTM A320, Grade B8 (ANSI Type 316L).

.9 Drill in anchors – stainless steel Type 304 adhesive anchors by "Hilti" or approved equal.

.10 Aluminum Welding Rod

.1 CSA-HA6-GM50P (Commercial Designation Type 5356) for joints to smooth aluminum plates.

.2 CSA-HA6-S5 (Commercial Designation Type 4043) for other work.

.3 Stainless Steel Welding Rod – E308.15 or 16, Anneal welds, where possible.

.11 Rivets – aluminum to CSA-HA4-G41-H32.

.12 Aluminum Grating – serrated top edge, depth to suit loading conditions, Type W/B by Borden Metal Products Ltd. or Dominion Bridge or IKG Industries equivalents.

.13 Safety Treads – serrated top edge complete with end plates having slotted holes and front edge having abrasive nosing, Type WB by Borden Metal Products Ltd. or Dominion Bridge or IKG Industries equivalents.

2.12 GLASS COATING SPECIFICATION

.1 Surface Preparation

.1 Following the decoiling and shearing process, sheets shall be steel grit-blasted on both sides to the equivalent of SSPC-10. Sand blasting and chemical pickling of steel sheets is not acceptable.

.2 The surface anchor pattern shall be not less than 1.0 mil.

.3 These sheets shall be evenly oiled on both sides to protect them from corrosion during fabrication.

.2 Cleaning

.1 After fabrication and prior to application of the coating system, all sheets shall be thoroughly cleaned by a caustic wash and hot rinse process followed immediately by hot air drying.

.2 Inspection of the sheets shall be made for traces of foreign matter or rust. Any such sheets shall be recleaned or grit-blasted to an acceptable level of quality.

.3 Coating

.1 All sheets shall receive one (1) coat of a catalytic nickel-oxide glass precoat

to both sides and then air dried.

.2 A second coat to both sides of the sheets, of milled cobalt blue glass, shall be made. The sheets shall be coated in strict accordance with the manufacturer's quality process controls.

.3 The sheets shall then be fired at a minimum temperature of 815˚C in strict accordance with the manufacturer's ISO 9001 quality process control procedures.

.4 The final cover coat of milled glass shall be applied to the inside of the sheet. This milled glass shall be formulated in powder form and applied electrostatically to ensure a pure glass topcoat. The exterior of the sheets shall be the same colour. The sheets shall then be fired at a minimum temperature of 815˚C.

.5 The same glass coating as applied to the sheet surfaces shall be applied to the exposed edges during the electrostatic process.

.6 The dry film interior coating thickness shall be 10.0 to 18.0 mils (0.010 to 0.018 inches) minimum.

.7 The dry film exterior coating thickness shall be 6.0 to 19.0 mils (0.006 to 0.019 inches) minimum.

.8 The interior and exterior coating for all sheets must be a 3-coat, 2-fire process.

2.13 FABRICATION AND ERECTION - GENERAL

.1 Fabricate all items in accordance with reviewed shop drawings.

.2 Fit and assemble Work in shop where possible and deliver to site in largest practical sections. Where shop fabrication is not possible, make trial assembly in shop. Fabricated Work shall be complete with components required for anchorage.

.3 Fabricate stairs with all welded joints and connections. Provide slotted, bolted connections where provision for movement may be required. Grind welds flush and smooth with main metal. Maintain sharp profiles and arises. Remove all weld spatter and scale.

.4 Isolate where necessary to prevent electrolysis due to dissimilar metal to metal contact or metal to masonry or concrete. Use bituminous paint or other approved isolating material.

.5 Carefully make and fit all details and make special care so that the finished Work presents a neat and workmanlike appearance.

.6 Assemble all members true and without twists or open joints.

.7 Provide properly sized holes for connecting the Work of other trades where such can be determined prior to fabrication. Where possible, such holes shall be shown on shop drawings. Holes shall be placed so as not to cause an appreciable

reduction in the strength of member.

.8 Field re-fabrication of structural components or panels will not be accepted. Forcing of the structure to achieve fit-up during construction is expressly forbidden and not acceptable.

.9 All sealant joints shall be tooled slightly concave after sealant is installed. Care shall be taken to keep sealant confined to joint area, and any outside of the joint shall be removed so that the panels will be free from misplaced sealant. All gasket materials shall be continuous; splices will not be allowed.

2.14 INSPECTION

.1 The manufactured quality system shall be ISO 9001 certified.

.2 Measurement of Glass Thickness

.1 Glass thickness shall be measured using an electronic dry film thickness gage (magnetic induction type). The thickness gage shall have a valid calibration record.

.2 Frequency of the test shall be every tenth sheet. The thickness of the glass shall be between 10.0 and 18.0 mils (0.010 and 0.018 inches).

.3 Measurement of Color

.1 The exterior color of the sheets shall be measured using a colorimeter. The colorimeter shall have a valid calibration record.

.2 Frequency of the test shall be every tenth sheet. The color must fall within the tolerance specified by the Contract Administrator.

.4 Impact Adherence Test

.1 The adherence of the glass coating to the steel shall be tested in accordance with ASTM B916-01. Any sheet that has poor adherence shall be rejected.

.2 Frequency of this test shall be one sheet per gage lot run minimum.

.5 Electrical Holiday Test

.1 An electrical holiday detection test shall be performed to the internal surface of every sheet. Any sheets that have discontinuities in the glass contact surface shall be rejected. The minimum voltage of this test shall be 1100v.

.2 An electrical Holiday detection test shall be performed to the external and internal surface of every sheet in accordance with ISO 28765 and test A of EN 14430 or approved equal. The test instrument shall be a high voltage detector having 90,000 ohms resistance using 3% sodium nitrite solution as the approved wetting agent.

.3 Sheets having any discontinuities in the glass contact surface shall be rejected. Only finished sheets with zero glass continuity defects on the surfaces shall be released for packing.

.4 The Owner reserves the right to request all QC documentation from the manufacturer for inspection of the sheets to be supplied for this project.

2.15 ACCEPTABLE MANUFACTURERS / SUPPLIERS

.1 Balmoral Tanks GFS Premium supplied by Greatario Engineered Storage Systems.

.2 Permastore HV “Tri- Fusion” or better supplied by H2Flow Tanks & Systems Inc.

2.16 PAINTING AND FINISHES

.1 Coordinate and provide any work involving surface preparation, shop and field painting in accordance with Section 09 91 00.

.2 Tank exterior colour: Provide cobalt blue.

.3 Tank interior coating: Per recommendation of tank manufacturer taking into consideration properties of medium being contained and other criteria within this section.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Construction of tank foundation will be by others. Erection of tanks and accessories supplied under this section, including embedment of items in the foundation required specifically for tank erection, is within the Equipment Supplier’s scope of work.

.2 Installation of tank mixing equipment and piping encased in the tank foundation will be by others.

3.2 INVERTED FOUNDATION

.1 The specialty tank foundation is a part of this Contract and shall be designed by the Supplier to sustain the structure and its live loads safely. The inverted foundation design shall be designed by the tank supplier and included in the foundation design submittal.

.2 The tank foundation shall be constructed by the Supplier or by the General Contractor under the immediate supervision of the tank Supplier.

.3 Tank footing and foundation design shall be based on the soil properties provided in the geotechnical investigation report.

.4 Process piping crossing under the foundation walls shall be installed in accordance with the structural detail, “Service Pipes Under Footings”.

3.3 TANK FLOOR

.1 The floor design shall be reinforced concrete, with an inverted sidewall containing an embedded glass-coated steel starter sheet per the manufacturer’s design and in accordance with AWWA D103-19 Section 13.4 Type 6. The floor pour shall be monolithic.

.2 A “notch” style foundation where the embedded steel ring is grouted will not be acceptable.

.3 Levelling of the starter ring shall be required and the maximum differential elevation within the ring shall not exceed 3.2 mm, or exceed 1.6 mm within any 3 m length.

.4 A levelling plate assembly consisting of two (2) 450 mm anchor rods (19mm diameter) and a slotted place (89 mm x 275 mm x 9.6 mm) shall be used to secure the starter ring, prior to encasement in concrete. Installation of the starter ring on concrete blocks or bricks, using shims for adjustment, is not permitted.

.5 One bentonite-impregnated water seal shall be placed on the inside surface of the starter ring a minimum of 150mm below the concrete floor line. One butyl rubber elastomer water stop seal shall be placed directly above and in contact with the Bentonite rubber seal. Materials shall be installed in accordance with tank manufacturer’s primer and instructions.

3.4 INSPECTION AND TESTING

.1 Factory Inspection

.1 Inspect the outside surface of all panels under good lighting conditions to locate defects in the glass coating. Reject panels with visible defects larger than 1 mm. Reject panels having more than 3 visible defects per square meter. Where panels meet the criteria for acceptance, repair visible defects using repair material and in accordance with the instructions approved by the manufacturer for this purpose.

.2 Perform electrical leak detection test on the inside surface after fabrication of each panel. Reject panels with leaks.

.3 Ensure that every panel shipped from the factory is holiday free.

.4 Check shell sheets and foundation sheets for proper curvature.

.5 Inspect thickness of coated sheets using an approved instrument suitable for a measurement range of 0-500 □m. The coating thickness shall be in the range of 180 □m to 360 □m, or greater as required for application and medium being contained, rejecting panels with a coating thickness at any location below the specified range.

.6 Check sheets for uniformity of colour using a colour comparator instrument against the standard limits set out by the manufacturer. Reject panels outside the standard limits.

.7 Test panels for fish scale by placing them in an oven at 400 degrees for one hour. Reject panels exhibiting fish scale.

.2 Field Inspection

.1 During erection, perform an electrical leak-detection test on the tank shell panels using a low voltage wet swab tester. Repair leak points in accordance with manufacturer's published touch-up procedure.

.2 Following completion of erection and cleaning of the tank. Test the structure for liquid tightness by filling tank with clear water to its overflow elevation. Correct any leaks discovered by this test in accordance with the manufacturer's recommendations.

.3 Include all labour and equipment necessary for testing the tanks.

.4 Perform a visual inspection of the tank interior coating and appurtenances; tank exterior coating and appurtenances; and the immediate area surrounding the tank, on or near the one-year anniversary date of initial tank use. Submit a written summary of this inspection to the owner and a copy to the engineer.

.5 Running check of pump performance at the specified flows and heads.

.6 Running check of fits and clearances.

.7 Demonstration of overload features, alarm settings and safety device settings.

.8 Check noise levels generated by the equipment.

3.5 OPERATIONS AND MAINTENANCE INSTRUCTIONS

.1 Have a technical representative provide instructions to the Owner's staff as specified in Section 01 33 00

.2 Provide complete operations and maintenance manuals for the equipment, covered by this Section, in accordance with Section 01 78 00.

3.6 WARRANTY

.1 Provide a warranty for the tank and dome materials and coating system, covering defects in workmanship or materials under normal and proper use, maintenance and operation, for one (1) year after the tanks are placed into service, containing the intended material to be stored.

.2 Warranty the tank coating systems providing for no corrosion under normal and proper use, maintenance, and operation for ten (10) years after the tanks are placed into service, containing the intended material to be stored.

END OF SECTION

BIOSOLIDS MIXING SYSTEM

PART 1 GENERAL

1.1 WORK INCLUDED

.1 The following section is to be included with Provisional Item P1 in the contract documents.

.2 The design, performance test, supply, delivery, installation, supervision of the start up, field testing and commissioning of biosolids mechanical mixing equipment as specified herein, complete with electric motors, speed adjustment systems, vibration isolator control equipment and other accessories necessary for a complete digester mechanical mixing system.

.3 The operation of the Ingleside WWTP digestion process shall be maintained throughout installation and commissioning of the new biosolids mechanical mixing equipment installation and commissioning. Installation of the new system must not interfere with on-going operations. The contractor shall be responsible for supply of temporary power, if necessary, to maintain equipment function.

.4 Any material or equipment that is not specifically mentioned or included in this specification but is necessary to ensure a fully operational system is to be supplied with the equipment and included with the quotation.

.5 Comply also with Divisions: 01, 25, 26, and 44 requirements

1.2 REFERENCE SECTIONS

.1 Section 01 11 00 – Summary of the Work

.2 Section 01 33 00 – Submittals

.3 Section 01 71 00 – Examination and Preparation

.4 Section 01 91 13 – Commissioning Requirements

.5 Section 09 91 00 – Paint

.6 Section 25 05 01 – Control Panels

.7 Section 26 27 26 – Wiring Devices

.8 Section 26 29 20 – Variable Frequence Drives

.9 Section 44 00 10 – Process General Requirements

.10 Section 44 05 50 – Process Piping

.11 Section 44 50 60 – Biosolids Storage Tanks

1.3 CODES AND STANDARDS:

.1 The work of this Section to conform to the following:

.1 Relevant Sections of the latest edition of the Ontario Building Code and associated regulations.

.2 The latest edition of the NBCC.

.3 Ontario Ministry of Labour, Relevant Sections of the latest edition of the Occupational Health and Safety Act and all applicable regulations and codes.

.4 Details and Fabrication – to NAMM – Metal Stair Manual, fourth edition, 1982.

.5 AISI - American Iron and Steel Institute.

.6 AISC - American Institute Steel Constructions.

1.4 DESIGN

.1 The biosolids mechanical mixing equipment will be used to mix a combination of digested sludge to a homogenous condition in the biosolids storage tanks.

.2 The biosolids mechanical mixing equipment shall be capable of pumping the liquid both up and down.

.3 The Supplier shall be responsible to ensure and guarantee that the mixing equipment will be:

.1 Designed, fabricated and assembled to provide a reliable and efficient operation;

.2 CSA Approved (where applicable) and comply with any Codes and Standards referred to in this Specification;

.3 Of new material which is of current manufacture and proven in the field for the duty required; and

.4 Fully compliant with the requirements of this specification

.4 If a bidder wishes to offer an alternative proposal, in addition to the proposal complying with this specification, each such alternative must be clearly set out and the related adjustment shall be stated for each alternative.

1.5 QUALIFICATIONS OF EQUIPMENT SUPPLIER

.1 The hydraulic mixing equipment for this project has been predicated upon the design criteria, construction methods specified, and optimum coating for resistance to corrosion and CFD qualified mixing design.

.2 Reference list of five (5) hydraulic mixing systems of similar size or greater capacity supplied in Ontario that were designed, supplied, and constructed by the supplier requesting to be named.

.3 The equipment manufacturers quality system shall be ISO9001, ISO14001 certified. Up-to-date health & safety and environmental certifications are required.

.4 The equipment supplier shall have dedicated service crews regularly engaged in the inspection, maintenance, and repair of municipal hydraulic mixing systems available to provide servicing for warranty or on an as-needed basis when requested by the Owner.

.5 Acceptable supplier of tank materials and construction:

.1 Ebara / Hayward Gordon Hydromix as supplied by Greatario Engineered Storage Systems. Dillon Occleston, doccleston@greatario.com, Regional Mgr – Ontario

.2 Vaughan Rotamix Mixing System, as supplied by John Brooks Company Limited. Terry Alweyn, talweyn@johnbrooks.ca, Senior Applications Specialist

.6 Alternate hydraulic mixing suppliers wishing to pre-qualify shall submit the following to the Consultant for consideration during the question period in advance of bid closing:

.1 Typical design drawing(s) in CAD.

.2 List of tank materials, appurtenances, coating specifications, and other documentation indicating compliance with all portions of this section

.3 Reference list of five (5) hydraulic mixing systems of similar size or greater capacity supplied in Ontario that were designed, supplied, and constructed by the supplier requesting to be named.

1.6 SUBMITTALS

.1 Design Coordination and Tender Drawings: To be provided as specified in Section 01 33 00

.2 Shop Drawings: In addition to the information specified in Section 01 33 00, submit the following:

.1 Make, model, weight, and kilowatts of each equipment assembly.

.2 Dimensional layout of nozzles, pumps, electric motors, valves, vibration isolators and anchor bolts.

.3 Layout of nozzles in each digester including plans and sectional views.

.4 Manufacturer's catalog information, descriptive literature, specifications, and identification of materials of construction. This information is required for all components in the scope of supply.

.5 Detailed structural, mechanical, electrical and process and instrumentation drawings showing the equipment fabrications and interface with other items. Include dimensions, size, and locations of connections to other work, and weights of associated equipment.

.6 External utility requirements such as air, water, power, drain, etc., for each component.

.7 Functional description of internal and external instrumentation and controls to be supplied including list of parameters monitored, controlled, or alarmed.

.8 Scaled Control Panel external and internal layout drawings showing construction and placement of operator interface devices, electrical and other elements.

.9 Power and control wiring diagrams, including terminals and numbers.

.10 Bill of materials for Equipment, Components, Control Panel and Instruments.

.11 Package Control Narrative, containing detailed description of operation

.1 Mixing System in Manual and Auto mode.

.2 Control Panel, including safety interlocks, adjustable set points, control panel interaction with MCC and plant PLC.

.12 Comply with P&ID drawings for Tag numbers related to pump Local Control Panel (LCP), LCP Hand Switches, LCP Pushbuttons, LCP wiring and devices.

.3 Information Submittals: In addition to the information specified in Section 01 33 00, the supplier shall submit the following:

.1 Manufacturer's Certificate of Compliance: Commercial products, including specific reference to meeting maximum noise level requirements and painting/coating system(s).

.2 Test results of all equipment provided for proper operation, construction, electrical connection and function.

.3 Special shipping, storage and protection, and handling instructions.

.4 Manufacturer's Certificate of Proper Installation.

.5 Operation and Maintenance Manual.

.6 Spare parts list.

.7 Service records for maintenance performed during construction.

.8 Sound Power Levels: Provide a list of predicted sound power levels for the pump when operating at full capacity. Report the predicted sound power levels in a standard format conforming to the requirements of the Acoustical Engineering Institute.

.4 Operating and Maintenance Data: Provide operation and maintenance manual as specified in Section 01 33 00. Include complete description of operation together with general arrangement and detailed drawings, wiring diagrams for power and control schematics, parts catalogues with complete list of repair and replacement parts, with section drawings, illustrating the connections and identifying numbers.

.5 Performance Tests: Prior to shipment submit performance test results.

.1 Complete descriptive data for the nozzles, pumps and components including performance curves. The pump speed and flow rate will be based

on the hydraulic data obtained from full-scale. Interpretation of this data will be prorated based on the characteristics of the sludge as per this specification. A copy of such certification shall be submitted. Rheology of the digester sludge will be provided by the Supplier prior to an accepted final design in order to verify that the mixing system has been designed using accurate viscosities.

.2 A 3-D model computational mixing analysis recommending biosolids tank minimum and maximum liquid operation levels, analysis justifying the quantity of the nozzles required for operation of each digester, nozzle sizing and selection. All design calculations and analysis shall be stamped by a Professional Engineer licensed in the Province of Ontario.

1.7 SHIPMENT, PROTECTION AND STORAGE

.1 Ship all equipment pre-assembled.

.2 Provide complete storage instructions, indicating specific requirements necessary to prevent any weathering, corrosion, contamination, mechanical damage, freezing, or any other deterioration of components.

1.8 CO-ORDINATION

.1 Co-ordinate all work with General Contractor to ensure there are no conflicts in the work.

PART 2 PRODUCTS

2.1 GENERAL

.1 Equipment provided under this section shall be fabricated, assembled and placed in proper operating conditions in full conformity with the drawings, specifications, engineering data, instructions and recommendations of the Manufacturer unless exceptions are noted by the Contract Administrator.

.2 The mixer shall be complete with drive motor, base, speed reducer, vibration isolators, inlet/outlet ports (vertical or horizontal), service platform, oil lubricating system for all bearings, electrical controls, control panels, instrumentation and all other appurtenances specified or required for proper operation.

2.2 PERFORMANCE AND DESIGN CRITERIA

.1 The mixing equipment is intended to be installed to mix stored biosolids prior to dewatering using a centrifuge.

.2 Sludge may comprise grit, fibrous and stringy material, rags, settleable and non-settleable solids typically found in raw sewage. Mixing equipment shall be designed to operate reliably without downtime due to fouling.

.3 Design the mixing equipment for year-round operation with exposure to ambient climatic conditions applicable to Ingleside, Ontario, suitable for operation in a hazardous environment and installation in the existing anaerobic digesters.

.4 Design the mechanical mixer equipment based on the biosolids storage tank details as described in Section 44 50 60:

2.3 MIXING SYSTEM DESCRIPTION:

.1 Mixing equipment shall be a simple, robust and highly effective nozzle mixing system capable of mixing the contents of each biosolids storage tank.

.2 The mixing system shall be designed to create a flow pattern to ensure uniform solids suspension throughout the tank, using one or more pumps in conjunction with strategically placed nozzles. The number of nozzles and their orientation shall be selected and positioned such that the contents are recirculated in a top to bottom manner in addition to a circular flow pattern to ensure a homogenous mix.

.3 The nozzles shall be configured with both horizontally and vertically angled outlets, such that a flow pattern is established parallel to the tank bottom and vertically angled to promote a strong top to bottom movement, ensuring uniform mixing throughout the tank. This strong vertical flow is also critical in creating a rolling liquid surface to incorporate scum and other floating material. The mixing system, consisting of chopper pump(s) and nozzle assemblies, will be sized and supplied by the manufacturer. The manufacturer will recommend the number of nozzles, size, location, orientation and the flow rates required to meet process requirements. The manufacturer must have in-house Computational Fluid Dynamics capability to accurately model the full-scale operational system and compare CFD results with recommendations to ensure process requirements are met.

2.4 HYDRAULIC MIXING SYSTEM

.1 Mixing System Description

.1 The Equipment Supplier shall design and supply the hydraulic mixing system under this specification section using new pumps.

.2 Mixing equipment shall be a simple, robust and highly effective nozzle mixing system capable of mixing the contents of each biosolids storage tank.

.2 The mixing system shall be designed to create a flow pattern to ensure uniform solids suspension throughout the tank, using one or more pumps in conjunction with strategically placed nozzles. The number of nozzles and their orientation shall be selected and positioned such that the contents are recirculated in a top to bottom manner in addition to a circular flow pattern to ensure a homogenous mix.

.3 The nozzles shall be configured with both horizontally and vertically angled outlets, such that a flow pattern is established parallel to the tank bottom and vertically

angled to promote a strong top to bottom movement, ensuring uniform mixing throughout the tank. This strong vertical flow is also critical in creating a rolling liquid surface to incorporate scum and other floating material. The mixing system, consisting of existing chopper pump(s), will be sized and supplied by the manufacturer. The manufacturer will recommend the number of nozzles, their size, location, orientation and the flow rates required to meet process requirements. The manufacturer must have in-house Computational Fluid Dynamics capability to accurately model the full-scale operational system and compare CFD results with the recommendations to ensure process requirements are met.

.4 Mixing System Performance CFD Analysis: The mixing system supplier must have in-house Computational Fluid Dynamics (CFD) capability and must provide models to validate design. The models are to show specific tank geometry, solids content and nozzle placements at the submittal stage.

.5 Mixing system supplier shall perform a Computational Fluid Dynamics (CFD) analysis for each unique mixing system. One CFD analysis maybe performed for mixing systems for tanks with identical sludge characteristics and geometries.

.6 The following shall be submitted with the CFD Report:

.1 Contours allowing visualization of developed velocities with a domain plane.

.2 Particle streamlines displaying the path 10 or more particles would take as they move through fluid domain.

.3 ISO-Surfaces displaying the physical shape of velocity distributions within the domain.

.4 Tabulated Velocity Distributions within the domain.

.7 The CFD report shall confirm the following performance conditions:

.1 Mixed Volume Condition: Fluid Velocity must be above 0.2 ft/s in greater than 90% of the active volume.

.2 Mixing Time Condition: Mixed Volume Condition must be achieved within 60 minutes of operation

.3 Dead Spot Condition: 95% of the active volume shall have a fluid velocity of greater than 0.05 ft/s

.8 Field Performance:

.1 The mixing system total solids concentration of any one sample taken shall be within 10% of the average total solids concentration of all samples taken from the tank.

.9 Nozzle Assemblies:

.1 Nozzles shall be nitride 316 Stainless Steel with a hardness of 650 BHN (Optional: Glass Lined 304 Stainless Steel (650 BHN)). Nozzle assemblies shall have a minimum wall thickness of 1”.

.2 Nozzles shall be adjustable in 360deg through the use of adjustable flanges or grooved couplings.

.3 Assembly fittings shall be constructed from nitride 316 Stainless Steel with a hardness of 650BHN (Optional: Glass Lined 304 Stainless Steel (650 BHN)).

.4 The nozzle assembly baseplates will be constructed from 316SS or 304SS. The baseplates will have a quantity of four (4) Ø7/8" bolt holes for Ø3/4" anchor bolts.

.5 Connection of the feed piping to the nozzle assembly shall be a flange-to-flange type. Single Nozzle assemblies will have a Ø6"-150# flanged connection. Dual Nozzle assemblies shall have a Ø8"-150# flange connection. Flange gaskets shall be Buna-N (Optional: EPDM or Viton)

.6 Sizing of nozzles shall be the responsibility of the equipment manufacturer. The equipment manufacturer shall be responsible for determining accurate system head losses based on actual nozzle size and piping layout. Any changes required to enhance system performance, including changes to the Mixing Pumps, pump piping, and electrical requirements, shall be the responsibility of the equipment manufacturer.

2.5 PROTECTIVE COATINGS

.1 Provide the mixers with shop coatings:

.1 All fabricated steel, except galvanized or stainless steel: one shop blast per SSPC-SP10, near white sandblast.

.2 Draft tube steel surface: one (1) coat Carboline, Carboweld HS, ¾ to 1 mil DFT.

.3 Mixer rotating and assemblies including the mixer mounting flange: shop finish coat of 3M Scotch Kote 135 Fusion Bonded Epoxy, 8-10 mls DFT.

.4 Vendor supplied items: manufacturers' standard shop paint.

.2 Provide the following coatings for the draft tube interior and exterior surfaces:

.1 Two (2) coats Carboline, Carboguard 890, 4-6 mls DFT.

2.6 SPECIAL TOOLS AND SPARE PARTS

.1 Provide any special tools requires to performance maintenance and operational adjustments to the mixers.

.2 Provide the following spare parts and disposable materials for each mixer:

.1 Provide drive belt and mounting flange gasket that shall be packaged for long term storage.

.2 Supply oil and grease in a quantity sufficient for three (3) months of operation.

PART 3 EXECUTION

3.1 MANUFACTURER'S REPRESENTATIVE

.1 A manufacturer's representative shall be required to attend the site to train installation personnel; to train operating personnel; and to witness installation and testing to ensure the equipment is installed and operated as intended.

3.2 INSTALLATION TRAINING

.1 Instruct the installer in the methods and precautions to be followed in the installation of the mixers.

3.3 INSTALLATION

.1 Ensure that the mixers are installed and aligned, as required to provide satisfactory service.

.2 Co-operate with the installer to fulfill the requirements for a successful installation.

3.4 TESTING

.1 Ensure that the mixers, including all component parts, operate as intended.

.2 Performance Test:

.1 Conduct on each mixer unit.
.2 Perform under actual or approved simulated operating conditions.
.3 Test for a continuous 3-hour period without malfunction.
.4 Perform with the Contract Administrator present.
.5 Adjust, realign, or modify units and retest in accordance with ASME Power Test Code if necessary.

3.5 COMMISSIONING

.1 The vendor shall coordinate and deliver to the System Integrator a fully programmed fully functional complete CompactLogix PLC system with Ethernet port to allow the System Integrator to carry out the following:

.1 75% Development Review Tests
.2 95% Development Review Tests
.3 Complete Process System Factory Acceptance Test

.2 Following satisfactory factory acceptance test, the vendor shall receive the PLC system back in order to re-install it in his panel for site installation.

3.6 MANUFACTURERS' SERVICES

.1 The Vendor will also provide a representative to be available during

.1 75% Development Review Tests
.2 95% Development Review Tests
.3 Dry Run Testing
.4 Factory Acceptance Test
.5 Site Acceptance Testing
.6 Commissioning
.7 One person-day for start-up classroom or job site training of Owner's personnel.

.2 Provide Manufacturer's Certificate of Proper Installation

.3 Training of Owner's personnel shall be at such times and at such locations as required and approved by the Owner

END OF SECTION

APPENDIX F – ADDITIONAL REPORTS

The following documents are available for download from the Bids and Tenders website and form part of the tender documents:

Geotechnical Investigation, Proposed Wastewater Treatment Plant Upgrades, 14754 County Road 2, Ingleside, ON. Paterson Group Inc., December 10, 2020

Full Site DSR, Ingleside WWTP, 14754 County Road 2, Ingleside. H.S.P. Consultants Inc. August 2019

APPENDIX G – AS-BUILT DRAWINGS

The following documents are available for download from the Bids and Tender website and form part of the tender documents:

May 1994	Sewage System Upgrading Ingleside Outfall Sewer
February 1998	Ingleside Sewage Pumping Station Modifications – As Built
March 1998	Ingleside Sewage Treatment Plant – As Built

APPENDIX H – PRE-SELECTED EQUIPMENT

The following documents are available for download from the Bids and Tender website and form part of the tender documents:

- System #1 – Fine Screen Shop Drawings by Claro
- System #2 – Vortex Grit Removal Shop Drawings by Claro
- System #5 – Ultra-Violet Disinfection Shop Drawings by Trojan